DEFLATION IN ZIMBABWE: CAUSES AND RISKS

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by

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Dedication

This thesis is dedicated to my late parents Kusikwenyu and Lillian Mahonde. It was only through their hard work that I have reached this far. Their guidance, love and effort were not in vain. May their souls rest in peace.

Acknowledgements

I would like to acknowledge the tremendous assistance rendered by my supervisor Dr A. Makochekanwa. Special thanks goes to the University of Zimbabwe Economics Department, for the invaluable support and encouragement rendered throughout the Masters degree learning and research period. Lastly I wish to express gratitude to my fellow classmates who remain a source of inspiration up to this day.

Abstract

This study seeks to identify the determinants of the persistent deflationary pressures that continued to besiege the economy of Zimbabwe for the period January 2012 to June 2015. The study highlights the risks associated with deflation that lead to stalled economic growth and unemployment. Identification of the causes of deflation is critical for the purposes of formulating informed policy interventions aimed at regaining a desired and sustainable economic trajectory.

Due to cointegration of series, an Error Correction Model was regressed on E-views 7 to establish possible causes of deflation in Zimbabwe for the period January 2012 to June 2015. The study established that deflation is mostly driven by declining interest rates, deflation expectations, income growth and depreciation of the rand against the US Dollar. These findings are in tandem with problems associated with monetary authorities that are not in control of the monetary aggregates of the economy. The introduction of the multicurrency regime in Zimbabwe in 2009, meant that the Reserve Bank of Zimbabwe lost control of monetary policy tools. It could not influence interest and exchange rates to manage economic fundamentals that continued to make imports cheaper and exports uncompetitive. The results suggest that the price levels of tradeable goods in Zimbabwe and South Africa were converging partly as a result of depreciation of the Rand against the greenback.

The study recommends that Zimbabwe should use a currency that it has control over. This is either through use of its own currency or through formal dollarisation with any country whose currency is currently in Zimbabwe's basket of official currencies. These options would give room for monetary authorities in Zimbabwe to make policy interventions to correct undesirable economic developments.

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Acronyms

ADF	Augmented Dickey Fuller
AIC	Akaike Information Criterion
ARDL	Auto-Regressive Distributed Lag
CPI	Consumer Price Index
CZI	Confederation of Zimbabwe Industries
DSP	Difference Stationary Process
ECT	Error Correction Term
ECM	Error Correction Model
GDP	Gross Domestic Product
M3	Broad Money Supply
MOFED	Ministry of Finance and Economic Development
OLS	Ordinary Least Squares
RBZ	Reserve Bank of Zimbabwe
SAR	Special Administrative Region
SC	Schwartz Criterion
TSP	Trend Stationary Process
USA	United States of America
US Dollar	United States of America Dollar
VMI	Volume of Manufacturing Index
ZAMCO	Zimbabwe Asset Management Company
ZimStat	Zimbabwe National Statistics Agency
ZSE	Zimbabwe Stock Exchange

Chapter 1

Introduction and Background

1.0 Introduction

Zimbabwe experienced a sustained decline in the general price level as measured by the consumer price index from January 2012. Lack of radical fiscal and monetary policy initiatives to stimulate and inflate the economy exacerbated the problem. By February 2014 the year on year rate of inflation was negative. Deflation, inflation and disinflation represent different behaviour characteristics of the general price level. Deflation is typically defined as a persistent drop in the general price level (Decressin and Laxton, 2009). Kumar et al (2003), defined deflation as a sustained decline in an aggregate measure of prices such as the consumer price index or the GDP deflator over a period of time. On the other end is inflation, which is a sustained increase in the general price level of goods and services in an economy over a period of time (Blanchard, 2000). While disinflation describes instances when the rate of inflation is decreasing in the short term. Ball (1994), defined disinflation as an episode that starts at an inflation peak and ends at an inflation trough with an annual rate of inflation at the trough at least two percentage points lower than at the peak.

A given rate of deflation and output depends on income, price, growth rate of money stock, rate of change of real money balances and fiscal outturn (Dornbusch and Fischer, 1992). Changes in any of these variables will affect the level of output and the rate of price change. Thus, the level of output and rate of price change are determined by aggregate demand and supply. The price level is measured by various methods that include but are not limited to the consumer price index, producer price index and the gross domestic product deflator. In Zimbabwe, the Zimbabwe National Statistics Agency use the Leysperes consumer price index with different weights assigned to various items in the basket. The items and corresponding weights are: food and non-alcoholic beverages (33.5), alcoholic beverages and tobacco (4.4), clothing and footwear (6.0), housing water, electricity, gas and other fuels (17.7), furniture, household equipment and maintenance (9.9), health (2.2), transport (9.8), communication (3.4), recreation and culture (2.1), education (5.7), restaurants and hotels (1.4) and (3.9) for miscellaneous goods and services (ZimStat, 2015).

Deflation may be caused by positive supply shocks such as productivity growth, trade liberalization or significant shifts in terms of trade. In such cases, deflation is a manifestation of adjusting to a new equilibrium in the context of rising incomes and will have less effect on demand (Baig, 2003). In some cases deflation reflects weaknesses in the economy, rather than positive supply shocks. In this context, it is characterized by slow growth and stagnant demand alternating with recession (Baig, 2003). Deflation as opposed to disinflation, more likely reveals macroeconomic imbalances manifesting in a generalized decline in the price level (Baig, 2003).

In addition, deflation may lead to job cuts, further declines in demand, a fall in asset prices and bankruptcies (Decressin and Laxton, 2009). Deflation reduces business profitability and leading to firms making losses. Businesses get caught up in a scenario where they order/manufacture goods at price/cost x but due to deflation will be forced to sell at a price lower than x. The magnitude of how much less depends on the rate of deflation and the time period involved. Akerlof, et al (1996), argued that downward nominal wage inflexibility could be a significant source of economic costs that could be avoided by keeping the inflation rate sufficiently high. Thus, deflation squeezes profitability of firms given sticky wages with an increase in unemployment being the inevitable result.

Further, deflation has a punitive impact on borrowers whose real debt burden increase, thereby redistributing income from debtors to creditors. It raises the real value of debt outstanding but does not raise the debtor's real capacity to service a loan, potentially leading to bankruptcies. In the process of deflation, collateral values are bound to decline making debtors lose more compared to creditors, especially where there are asset price reductions (Baig, 2003). On the fiscal account deflation has the potential to increase public debt stock. Attempts to stimulate the economy through tax cuts and increased expenditures are bound to further increase public debt. Revenue collections decline due to a contracting gross domestic product while social security payments increase thereby increasing government expenditure, hence debt (Baig 2003).

Prolonged deflation dampens the financial sector through falling interest rates and in the extreme case by the zero bound interest rates. Nominal returns on debt instruments, bonds and bank deposits are not designed to fall below zero. Retail bankers fail to bid at below market rates for

deposits (Baig, 2003). In addition, credit spreads are compressed thereby reducing financial sector profitability. Further, deflation potentially renders monetary policy ineffective due to the reductions in interest rate for prolonged periods in an attempt to increase lending to stimulate the economy. If deflation prevails for prolonged periods and expectations build up, a liquidity trap could become inevitable as argued by Keynesians. The worst case scenario occurs when policy interest rates reach the zero interest floor. Zero interest rate fails to close output gap and the downward pressure on prices is reinforced (Decressin and Laxton, 2009).

Zero bound interest rates make it difficult for monetary authorities to successfully guide inflation expectations. As such monetary policy initiatives would be ineffective in stimulating aggregate demand. This is particularly relevant to economies that have their own currencies, functional monetary policies and set their own interest rates. In the case of Zimbabwe's multicurrency regime context, the zero interest rate would be difficult to attain as interest rates were mostly determined by the rate at which foreign lines of credit were obtained. However, authorities in Zimbabwe could find the economy in a predicament necessitating lowering interest rates to levels below or equal to those for which foreign lines of credit were obtained, in a bid to stimulate economic activity and hence aggregate demand.

1.1 Statement of the Problem

Zimbabwe experienced a sustained decline in the general price level from January 2012 and by February 2014 the year on year rate of price change was negative. The decline in the general price level continued for the whole of 2015 as the economy remained under deflationary pressures. Deflation potentially reduces profitability of firms or in the extreme case renders them loss making, leading to firm closures and deindustrialisation. The financial sector is dampened by falling interest rates with potential bankruptcies while the fiscal account may incur unsustainable debt. Resultantly, if deflation remained unchecked, Zimbabwe would potentially experience company closures, high levels of unemployment and stalled economic growth. Hence, the need to study the causes of this phenomenon so that possible solutions could be proffered.

1.2 Objectives of the Study

The objectives of the study are to establish:

a) Determinants of deflation in Zimbabwe; and

b) If loss of control of monetary aggregates was responsible for deflation.

1.3 Research Questions

a) What were the significant determinants of deflation in Zimbabwe?

b) Was deflation caused by money supply growth that was proportionately less than economic growth?

1.4 Hypothesis Statement

The study tests the hypothesis that insufficient money supply growth in an economy causes deflation.

1.5 Significance of the Study

Deflation is not a common phenomenon in most economies, and in the few instances that it occurred research was conducted on its possible causes, the risks, costs and potential remedies. Literature has the experiences of Japan, Hong Kong and Macao. This study looks at a peculiar case where Zimbabwe abandoned its currency in 2009, after it experienced hyperinflation and adopted a multicurrency regime.

The fact that Zimbabwe did not formally dollarise left the monetary authorities hamstrung and unable to make critical monetary policy interventions. This study seeks to highlight the monetarist view that inflation/deflation is always a monetary phenomenon and will benefit both academics and policy makers. The study seeks to help government identify the possible drivers of deflation. Further, government needs to consider the risk of a contracting economy that is associated with deflation. The study ends by proffering solutions on how to take the economy out of deflation.

1.6 Organisation of the Study

Chapter 1 presented the introduction, problem statement, research objectives, research questions and significance of the study. Chapter 2 presents a macroeconomic background to the economy of Zimbabwe from 2009 to 2015. Chapter 3 presents literature review while Chapter 4 presents the methodology. Chapter 5 presents the results of the study and Chapter 6 presents the findings, policy recommendations and suggestions for further research.

Chapter 2

Macroeconomic Background

2.0 Introduction

This chapter investigates macroeconomic developments prior to and including the period of study. The intention is to ascertain whether the deflationary pressures experienced were due to positive supply shocks that increase income or the pressures emanated from structural weaknesses in the economy and would be accompanied with weak aggregate demand and contraction. This chapter looks at consumer price index developments commencing 2009. It then looks at the real sector performance of the economy and other major macroeconomic variables.

2.1 Macroeconomic Background

In January 2009 the Zimbabwe Government abandoned use of the Zimbabwe Dollar due to hyperinflation experienced up to 2008 (RBZ, 2009). Government had two choices namely to formally dollarize or adopt a multicurrency regime without formal arrangements with any external monetary authority. Government went for the latter choice where the United States Dollar and the Rand emerged as the widely used currencies under the multicurrency regime. However, the introduction of a multicurrency regime, meant the monetary authorities in Zimbabwe lost control of monetary aggregates, interest and exchange rates as these were determined exogenously.

Adoption of the multicurrency regime succeeded in taming inflation. However, performance of the fiscal, monetary, balance of payment and real sectors did not benefit as much. The fiscal account suffered as domestic financing of the budget deficit became a challenge given that treasury bills had a low uptake as Government could not be considered to be 'default free' as it did not have its own currency. In other words it was possible for Government to default at the time of maturity of bills and other financial instruments. However, Government could only raise finance through private placements with major firms in the finance and insurance sector. Further, there was an absence of seigniorage such that expenditures were heavily dependent on revenues collected, making budget deficit financing difficult (MOFED, 2010).

The introduction of the multi-currency regime saw Zimbabwe experiencing liquidity challenges. This was partly due to the high cost of external lines of credit that had a country risk premium

(RBZ, 2013). The financial sector could only issue short term loans at high interest rates to the productive sectors of the economy. There was gradual loss of employment as firms closed partly due to unsustainable debts and insolvency, emanating from unsustainably high interest short term financing for the productive sectors of the economy (CZI, 2014). Disposable incomes resultantly declined causing aggregate demand to weaken.

The real sector performance was affected by a low performing agriculture sector due to high cost inputs, unfavourable rain seasons and poor markets. The manufacturing sector suffered company closures due to high costs of finance and lack of competitiveness given its heavy dependence on antiquated machinery in the absence of significant re-tooling. Manufacturing sector surveys by the Confederation of Zimbabwe Industries show that the weighted capacity utilization fell from a maximum 57.2% in 2011 to 34.3% in 2015 (CZI, 2015). The mining sector was affected by low commodity prices on the international markets from 2011. This was worsened by appreciation of the US Dollar against major currencies which made exports from Zimbabwe less competitive. Power shortages slowed activity in agriculture, mining and manufacturing sectors. Low capacity utilization was characteristic of most sectors of the economy resulting in low GDP levels. The tourism sector was an exception as it registered growth from 2009 to 2015. The decline in the consumer price index possibly made tourism products in Zimbabwe more competitive and hence growth (MOFED, 2015).

In turn, this impacted on the trade balance as the economy continued to import more than it was exporting. From 2009 Zimbabwe's trade balance was negative. The monetary authorities could not come up with policy interventions to make exports competitive as they had no control on interest and exchange rates. Developments on the foreign exchange market further compounded Zimbabwe's predicament. Over the period of the study, the Rand weakened against the US dollar continuously. This made imports from South Africa cheaper while exports became uncompetitive. The negative trade balance impacted on the balance of payments account, especially given the absence of an active capital account and balance of payments support from the IMF to offset the negative current account position. This led the Reserve Bank of Zimbabwe (2015) to proffer internal devaluation in an attempt to correct appreciation of the US Dollar.

2.2 Consumer Price Index Developments

The year on year rate of inflation as measured by the consumer price index was last at its peak in December 2011 when it recorded 4.9% (ZimStat, 2011). From January 2012 the rate of inflation took a sustained decline as depicted in Figure 2.1 below. To determine the driving forces behind the deflationary pressures this study will consider developments from January 2012 that triggered the gradual fall in the year on year rate of inflation.

Figure 2.1: Year on year rate of inflation

Source: ZimStat

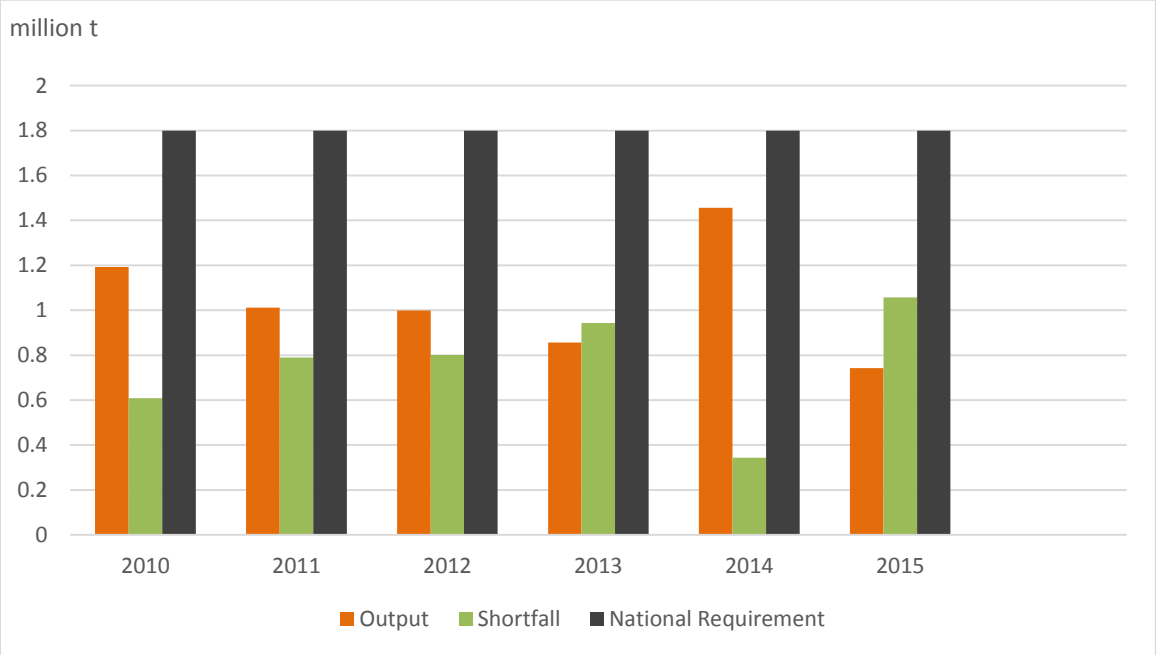
The graphical illustration shows the sustained decline in the general price level as measured by the consumer price index. The economy experienced deflationary pressures from January 2012. This necessitated checking on the performance of the major economic sectors with a view to find out whether there were significant positive supply shocks that could have triggered deflation or some structural weaknesses and imbalances were responsible.

2.3 Agriculture Sector

In the national income accounts the sector that has agriculture aggregates it with hunting, fishing and forestry figures. To assess the performance of agriculture per se the study makes use of

production levels of maize, which is the staple food of Zimbabwe and the major crop used to assess food security. Zimbabwe had an annual requirement of 1.8 million tonnes of maize (ZimStat, 2014) but since 2010 it persistently suffered maize output deficits. Low production was partly due to unreliable rainfall patterns in an economy that heavily relied on rain fed agriculture with minimal irrigation development. Low levels of mechanisation resulted in low productivity, while the high cost of inputs namely seed, chemicals and fertilizers was a constraint to production. Lack of financial support by banks to the sector resulted in capacity underutilisation. In the few cases where loans were availed, the banks had stringent loan application conditions that required collateral security of prescribed type and value (RBZ, 2013). In most cases the majority of farmers did not have acceptable collateral security to surrender to banks and the ninety nine year leases given by government to farmers were not accepted as collateral by financial institutions for the purposes of securing loans.

Figure 2.2: Maize Production since 2010



Source: ZimStat

Further, the agriculture sector was affected by an acute electricity shortfall that bedevilled the economy. The economy's capacity to generate and import electricity continued to decline from 2010 to 2015. Irrigated crops and livestock breeding were the worst affected. Poorly organised

markets with the exception of tobacco further compounded problems for the sector. Marketing is the end game for farmers in agriculture and lack of good markets add to post harvest losses. This was aggravated by the Grain Marketing Board that failed to pay farmers on time for deliveries (MOFED, 2014). In general, Zimbabwe appeared to have failed to produce adequate agricultural output levels ever since the country embarked on the fast track land reform programme that started in 2000.

Figure 2.2 above, shows the levels of maize production in relation to national requirement and the resultant shortfalls, since 2010. Agricultural performance from 2010 to 2015 was characterised by shortfalls compared to national requirement. An increase in production realised in 2014, which did not even satisfy national requirement, was mostly due to a very favourable rainy season among other factors. Otherwise Zimbabwe had to supplement staple food requirements through imports from Zambia and South Africa for the whole period under review (MOFED, 2015).

The agriculture sector remained peculiar in that it heavily depended on the domestic market for its produce, with the exception of crops such as tobacco. Agricultural products are very competitive in nature and when the decline in CPI started in 2012, the sector's produce was not spared. In contrast, inputs used in the sector such as seed, fertilizers and chemicals were expensive due to an oligopolistic price structure. The decline in the general price level that affected produce, against a background of highly priced inputs, contributed to making agriculture in general less profitable and hence low levels of production. This was evident when compared with crops like tobacco that had an organised international market that registered considerable growth (ZimStat, 2014). More farmers took up tobacco farming as it was profitable and viable due to the auction system that was independent of a falling consumer price index.

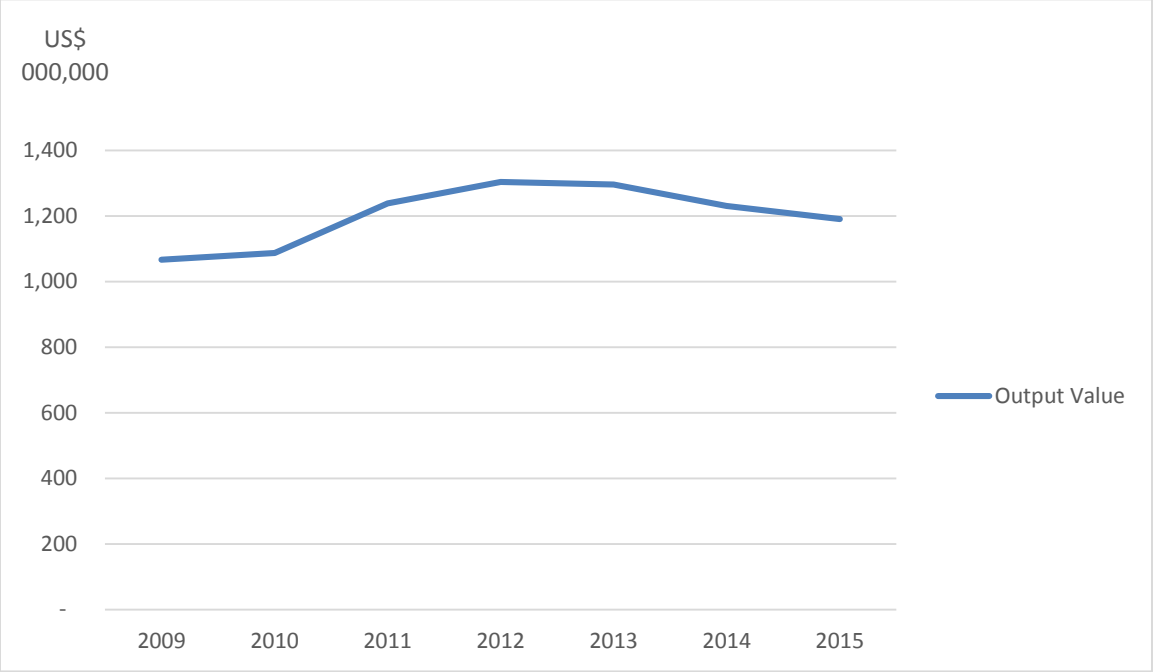
2.4 Manufacturing Sector

The manufacturing sector had bottlenecks that manifested through low productivity resulting in the sector gradually contracting and laying off employees. Major problems encountered included acute electricity supply deficits that the economy endured during the period. Further, the financial sector could only secure lines of credit at high interest rates that included a country risk premium following the political unrest of 2008. This resulted in high interest short term loans as opposed to

the ideal low interest long term loans being offered to the manufacturing sector (RBZ, 2012). Resultantly, this increased the cost of production and reduced competitiveness and hence business viability. Continued appreciation of the US Dollar against major currencies further compromised competitiveness of exports.

Further, the sector failed to replace antiquated equipment and machinery due to lack of appropriate financing. This was worsened by the low levels of new investment into the sector. Resultantly the manufacturing sector suffered from low capacity utilisation from a high of 57.2% in 2011 to 34.3% in 2015 (CZI, 2015). Figure 2.3 below gives the output value at constant prices of the sector as it contributed to GDP from 2009 to 2015.

Figure 2.3: Manufacturing Sector Output Value



Source: ZimStat

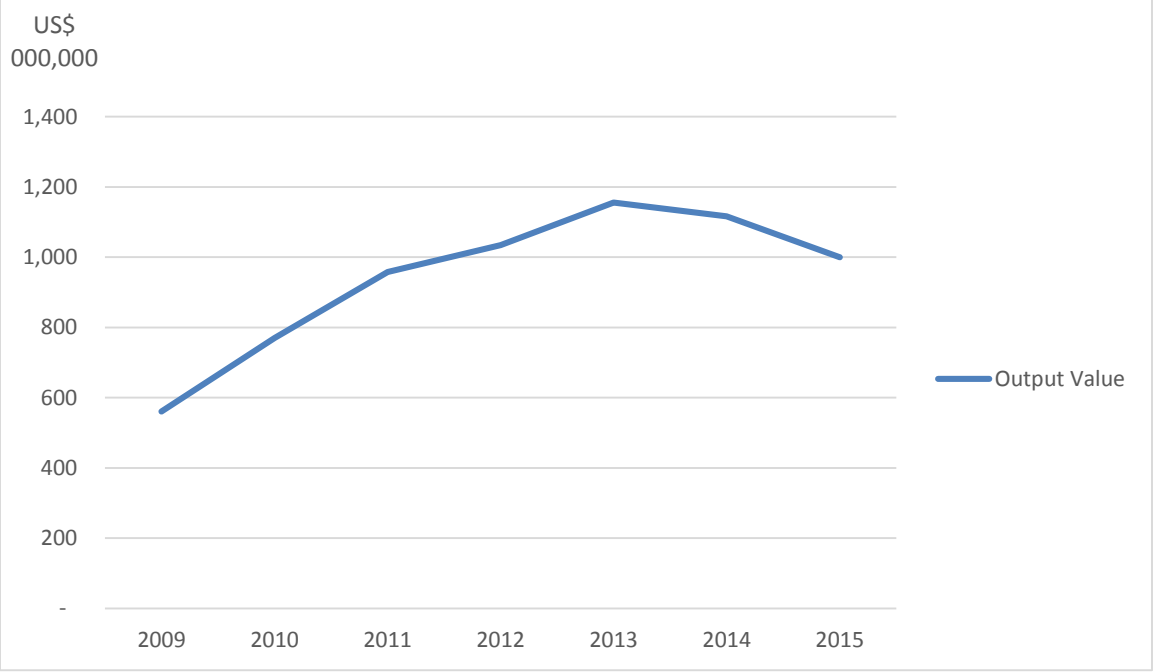
Performance of the manufacturing sector shows a steady rise up to 2012, then a slow decline thereafter. Lack of growth experienced by the sector after 2012 was mostly due to the bottlenecks cited above. Like agriculture, this sector depended heavily on the local market for its products. Likewise, the manufacturing sector was not spared from the effects of a decline in the general price level since January 2012. The deflationary pressures experiences on the market were in contrast

with price levels for some of the sector's inputs which were sourced from outside the country or from uncompetitive markets. Further, wages were a prohibiting factor due to stringent labour laws and their downward sticky nature. Municipal charges, electricity and water rates did not decline as the CPI declined. This resulted in reduced profitability, debts, company closures, unemployment and expensive employment retrenchments (CZI, 2015).

2.5 Mining Sector

The mining sector registered growth up to 2012 as depicted in Figure 2.4 below, and declined from 2013. The decline was partly due to acute electricity supply deficits, high interest short term loans as opposed to the ideal low interest long term loans and low levels of new investment. In addition, a Chinese led global economic slowdown, that saw a decline in the growth rates of the Chinese economy since 2011, was followed by tumbling commodity prices due to a weak demand for commodities by the then world's second biggest economy. In Zimbabwe, this was compounded by appreciation of the US Dollar against major currencies from 2012 that compromised export competitiveness.

Figure 2.4: Mining Sector Output Value



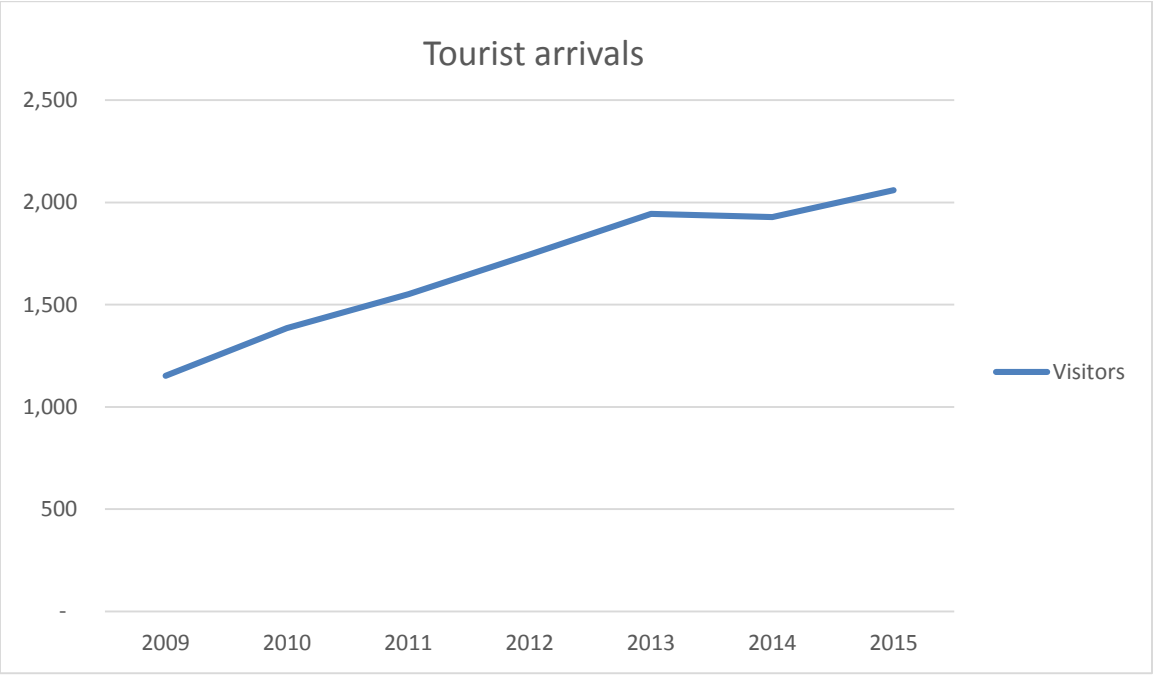
Source: ZimStat

The above cited bottlenecks in the economy stalled growth in the mining sector for the period post 2013. The mining sector could have escaped the deflationary pressures as it depended heavily on international markets. However, the appreciation of the US Dollar, and the softening of commodity prices on the international market partly led to the sector's subdued performance from 2013. However, sectoral linkages came into play as local uptake of minerals such as coal declined in tandem with reduced activity in agriculture and manufacturing where they are used as inputs. Thus, deflation had an indirect impact on the slow performance of the mining sector.

2.6 Tourism Sector

Tourism is a high value sector that depends on high disposable income expenditure with an international market. It is thus possible to have other sectors of the economy declining while tourism is flourishing. This is possible as some determinants of the performance of this sector are exogenous. A rise in income levels in Europe, United States of America and Australia, which are Zimbabwe's major overseas tourism markets, will impact positively on tourism in Zimbabwe independent of local declining incomes and deflationary pressures.

Figure 2.5: Performance of the Tourism Sector



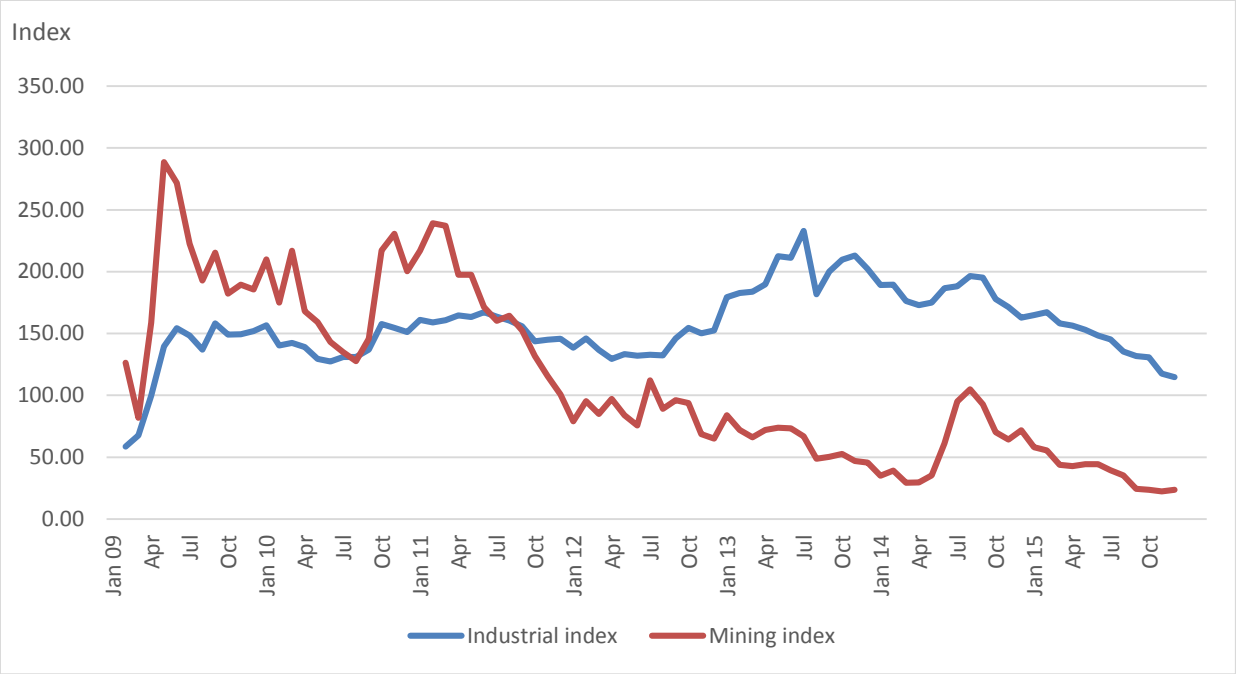
Source: ZimStat

Figure 2.5 above, depicts the performance of the tourism sector that suggests Zimbabwe had possibly overcome the perception problems that it was associated with prior to 2009. These bordered on perceived lack of human and property rights, non-adherence to rule of law, democratic deficiencies and violence during the 2008 runoff election. Performance of the sector shows an upward trend up to 2015 registering growth in defiance of economic contraction in other sectors. As the consumer price index declined in Zimbabwe, ceteris paribus, it meant that tourism products became more competitive and hence the potential to grow increased. This trend was buoyed by regional, continental as well as international conferencing and religious tourism that responded to the competitive prices.

2.7 Stock Market Performance

Stock market indices are largely driven by a combination of fundamental macroeconomic factors and investor perceptions. To a large extent sentiments emanate from political and policy swings, more so given that foreign investor participation on the Zimbabwe Stock Exchange averaged 65 percent since 2009 (ZSE, 2015). Figure 2.6 below, shows the benchmark industrial index registered strong growth in 2009, primarily driven by low base effects, as the market had re-opened following a temporary shutdown due to hyperinflationary propelled speculative behaviour. Between 2010 and 2012 the industrial index was firm and stable as it responded to policy stability. The end of 2012 and the first half of 2013 saw strong gains, driven by speculative buying as foreign investors anticipated a new political administration in the aftermath of elections that were held on 31st July 2013. However, the deflationary pressures that reduced profitability in the agricultural and manufacturing industries filtered to the stock markets post 2013 elections. The decline was sustained since then, exacerbated by thinning corporate earnings under depressed aggregate demand and accompanying deflationary conditions.

Figure 2.6: Performance of stocks at the Zimbabwe Stock Exchange



Source: Zimbabwe Stock Exchange

The mining index was composed of four counters namely Bindura Nickel Mine, Hwange Colliery Company Limited, RioZim Limited and Falcon Gold Zimbabwe Limited (Zimbabwe Stock Exchange, 2015). The mining index was primarily driven by commodity pricing. From 2009 to July 2011 the index was significantly driven by record high gold price. Gold prices then subsided and the index also retreated. The recovery of the mining index in the second quarter of 2014 was largely driven by improved nickel prices. With China being the leading significant consumer of minerals, the slowdown in the Chinese economy impacted on the prices of minerals and hence the index.

Overall, it is also worth noting that from 2012 the economy was gripped with uncertainty with regard to its future political dispensation. From 2009 the country was under a Government of National Unity which succeeded to bring political and economic stability. Investor and business perceptions on Zimbabwe were brighter during that period. However, as the constitutional lifespan of the unity government drew to its end, economic agents were no longer certain of the future. The economic performance began to reflect this uncertainty with 2012 registering a 10.6% GDP growth rate down from 11.9% in 2011 (ZimStat, 2015). This continued into 2013 when the country held

elections and the year that the Government of National Unity came to an end, economic growth rate fell to 4.5%. In 2014 the growth rate further declined to 3.8% and 2015 had a growth projection of 1.1% (ZimStat, 2015).

2.8 Conclusion

The above analysis on the sectoral performance of the economy does not suggest any positive supply shocks that increased income. Instead, it reveals an economy that was struggling to perform and hence, the study will now be guided by Baig (2003), who characterised deflation in some instances to be reflective of macroeconomic weaknesses and imbalances. Such cases of deflation usually come with slow economic growth, weak demand and may be accompanied with recession. This is the scenario that approximates the economy of Zimbabwe during the period under review where the economy registered phenomenal growth from 2009 to 2012. However, the setting in of a decline in CPI in January 2012, hit hard the agriculture and manufacturing sector as the two sectors heavily depend on local markets, where prices were falling. This was against escalating costs of production that manifested through high municipal, electricity and waters bills. High environmental management fees, penalties and labour costs further compounded the predicament of the real sector. The mining sector had its own dilemma of falling commodity prices on the international market. This resulted in the three sectors facing a scenario where there was low demand for their products. In some cases costs were greater than revenues resulting in loss making firms, hence firm closures and retrenchments. Thus, the sustained decline in the CPI was accompanied by reduced profitability, company closures, worker layoffs, declining aggregate demand and hence the downturn in GDP since 2012 that is coincidental to the year the CPI started declining.

Chapter 3

Literature Review

3.0 Introduction

This chapter looks at what theory says are the determinants of the rate of price change. It goes further to look at existing empirical studies by some researchers and the conclusions they reached on economies that experienced deflation. This assists in terms of guiding methodology and policy guidance in the study of deflation in Zimbabwe.

3.1 Theoretical Literature Review

This section focuses on what theory says are the drivers of the rate of price change in the form of deflation or inflation. Where possible, an attempt to critique the theories is made. The predicted relationship between the theory and deflation is stated.

3.1.1 The Quantity Theory of Money

According to Milton Friedman (1968), inflation can be considered as an occurrence that is everywhere and always a monetary phenomenon. Likewise, deflation which is a sustained decline in the general price level or the reverse of inflation may be considered a monetary phenomenon as well. It is considered a monetary phenomenon in the sense that the money supply growth relative to the growth of GDP is influential in determining the rate of inflation/deflation as measured by the consumer price index.

The theory relates nominal income (PY) to money stock (M) and velocity of money (V):

$$MV=PY \quad (1)$$

According to Dornbusch and Fischer (1992), the quantity equation can be written in terms of percentage change over time of each of the four terms in the above equation as follows:

$$m + v = \pi + y \quad (1a)$$

Putting the rate of deflation on the left hand side we obtain

$$\pi = m - y + v \quad (1b)$$

where m is money growth rate, v is percentage change in velocity, π is the deflation rate and y is the growth rate of output. Equation (1b) can be used to account for deflation in terms of growth rate of money, growth of output and velocity. The monetarist view that inflation is a monetary

phenomenon implies that velocity changes are minimal (Dornbusch and Fischer, 1992). Thus, if monetary aggregates grow at rates below real output, then the theory predicts downward pressure on prices and the reverse holds.

While deflation is a monetary phenomenon in the long run, Dornbusch and Fischer (1992), go further to say the relationship between money growth and the rate of price change is not precise. They cite nonmonetary shocks that change the level of output can change the rate of deflation while growth rate of money remains constant. Secondly, changes in interest rates affect the cost of holding money bringing about changes in the ratio of income to money. Thirdly, changes in the definition of money by financial institutions, through financial innovation, shifts the demand for money over time. The first two reasons explain the short run instability of the money-deflation/inflation relationship. The third factor, through financial innovation, an increase in interest rates on M2 components may raise demand for M2 and hence reduce inflation associated with a certain money growth rate.

Despite the above criticism, it is apparent that the Quantity Theory of Money predicts deflation when money supply growth is less than GDP growth. The theory also predicts that the relationship between money supply and the general price level is positive, with a reduction in money supply, ceteris paribus, leading to deflationary pressures.

3.1.2 Cost Push Theory

The theory looks at factors that influence the general price level from the supply side of the economy. The cost push theory is used to explain the progression of prices due to input costs. Prices are expected to respond to input cost factors such as labour, energy and imports. It is also associated with imperfect market structures such as monopolies and effects of trade unions especially as a cause of inflation. Monopolies tend to set prices that are above marginal costs of production while trade unions bargain for wage rates above labour productivity.

Nominal interest rates are a cost factor in the provision of goods and services. With real interest rates approximately constant in the long run, and with expectations of deflation adjusting to actual

deflation, the Fisher equation asserts a positive relationship between nominal interest rates and the rate of deflation (Dornbusch and Fischer, 1992).

$$r \approx i - \pi \quad (2)$$

where r is real interest rate, i is nominal interest rate and π the deflation rate. In Zimbabwe the multicurrency regime came with high interest rates with a significant component being the country risk premium. However, with the passage of time and change of perception, the country risk carried less weight forcing interest rates that were at 60 percent in 2009 to subside to 8 percent in 2015 (RBZ, 2015). The monetary authorities through moral suasion also managed to reign in high interest rates in the financial sector. Hence, the positive relationship between nominal interest rates and deflation.

Exchange rate developments influenced the general price level in Zimbabwe, a small economy, dependent on a significant share of imported goods and services. The strengthening of the US Dollar against the currencies of Zimbabwe's major trading partners resulted in imports landing cheaper in Zimbabwe. The overall effect on the general price level was determined by the relative large proportion of both raw materials and finished products imported. In Zimbabwe the trade balance continued to be negative signifying more imports (ZimStat, 2015), while the Rand, the currency of Zimbabwe's major trading partner, continued to weaken against the US Dollar (RBZ, 2015). This was bound to dampen the general price level in Zimbabwe.

Thus, the Cost Push Theory envisages deflationary pressures if there is a sustained decline in factors used in the cost build-up of goods and services such as interest rates, wages and depreciation of currencies from which an economy imports most of its goods and services. The theory predicts a positive relationship between costs and the general price level.

3.1.3 Demand Pull Theory

The theory analyses the determinants of deflation from the demand side of the economy. It postulates that the level of aggregate demand in relation to goods and services will determine the direction of price change. This theory has the monetarist and Keynesian perspectives. The monetarist perspective says a substantial decrease in money supply, relative to money demand will leave economic agents with low cash balances. The low cash balances lead economic agents to

demand less goods and services. When this is not accompanied by a proportional decrease in output, the low demand will induce downward pressures on prices (Friedman, 1968).

The Keynesian perspective is premised on fiscal developments with government expenditure constituting the greatest component of aggregate demand. According to the Keynesian school, when the economy is at full employment level, if aggregate demand exceeds aggregate supply then prices will rise (Killick, 1981). Under this school of thought the government budget deficit is the major culprit. Likewise, if government expenditure is weak due to acute resource constraints then aggregate demand will also be weak. Once aggregate demand is less than aggregate supply then a downward pressure on prices is bound to take place.

The effect of demand pull on employment is clear and positively related. If aggregate demand is weak due to fiscal and monetary policies then deflation is bound to take place, output falls and unemployment rises (Branson, 1989). In addition, sustained deflation makes an economy vulnerable to a weakening aggregate demand (Decressin and Laxton, 2009). In Zimbabwe the fiscal space continued to decrease due to poor revenue performances leading to a weak aggregate demand and hence deflation. Thus, the overall relationship between demand and the general price level is positive, with weak demand resulting in deflationary pressures.

3.1.4 Deflation and Expectations

Modern macroeconomic theory emphasizes the role of expectations by agents in forming a price level trajectory. In the literature, expectations are broadly dichotomised into adaptive and rational expectations although theory has six types[1].

Adaptive expectations can be expressed as:

$$eP_{t+1} = aP_t + (1\text{-}a)\, eP_{t-1}, \qquad 0 < a < 1$$

where, eP is the expected price, *a* is a weighted function and t represents time period. The equation says the expected price in one period's time is equal to a weighted function of the current price

[1] The other four types are static, extrapolative, perfect foresight and regressive expectations. However, literature dwells on adaptive and rational expectations.

and the price that was expected to prevail one period before (Pilbeam, 2013). According to adaptive expectations, both households and firms form their expectations of a price trend based on recently observed deflation and this may affect the general price level. Proponents of the theory maintain that prices decline as economic agents expect them to decline because they saw them declining over a period of time. Economic agents also learn from previous mistakes when modelling their expectations.

Rational expectations, on the other hand, assume that people use all the available information including current information on policies to forecast the future. Rational expectations can be modelled as follows:

$$eP_{t+1} = P_{t+1} + U_{t+1,}$$

where the mean or $E(U_{t+1}) = 0$, eP is the expected price, t represents time period and U is a random error term. The equation says the expected price in the next period will on average equal the actual price although it may deviate by a random error of U_{t+1} (Pilbeam, 2013). On average, the expected price is the one that materialises. Thus, according to this theory economic agents are forward looking rather than backward looking. The basic notion of the advocates of this theory is that if policymakers are credibly committed to reducing deflation, rational people will understand their commitment and quickly lower their deflation expectations.

In Zimbabwe the initial reaction of authorities was to claim that the sustained decline in the general price level was disinflation in the context of a multicurrency regime and prices that were highly pitched in 2009. It was seen as a self and necessary price correction mechanism and as such adaptive expectations played a role as prices were expected to decline. In addition, rational expectations also played a role as prices in Zimbabwe were initially generally higher than elsewhere in the region and were thus expected to come down through price equalisation. Further, lack of credible economic policy interventions to stimulate the economy out of deflation did not help economic agents to lower their deflationary expectations.

In this regard, adaptive expectations predict that economic agents form expectations of price trends based on recently observed deflation. Rational expectations predict that only in the presence of

credible and convincing policy interventions, will economic agents lower their deflation expectations. Thus, current economic developments help shape deflation expectations.

3.1.5 Other Theories on Deflation

Other theories on price developments have focused on institutions. North (1990) defined institutions as rules of the game or any form of constraint that human beings devise to shape human and economic interactions. This theory looks at whether institutions have a developmental or predatory thrust. Under this theory it is recognised that monetary and fiscal policy institutions are necessary to provide a stable macroeconomic environment to reduce risk and uncertainty. Therefore a credible and responsible central banking system and fiscal prudence remain critical ingredients of macroeconomic stability.

The theory has implications on policy credibility, time consistency and reputation of the monetary and fiscal institutions. Zimbabwe did not have a currency of its own since 2009 when government adopted a multi-currency regime instead of formal dollarisation. This resulted in loss of control of monetary aggregates, interest and exchange rates by the monetary authority, leaving the monetary sector without the requisite tools for policy interventions. This raised questions on ability of macroeconomic institutions to apply and adhere to the rules of the game in attaining and maintaining price stability.

It becomes apparent that appropriate monetary institutions equipped with appropriate monetary policy tools are required to steer the economy out of deflation. In the absence of appropriate tools, deflation is bound to persist.

3.2 Empirical Literature Review

Schellekens (2003), studied the causes of deflation in Hong Kong Special Administrative Region (SAR). The sustained decline in the general price level started in the last quarter of 1998. The researcher used a semi-log model to determine the price level gap, a proxy for price equalisation pressures between Hong Kong and Shenzhen city in mainland China. Shenzhen city was chosen because of its proximity to Hong Kong SAR and high trade levels between the two. The results

showed that the price levels of Shenzhen and Hong Kong SAR were converging as a result of price equalization pressures.

Deflation could also be due to other factors other than price equalisation, hence the need to control for other factors including the cyclical state of the economy. Using quarterly data, the Hong Kong rate of inflation and disaggregated components of the consumer price index were the dependent variables that were regressed on the following independent variables: unemployment (which was chosen as a proxy of business cycles), nominal effective exchange rate, nominal credit growth (lagged by four quarters) and the price level gap. From the various regressions all coefficients had the expected signs and most of them were statistically significant at 1% level, which is a high explanatory power.

However, the study did not look at the direct interaction of GDP and broad money supply in Hong Kong. While unemployment levels have an impact on output, it is possible to increase output through technological advances that reduce employment. This makes unemployment a better proxy for business cycles than output. It should also be noted that nominal credit growth does not adequately proxy broad money supply growth. Nominal credit growth was included to capture the buildup and subsequent collapse of the asset prices and its lagged effect on the housing component of the consumer price index. This made the model not take care of the relationship of money supply and GDP growth as they determine price levels as advocated by the monetarists and the quantity theory of money.

N'diaye (2003), studied the determinants of deflation in Hong Kong. The paper decomposed aggregate price level into transitory and permanent components and investigated drivers of deflation in the two components. A vector error correction model was used due to co-integration of variables. The common trends model looked at the interaction of the following five variables, output, broad money, CPI, trading partner's CPI in Hong Kong Dollars and a measure of real stock prices. All variables were expressed in natural log. Effects of permanent shocks such as productivity shocks, shocks related to money supply changes and price convergence with trading partners were more important in explaining deflation. Transitory shocks related to aggregate demand, demand pull and cost push shocks had less impact.

Kai (2004) studies deflation in Macao where the rate of change in GDP deflator was regressed on the nominal effective exchange rate, nominal credit growth and a dummy variable on effects of the Asian crisis on asset prices. All coefficients were significant at 5 percent level and had the expected signs. The model revealed that deflation could be explained by the three variables namely, nominal effective exchange rate, nominal credit growth and the 1997 Asian crisis. However, this model did not have money supply and GDP as variables. It therefore failed to investigate the interaction of broad money supply growth and output as they relate to price level determination according to the quantity theory of money and monetarists.

Interestingly, both Macao and Hong Kong SAR were under a currency board arrangement, which is a very strong form of a fixed exchange rate. Both countries had no discretionary monetary powers and could not independently issue their own currencies. The management of the monetary sector in the economy of Zimbabwe during the time of study, resembled that of Macao and Hong Kong SAR in most respects.

Baig (2003) studied costs associated with Japan's deflation that started in the 1990s. The most significant impact of deflation was on monetary policy, which was constrained by the zero bound nominal interest rates, commonly referred to as a 'liquidity trap'. The labour market failed to adjust to deflation due to downward sticky wages. Wage rigidities in the face of falling prices squeezed corporate profits and were partly responsible for a rise in unemployment. Low interest rates negatively affected the financial sector as nominal returns on bank deposits and bonds are not designed to fall below zero. This effectively put a floor on real returns thereby putting pressure on bank profitability. Deflation redistributed wealth from debtors to creditors through an increase in the borrower's real debt burden. This was worsened by a decrease in debtors' collateral values, thereby threatening financial intermediation. Households and firms experienced debt-service difficulties, curtailed spending and investment, and some cases resulted in bankruptcy that left banks with bad loans. On the fiscal account, the real debt burden on government increased while revenues declined in tandem with a contracting economy. Attempts by government to revive the economy through tax cuts and expansionary expenditures further increased the debt stock.

3.3 Conclusion

From the above discourse, it is apparent that no single theory explains the phenomenon of deflation adequately but a combination explains diverse circumstances. However, the empirical research seems to suggest that when monetary authorities are not in control of monetary aggregates, as in the case of Hong Kong SAR and Macao, the economy can deviate from the desired trajectory and take an unstable and unsustainable path. This tends to give credence to the monetarist perspective that issues to do with deflation/inflation are a monetary phenomenon.

Chapter 4

Methodology

4.0 Introduction

The last two chapters provided the conceptual framework and ideas for the specification of a model. This chapter presents the estimation procedures used to determine the possible causes of persistent deflationary pressures. A theoretical mathematical derivation of variables aided by empirical developments is used to build an econometric model. The chapter also presents estimation techniques, justification of explanatory variables and their expected signs.

4.1 The Econometric Model

Price levels are determined by forces of demand and supply through cost push and demand pull factors in the goods market. In addition, developments in the money market are a determinant factor in attaining equilibrium as real money demand equal money supply. This study develops a model based on similar models by Dornbusch (1980), Olubusoye and Oyarembe (2008) and Pindiriri (2012) models. The general price level (P), is considered to be the weighted average price of the tradable (P_T) and non-tradable goods and services (P_N). The price index P, can be expressed as:

$$P = E\, P_T^{\propto}\, P_N^{1-\propto} \qquad 0 < \propto < 1 \tag{1}$$

where α is the share of tradable goods in total expenditure and *E* is the exchange rate. Rearranging equation (1) gives:

$$P = E\, \frac{P_T^{\propto}}{P_N^{\propto}}\, P_N = e^{\propto} P_N \tag{2}$$

where $e^{\propto} = E\, \frac{P_T^{\propto}}{P_N^{\propto}}$ and *e* is the real exchange rate.

The price of non-tradable goods (P_N) is a weighted average price of non-tradable food (NF) and non-tradable other goods (NO), that is,

$$P_N = P_{NF}^{\beta}\, P_{NO}^{1-\beta} \qquad 0 < \beta < 1 \tag{3}$$

where β is the share of non-traded food items in total expenditure of the non-tradable sector. Introducing natural logarithms in equation (3) gives us,

$$lnP_N = \beta lnP_{NF} + (1-\beta)\, lnP_{NO} \tag{4}$$

Letting $p = ln\, P$, (4) can be re-written as,

$$p_N = \beta\, p_{NF} + (1-\beta)\, p_{NO} \quad (5)$$

Substituting equation (3) into equation (2) gives,

$$P = e^{\propto} P_{NF}^{\beta}\, P_{NO}^{1-\beta} \quad (6)$$

Introducing natural logarithms to equation (6) gives,

$$p = \propto lne + \beta\, p_{NF} + (1-\beta)p_{NO} \quad (7)$$

Equation (7) shows the critical determinants of the general price level in the goods market. This is given by a weighted average of the real exchange rate (that gives the weighted average price of tradable goods) and price of non-tradable goods which is constituted by a weighted average of the price of non-tradable food and non-tradable other goods.

On the other hand, equilibrium is attained in the money market when $\frac{M^S}{P} = \frac{M^D}{P}$. Introducing logarithms, we get,

$$p = \log(M^S) - m^D \quad (8)$$

Where *p* and *m* are logarithms of the price index *P* and real money demand M^D respectively while M^S is the nominal stock of money. Equating (7) and (8) and solving for p_{NO} we obtain,

$$p_{NO} = (1-\beta)^{-1}[\log(M^S) - m^D - \alpha\, lne - \beta p_{NF}] \quad (9)$$

The demand for real money balances (m^D) is assumed to be a function of real income (y), expected inflation rate p^e and the interest rate (i), which can be expressed as,

$$m^D = f(y, p^e, i) \quad (10)$$

In theory, there is a positive relationship between real income and demand for real money balances. Expected inflation and interest rates have a negative relationship with demand for real money balances. Thus, the money demand function (10) can be expressed as follows in its linear form,

$$m^D = \delta_1 y - \delta_2 p^e - \delta_3 i \quad (11)$$

Substituting equation (11) into equation (9) we obtain,

$$p_{NO} = (1-\beta)^{-1}[\log(M^S) - \delta_1 y + \delta_2 p^e + \delta_3 i - \alpha\, lne - \beta p_{NF}] \quad (12)$$

Substituting equation (12) into equation (5) we get,

$$p_N = \beta\, p_{NF} + (1-\beta)[(1-\beta)^{-1}\log(M^S) - \delta_1 y + \delta_2 p^e + \delta_3 i - \alpha\, lne - \beta p_{NF}] \quad (13)$$

Equation (13) in its general form can be expressed as,

$$p_N = \varphi_1 m^S - \varphi_2 y + \varphi_3 p^e + \varphi_4 i - \varphi_5 lne \quad (14)$$

From equation (7),

$$p = \propto lne + p_N \quad (15)$$

Substituting equation (14) into (15) we get the following function for the general price level,

$$p = \tau_1 m^S - \tau_2 y + \tau_3 p^e + \tau_4 i - \tau_5 lne \quad (16)$$

Equation (16) gives the general inflation model, which can be expressed as,

$$p_t = f(m_t^S, y_t, p_t^e, i_t, e_t) \quad (17)$$

Over the period of study, South Africa was Zimbabwe's major trading partner with the latter heavily depending on imports from the former (ZimStats, 2015). The dependency on imports was exacerbated by the depreciation of the Rand against the US Dollar that made imports from South Africa more affordable than before. Economies whose markets are dominated by significant imports, have their prices influenced by foreign inflation levels, that is, of countries from which goods are imported (Pindiriri, 2012). Accordingly, the value of imports from South Africa were expected to influence the general price level in Zimbabwe.

Further, the price of crude oil declined significantly on the international markets from an average of US$107.1 in January 2012 to an average of US$36.57 per barrel in December 2015 (World Bank, 2016). Developments in the price of crude oil remain a critical component of the cost push element of price determination. The deflationary process needs to be modelled by augmenting equation (17) with an imports value variable (Mports) and crude oil price variable (oil). The general deflation model becomes,

$$p_t = f(m_t^S, y_t, p_t^e, i_t, e_t, Mports_t, oil_t) \quad (18)$$

The interaction of economic variables is more of a dynamic than a static nature. A change in a policy variable may not have an instant impact hence the need to lag variables. An autoregressive distributed lag (ARDL) model deals with the current and lagged effects of both the dependent and independent variables. The ARDL model uses time series data integrated of order zero and one and has become the workhorse in dynamic regressions that use a single equation. Equation (18) may thus be expressed as:

$$p_t = \pi_0 + \sum_{j=1}^{k} \gamma_{1j} p_{t-j} + \sum_{j=1}^{k} \pi_{1j} m_{t-j}^S + \sum_{j=1}^{k} \pi_{2j} y_{t-j} + \sum_{j=1}^{k} \pi_{3j} p_{t-j}^e + \sum_{j=1}^{k} \pi_{4j} i_{t-j} + \sum_{j=1}^{k} \pi_{5j} e_{t-j} + \sum_{j=1}^{k} \pi_{6j} Mports_{t-j} + \sum_{j=1}^{k} \pi_{7j} oil_{t-j} + u_t \quad (19)$$

The model makes use of differencing and this would transform equation (19) to the following:

$$\Delta p_t = \chi_0 + \sum_{j=1}^{k-1} \lambda_{1j} \Delta p_{t-j} + \sum_{j=1}^{k-1} \chi_{1j} \Delta m_{t-j}^S + \sum_{j=1}^{k-1} \chi_{2j} \Delta y_{t-j} + \sum_{j=1}^{k-1} \chi_{3j} \Delta p_{t-j}^e + \sum_{j=1}^{k-1} \chi_{4j} \Delta i_{t-j} + \sum_{j=1}^{k-1} \chi_{5j} \Delta e_{t-j} + \sum_{j=1}^{k-1} \chi_{6j} \Delta Mports_{t-j} + \sum_{j=1}^{k-1} \chi_{7j} \Delta oil_{t-j} + v_t \quad (20)$$

A test for co-integration is carried out and if the variables are co-integrated then an error correction model (ECM) is used, as given below:

$$\Delta p_t = \theta_0 + \sum_{j=1}^{k-1} \sigma_{1j} \Delta p_{t-j} + \sum_{j=1}^{k-1} \theta_{1j} \Delta m_{t-j}^S + \sum_{j=1}^{k-1} \theta_{2j} \Delta y_{t-j} + \sum_{j=1}^{k-1} \theta_{3j} \Delta p_{t-j}^e + \sum_{j=1}^{k-1} \theta_{4j} \Delta i_{t-j} + \sum_{j=1}^{k-1} \theta_{5j} \Delta e_{t-j} + \sum_{j=1}^{k-1} \theta_{6j} \Delta Mports_{t-j} + \sum_{j=1}^{k-1} \theta_{7j} \Delta oil_{t-j} - \psi(p_{t-1} - \kappa_1 m_{t-1}^S - \kappa_2 y_{t-1} - \kappa_3 p_{t-1}^e - \kappa_4 i_{t-1} - \kappa_5 e_{t-1} - \kappa_6 Mports_{t-1} - \kappa_7 oil_{t-1}) + \varepsilon_t \quad (21)$$

The term in parenthesis is the error correction term (ECT) whose coefficient is ψ. The error correction coefficient measures the speed of adjustment towards long run equilibrium.

4.2 Estimation Technique

Time series data from January 2012 to June 2015 was collected for use in an ARDL model using E-views 7. Tests for stationarity, cointegration and serial correlation are conducted to avoid spurious regression.

4.2.1 Unit Root Tests

A stochastic process whose statistical parameters, mean and variance, do not change overtime is said to be stationary. Running an OLS regression on non-stationary series results in spurious regression therefore tests for stationarity are conducted. For the stationarity tests, the Augmented Dickey Fuller (ADF) test is used. The test is conducted on the hypothesis that a series is non-stationary, meaning it has a unit root. The hypothesis is rejected if the modulus of the calculated t statistic is greater than the critical ADF values. However, if a series is found to be non-stationary,

there is need to avoid spurious regression by transforming non-stationary time series to make them stationary. The transformation method depends on whether the time series are difference stationary (DSP) or trend stationary (TSP) (Gujarati, 2004). If a time series has a unit root and is DSP, the first differences of such time series are stationary. The simplest way to make TSP time series stationary is to regress it on time and the residuals from this regression are stationary (Gujarati, 2004).

4.2.2 Diagnostic Tests

Serial autocorrelation is tested using the Breusch-Godfrey Serial Correlation LM test. The null hypothesis of serial correlation is not rejected if the probability value of the F-statistic is less than 5%. A Ramsey RESET test for specification of the model is conducted. The null hypothesis of misspecification is rejected if the probability value of the F-statistic is insignificant. A test on normality distribution of the residuals is conducted. The Jarque-Bera value of close to zero and a probability value insignificant at 5% level confirms that the residuals are normally distributed. A test for heteroscedasticity is also conducted with the null hypothesis of heteroscedasticity being rejected if the probability value of the F-statistic is insignificant. The above diagnostic tests determine the extent to which the estimated results can be relied on.

4.2.3 Cointegration Analysis

Two or more variables are said to be cointegrated if they have a long run equilibrium relationship between them. If some variables are integrated of the same order, there is need to test for cointegration. If the series are co-integrated, then an Error Correction Model (ECM) is used. A bounds test for cointegration is conducted and when the calculated F statistic is greater than the critical upper bounds statistic, then the series are cointegrated.

4.3 Justification of Variables

The study now justifies the economic reason why a variable was included in the model. Reasons for justification are based on both theoretical and empirical logic. The a priori expected sign for the relationship between the regressand and the regressor is given for each of the variables.

4.3.1 Consumer Price Index (CPI)

The change in the monthly all items CPI was used as a proxy for (p_t) a variable measuring deflation. The all items CPI was chosen on the basis that it is representative of most sectors of the economy.

4.3.2 Expected Deflation

In an ARDL model the deflationary expectations are represented by lagged consumer price indices. A lagged regressand becomes a regressor. Assuming adaptive and rational expectations, in the absence of credible policies to combat deflation, economic agents expect prices to fall because they have seen them falling, that is a marginal increase in the deflation rate in period t_{+1} compared to period t. The relationship between expected and actual deflation is predicted to be positive.

4.3.3 Volume of Manufacturing Index (VMI)

The study used monthly data series, which necessitated that the Volume of Manufacturing Index be used as a proxy for GDP. This was due to non-availability of monthly GDP data, hence use of VMI which was available on a monthly basis and depicted performance of the manufacturing sector which contributed an average of 13.1% to GDP (Zimstat, 2015). In terms of contribution to GDP, the manufacturing sector came after the distribution, hotels and restaurants sector (14.2%) and transport and communication sector (13.2%) (Zimstat, 2015). However, monthly data was not available for the two highest contributing sectors hence settling for the third highest. GDP as a variable shows the growth of goods and services available in an economy. The interaction of GDP and demand affects the general price level. An increase in output, *ceteris paribus*, results in a downward adjustment of prices due to increased supply of goods on the market. We therefore hypothesise that an increase in GDP is accompanied by a decline in the general price level, meaning there is a negative relationship between GDP and p_t.

4.3.4 Money Supply

Money supply was included as a predictor due to its effects on the general price level in accordance with the quantity theory of money. In this study, the definition of money supply used is M3, which comprises of notes and coins in circulation, plus demand deposits with the banking sector, plus saving deposits, plus less than 30 day deposits with the banking sector, plus over 30 day time deposits with the banking sector. According to Fama (1982) base money is the relevant monetary variable in the process of setting the general price level and hence the key variable in the control thereof. Money growth rates that are not consistent with income growth rates are theoretically

considered to be pivotal in setting the general price level trends. The quantity theory of money predicts a positive relationship between money supply and the general price level.

4.3.5 Price of Crude Oil

The price of crude oil was included as an exogenous variable in the model due to the central role that fuel plays in determining the general price level from a cost push theory perspective. In addition, the international yearly average price of crude oil was declining from 2012 culminating in a sharp decline in mid-2014. The effects of a decline in oil price has a direct and indirect effect on the general price level in Zimbabwe. The direct effect is through a decrease in price of fuels in Zimbabwe, which is usually marginal due to a specific tax imposed on importing fuel. The indirect effect is through importing goods that have prices reflective of cheaper fuels in their countries of origin. The price of oil is a determinant factor in the cost build-up of goods and services and in accordance with the cost push theory, a positive relationship is expected between the price of oil and the general price level.

4.3.6 Value of Imports

Capacity utilisation in Zimbabwe was low with the manufacturing sector operating below sixty percent (CZI, 2015) for most of the time. The commodities gap had to be filled by imports with a monthly range of thirty four to forty percent being imports from South Africa, which is Zimbabwe's major source of imports (Zimstat, 2015). The value of imports from South Africa was included as a covariate, given the effect of increased competition brought on the local market by the high level of imports that compensated for the weak economic performance in Zimbabwe. If the value of imports increase competition increases and prices are expected to adjust downwards. Therefore the value of imports is expected to have a negative relationship with the general price level.

4.3.7 Interest Rates

The introduction of the multicurrency regime in 2009 came with very high interest rates as foreign lines of credit were obtained with a country risk premium (RBZ, 2010). This risk was mostly associated with the political disturbances of 2008 and lack of economic stability just prior to 2009. The Reserve Bank of Zimbabwe then embarked on a moral suasion strategy by engaging commercial banks to lower interest rates to lower costs of production. As early as 2012 interest

rates began to ease, hence the inclusion of the variable as a stimulus in the model. The commercial bank lending rates were used as a proxy for interest rates. Interest rates may be used as a demand management tool and the relationship between interest rates and the general price level will be negative. However, from the supply side of the economy that is in production, interest rates are a cost of production and by reducing interest rates significantly we expect prices to respond positively. The latter scenario was more applicable to Zimbabwe during the period of the study. As such and in accordance with the cost push theory of inflation a positive relationship is expected between interest rates and the general price level.

4.3.8 Bilateral Nominal Effective Exchange Rate

A bilateral nominal effective exchange rate of the Rand to the US Dollar was used as a control variable in the model as it translates foreign prices into local prices given the high volume and value of monthly imports from South Africa. In addition, the Rand depreciated against major currencies for the duration of the study period. This made South African imports cheaper, increased competition in Zimbabwe, brought price equalisation into play and thereby pushed prices down. A positive relationship is therefore expected between depreciation of the Rand and the general price level in Zimbabwe.

4.4 Data Source and Limitations

Monthly secondary data was utilised in this study with VMI, inflation rate and value of imports sourced from the Zimbabwe National Statistics Agency. Money supply, lending interest rates and bilateral nominal effective exchange rates were sourced from the Reserve Bank of Zimbabwe. International prices of crude oil were sourced from the World Bank Development Indicators Database. The only limitation was the unavailability of monthly GDP data, hence use of VMI as a proxy.

4.5 Conclusion

The chapter presented a mathematical derivation of variables, aided by empirical developments, for use in the model. It then proposed use of an ARDL model, presented estimation techniques and justification of variables. The expected signs of the variables were also discussed. The next chapter presents the results of the study and risks associated with deflation.

Chapter 5

Model Estimation, Interpretation of Results and Analysis

5.0 Introduction

This chapter presents results of tests that were carried out, empirical results of the model developed in the last chapter and interpretation of the results. The study employs the Augmented Dickey-Fuller test for stationarity to avoid the problem of spurious regression. A bounds test for cointegration was carried out and resulted in the formulation of an error correction model. E-views 7 is used for carrying out the tests and running the long run ARDL and the Error Correction Models.

5.1 Tests Results

5.1.1 Unit Root Tests

The Augmented Dickey Fuller tests were employed for unit root tests of the time series data used in the study. A sequential test was used to determine whether the intercept and trend were to be included in the test of each series. The results are as shown in Table 5.1 below.

Table 5.1: Unit Root Test Results

Variable	ADF Statistic	Integration Order	Level of Significance
DEFL (p_t)	-7.2816216	I(1)	***
M3	-7.2816216	I(1)	***
VMI	-5.541757	I(0)	***
Int	-11.52707	I(1)	***
BNEER	-6.928129	I(1)	***
Mports	-5.591091	I(0)	***
Oil	-4.177930	I(1)	***
Residuals	-6.061456	I(0)	***

*Key: *, ** and *** denote level of significance at 10%, 5%, and 1% respectively*

5.1.2 Optimal Lag Length Selection

The Akaike Infomation Criterion (AIC) in conjunction with the Schwarz Criterion (SC) were used to determine the optimal lag length for the ARDL model. The ARDL cointegration approach has advantages over other cointegration methods by Engel and Granger and Johansen in that the ARDL procedure allows variables to have different lag lengths, which the other methods do not allow (Bhatta, 2013).The results for the model's optimal lag lengths are as shown in Table 5.2 below.

Table 5.2: Optimal Lag Length

Lag	**AIC**	**SC**
1	1.017	1.609
2	0.626	1.522
3	0.470	1.676
4	-1.004	0.519

Lag four had the minimum values for both the AIC and SC values meaning that the optimal lag length is four. It was considered that the income (VMI) and money supply M3 variables need more time to register their impact on price level changes. As such a lag length of four was assigned to the two variables as suggested by the AIC and SC values. However, deflationary expectations, interest rates, bilateral nominal effective exchange rate, volume of imports and oil price are variables whose impact can be realised in a shorter period, and were therefore allocated a lag length of one month. This is consistent with rational economic behaviour where economic agents quickly react to exchange rate, interest rate and oil price developments. in the same respect, immediate past expectations on deflation formed in period t_{-1}, have more influence on the general price level in period t. These variables had better results consistent with expectations at a lag length of one.

5.1.3 Diagnostic Tests Results

To establish if the results of the model could be relied on, various diagnostics tests were conducted. The actual results are in Appendix A. A Breush-Godfrey Serial Correlation LM Test was conducted to test for serial correlation. The hypothesis of serial correlation could not be rejected if the Chi-square probability value is less than 5%. The probability for Chi-Square (4) was 0.1333 which is not significant. The null hypothesis of serial correlation is therefore rejected at 5% level of significance. This means there is no serial correlation in the model.

A Ramsey RESET was conducted to find out if the model is correctly specified. The results show an F-statistic of 0.6605 with an insignificant probability value of 0.4262. The null hypothesis of misspecification is therefore rejected at 5% level of significance.

The model was tested for heteroscedasticity. The results show an F-statistic value of 0.9824 with a probability value of 0.5090 which is insignificant. Accordingly the null hypothesis of heteroscedasticity is rejected at 5% level of significance.

Tests for normality of the residuals were conducted. A Jarque-Bera statistic of 0.6535 with an insignificant probability value of 0.7212 was obtained. The null hypothesis of normality could not be rejected at 5% level of significance. This means that the residuals are normally distributed.

In view of the above results, the model passed all the diagnostic tests. The implication being that the estimated results could be relied upon for interpretation.

5.1.4 Cointegration Test

The bounds test methodology for cointegration testing by Pesaran *et al*. (2001) was used in the study. The methodology is considered superior in that the series do not need to be integrated of the same order as required under the Engle Granger and Johansen Tests. Bounds testing can be used with a mixture of I(0) and I(1) or fractionally integrated data, with a strict no I(2) data, the errors of the model must be serially independent and the methodology applies to a single equation model. The methodology is also superior in that if an equation has seven variables as in this case with five of them being I(1) and two being I(0). It is not convincing that the two variable I(0) can totally

remove the possibility of cointegration in the five variables that are I(1). The bounds test gave a test F-statistic of 3.390 (with a probability value of 0.0187). The F-statistic critical values for a seven variable equation without an intercept are 2.003 for the lower bound and 3.199 for the upper bound (Pesaran and Shin, 1999). When the test F-statistic is less than the lower bound then there is no cointegration and when it is greater than the upper bound then we conclude there is cointegration. If the test F-statistic is in between the lower and upper bounds then the results are inconclusive (Pesaran and Shin, 1999). In this case 3.390 is greater than the upper bound limit signifying existence of cointegration. The study then makes use of an error correction model as in equation (21) of Chapter 4.

5.2 Presentation of Long Run ARDL Results

Cointegration tests conducted indicated that there was a long run relationship among some of the variables. Guided by this finding, a long run model was regressed on the understanding that in practice the introduction of a policy initiative or a change in the performance of a variable is not expected to have an immediate impact on deflation. The model was run with all explanatory variables having a lag length. The estimated long run coefficients are presented in Table 5.3 below.

Table 5.3: Estimated Long Run Coefficients

ARDL(1,4,4,1,1,1,1) Dependent Variable: DEFL				
Variable	**Coefficient**	**Standard Error**	**t-Statistic**	**Probability**
DEFL(-1)	0.65***	0.12	5.37	0.00
VMI(-1)	-0.00	0.01	-0.35	0.73
VMI(-2)	-0.02**	0.01	-2.22	0.04
VMI(-3)	-0.01	0.01	-1.33	0.20
VMI(-4)	-0.01	0.01	-1.42	0.17
M3(-1)	-0.00	0.00	-0.42	0.68
M3(-2)	-0.00	0.00	-0.32	0.75
M3(-3)	0.00	0.00	0.39	0.70
M3(-4)	0.00	0.00	0.19	0.85
MPORTS(-1)	-0.00	0.00	-0.42	0.68
INT(-1)	0.17	0.15	1.10	0.28
OIL(-1)	-0.00	0.00	-0.08	0.93
BNEER(-1)	0.04**	0.12	2.26	0.03

*Key: *, ** and *** denote level of significance at 10%, 5%, and 1% respectively*

The estimated long run results have the expected positive sign for deflation expectations and the long run coefficient is significant at 1% level. This means that in the long run deflation

expectations by economic agents contribute significantly to the price level trajectory. The volume of manufacturing index has the expected negative sign for all the four lags. The long run second lag coefficient of VMI of 0.02 is significant at 5% level. This means that in the long run a one percent increase in GDP in period t, is estimated to result on average in a reduction by 0.02 units in the general price level in period t_{+2}. BNEER has the expected positive sign and a coefficient of 0.04 implies that in the long run a one percent depreciation of the Rand leads to a reduction of 0.04 units in the general price level. The long run coefficient for BNEER is significant at 5% level.

Money supply has the expected positive sign for the third and fourth lags only. This means that in the long run a decrease in money supply results in a decline in the general price level and the reverse also holds. The value of imports has the expected negative sign implying that in the long run if the value of imports from South Africa increase, competition increases on the domestic market and prices go down. Interest rates have the expected positive sign while price of oil has an unexpected negative sign.

5.3 Analysis of Error Correction Model Results

Guided by findings from the bounds test for cointegration, an error correction model (ECM) was regressed. The results are shown in Table 5.4 below, under Model 1. Models 2 and 3 were for robust testing where the model was run without the Mports and Oil variables respectively. The dissertation is however, going to interpret results for Model 1. Results for Model 1 show that the interest rates coefficient has the expected sign and is significant at 1 percent level while BNEER, lagged income (VMI(-4)), lagged deflation (defl(-1)) and the error correction term have the expected signs and are significant at 5% level. The variables in the model explain 69.43 percent of variations in deflation as shown by the value of R^2.

Table 5.4: Error Correction Model Results

Variable	Model 1	Model 2	Model 3
D(DEFL(-1))	0.27** (2.12)	0.24** (1.97)	0.27** (2.15)
D(VMI(-1))	0.00 (0.01)	-0.00 (-0.14)	0.00 (0.05)
D(VMI(-2))	-0.01 (-1.47)	-0.01 (-1.4)	-0.01 (-1.7)
D(VMI(-3))	-0.01 (-1.47)	-0.01 (-1.04)	-0.00 (-0.95)
D(VMI(-4))	-0.02** (-2.62)	-0.02** (-2.5)	-0.02** (-2.73)
D(M3(-1))	-0.00 (-0.02)	-0.00 (-0.18)	-0.00 (-0.04)
D(M3(-2))	0.00 (0.17)	0.00 (0.36)	0.00 (0.13)
D(M3(-3))	0.00 (0.5)	0.00 (0.6)	0.00 (0.5)
D(M3(-4))	0.00 (1.89)	0.00 (1.86)	0.00 (1.91)
D(MPORTS(-1))	-0.00 (-0.85)		-0.00 (-0.91)
D(INT(-1)	0.82*** (4.48)	0.85*** (4.75)	0.81*** (4.48)
D(OIL(-1))	0.01 (0.75)	0.01 (0.82)	
D(BNEER(-1))	0.07** (2.76)	0.07*** (2.94)	0.07*** (3.16)
ECT(-1)	-0.84** (-2.59)	-0.79** (-2.5)	-0.84** (-2.61)

Key: *t-statistic in parentheses.*

, ** and * denote level of significance at 10%, 5%, and 1% respectively.*

Interest rates

Lagged interest rates INT(-1) has an expected positive sign and a coefficient 0.82. The positive sign means that a reduction in interest rates results in a decline in the general price level. This is consistent with the cost push theory where we consider interest rates as a cost of financing production and transactions. Interest rates were exorbitantly high in Zimbabwe and hence their continued reduction impacted on the cost of doing business. A coefficient of 0.82 means that a one percent reduction in lending rates in period t, is estimated to result on average in a reduction by 0.82 units in the general price level in period t_{+1}. The p value of 0.0002 indicates that the results are significant at a 1% level.

Exchange rate

The lagged bilateral nominal effective exchange rate variable BNEER(-1) has an expected positive sign with a coefficient of 0.07. The positive sign means that a depreciation of the Rand leads to a decline of the general price level in Zimbabwe and the opposite holds. The coefficient means that a depreciation of the South African Rand by one unit against the US Dollar in period t, is estimated to result on average in a decline of the general price level in Zimbabwe by 0.07 units in period t_{+1}. Considering that the value of imports by Zimbabwe from South Africa range between 34 to 40 percent every month (Zimstat, 2015), this means that the deflationary process in Zimbabwe is significantly imported. This implies a price equalisation process is at play given that the depreciation of the Rand against the US Dollar translates into a lower general price level through the exchange rate. The p value of 0.01 indicates that the results are significant at 5% level.

Income

VMI(-4) a proxy for income with a lag length of four months, has the expected negative sign. This means that an increase in GDP results in a decline in the general price level and the opposite holds, that is if production goes down then it becomes the classical case of too much money chasing few goods which is inflationary. The coefficient of -0.02 implies that a one percent increase in GDP in period t, is estimated on average to cause the general price level to decline by 0.02 units in period t_{+4}. These results are significant at 5% levels as signified by a p value of 0.02. It is critical to note that an increase in GDP accompanied by a proportional increase in money supply should not result

in deflation. The fact that the monetary authorities were not in control of the monetary aggregates to intervene appropriately, is responsible for GDP growth leading to deflation.

Deflation Expectations

The variable DEFL(-1) represents deflation expectations. It has an expected positive sign and a coefficient of 0.27. The positive sign shows the role of expectations in determination of the general price level. Assuming rational expectations, economic agents make use of all available information including current policies to forecast the future. In the absence of credible policies by authorities to reverse the trend, economic agents expect a progression of the current trend. The same would apply to adaptive expectations were economic agents expect prices to fall in period t_{+1} as they were falling in period t. The results are significant at 5% level as shown by a p value of 0.046.

Money Supply, Imports and Price of Crude Oil

All the lagged variables of M3 are not significant. The second, third and fourth lags have the expected positive signs except for the first lag which has an unexpected negative sign. The value of imports has the expected negative sign but the results are not significant. The international price of crude oil has the expected positive sign with results that are not significant.

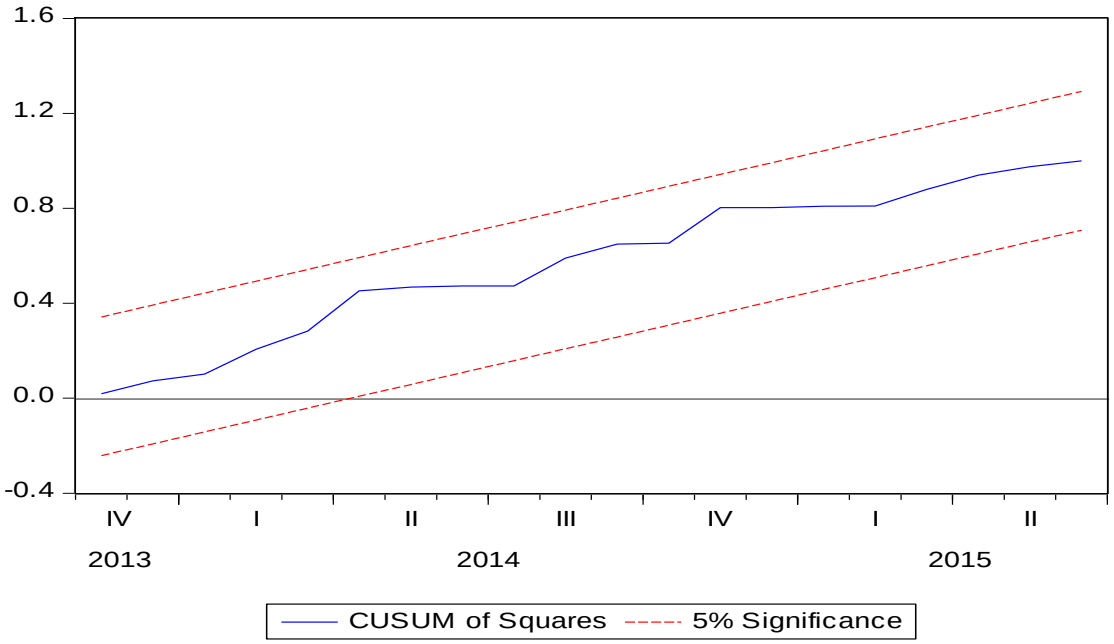
Error Correction Term

The error correction term has an expected negative sign and a coefficient value of -0.84. The negative sign means that there is convergence towards equilibrium in the long run. The absolute value of the coefficient represents a high speed of adjustment to equilibrium following short run disturbances or shocks. This means about 84% of the disequilibrium caused by shocks in one period, converge to long run steady state in the next period, in this case, one month. The coefficient of the error correction term is significant at 5% level.

5.3.1 Stability Test Results

The CUSUM and CUSUM of Squares Tests were used to test for model stability, with the CUSUM of Squares Test being the stricter of the two. Figure 5.1 below show results from the CUSUM of Squares test.

Figure 5.1: CUSUM of Squares Test



The plots of the cumulative sum of squares of recursive residuals show that the coefficients of the estimated error correction model fall within the critical bounds at 5% level of significance. This meant that the model is stable over the sample period.

5.3.2 Test for Model Robustness

To test for the robustness of the model, the variables that were not significant were dropped from the equation one at a time and the results were noted under Model 2 and 3 in Table 5.4 above. The variables that were dropped from the equation are value of imports from South Africa and international price of crude oil. In both cases all the coefficient signs of significant variables did not change and the variables remained significant.

Model 2 shows the results of the model run without the Mports variable. Interest rates maintained their positive sign and remained significant at 1% level. The D(BNEER(-1)), D(VMI(-4)), D(DEFL(-1)) variables and the ECT(-1) maintained their expected signs and remained significant at 5% level.

Model 3 shows the results of the model run without the international price of crude oil variable. Interest rates maintained their positive sign and remained significant at 1% level. The D(BNEER(-

1)), D(VMI(-4)), D(DEFL(-1)) variables and the ECT(-1) maintained their expected signs and remained significant at 5% level. The fact that the significant variables did not change signs and maintained their significance shows that the model is robust.

5.4 Risks Associated with Deflation

The deflationary pressures in the economy reflected structural weaknesses in the economy. In the financial sector, the risk of bankruptcies remain high as a result of increased real debt burdens due to deflation, while the capacity to pay debts does not improve. The above cited reduced profitability by firms reduces debtors' capacity to service debts leading to financial institutions having bad debts. During the period of the study, the Reserve Bank of Zimbabwe was in the process of attempting to resolve the problem of non-performing loans under a special purpose vehicle named the Zimbabwe Asset Management Company (ZAMCO). Bad debts were mostly due to a combination of high interest rate charges and weak demand in the economy. If deflation was not tackled a new generation of non-performing loans remained inevitable. Eventually deflation risks poor performance of the financial sector through falling interest rates. In the extreme case the financial sector is hamstrung by zero bound interest rates that also render monetary policy ineffective. A combination of the risks analysed above potentially lead to economic contraction accompanied by job losses. The ultimate risk is that the economy slides into a recession that brings more stagnation.

Further, deflation is associated with a high risk of an increasing public debt stock due to attempts to stimulate the economy through increased public expenditures and reduced taxes. This would be reinforced by declining revenues due to GDP contraction and an increase in social security payments to cushion vulnerable groups in the economy. In Zimbabwe, the tax base thinned over the years. Fiscal revenues were struggling to fund Government expenditures as the wage bill was in excess of eighty percent (MOFED, 2015). In 2015 in Lima, government negotiated with the World Bank, International Monetary Finance and African Development Bank on an external payments arrears clearance strategy to enable it to negotiate for new access to external resources to stimulate the economy. This meant the risk of a ballooning debt and problems associated with a debt overhang remained real.

The poor performance of the stock market is indicative of negative perceptions and weak macroeconomic fundamentals. The continued decline in the industrial and mining indices meant households and firms were losing capital wealth. This put the economy at the risk of a possible asset price fall leading to further loses by economic agents.

Accordingly, if deflation is left unattended the real sector of the economy suffers further. Agriculture and manufacturing are vulnerable as they depend mostly on domestic competitive markets. However, through sectoral linkages other sectors of the economy could experience reduced profitability and decline in performance. A contraction of the real sector comes with company closures, unemployment and reduced disposable income leading to weak aggregate demand. At this point, economic growth is threatened and the possibility of poverty and hunger become imminent.

5.5 Conclusion

The chapter carried out stationarity tests on the series to avoid spurious regression. A lag length of four was found to be optimal for the ARDL model. A bounce test for cointegration was conducted and the series were found to be cointegrated. The error correction model passed diagnostic tests, which meant the estimated results could be relied upon for interpretation. Variables that were found to significantly influence deflation are interest rates, deflation expectations, bilateral nominal effective exchange rate and income. The testing for model robustness was conducted. Two variables were dropped one at a time and the model proved to be robust. The chapter ended by discussing the risks associated with deflation.

Chapter 6

Findings, Policy Recommendations and Summary of the Study

6.0 Introduction

This chapter summarises the main findings of the study, gives policy recommendations and suggestions for further research. The findings and recommendations are based on results obtained in Chapter 5.

6.1 Findings

The major objective of the study was to establish the causes and risks of deflation in Zimbabwe and ascertain if money supply was the major driver. The study established that deflation is mostly driven by deflation expectations, decline of interest rate charges, income movements and depreciation of the Rand against the US Dollar. The money supply variable per se was not significant in the error correction model. However, deflation emanating from change in income, expectations, interest rates and uncontrollable depreciation of the Rand against the US Dollar is in tandem with problems associated with monetary authorities that are not in control of monetary aggregates of the economy.

Although the money supply variable was not significant in the model, it is critical to note that changes in money supply affect and can be used to influence variables that were significant in the model namely, deflation expectations, income changes as they relate to price levels, interest rates and exchange rates. The trajectories of each of the four variables that were found to be the major drivers of deflation in Zimbabwe are a function of money supply. This implies that Zimbabwe needed to use a currency with aggregates under the control of the Reserve Bank of Zimbabwe. This could have resolved a scenario where monetary authorities were reduced to spectators, unable to control or influence developments on economic variables such as exchange and interest rates. As in any developing economy, sound and effective monetary management remains critical to achieve macroeconomic stability that fosters sustainable economic growth.

The introduction of the multicurrency regime meant there was no authority in charge of all monetary policy tools and instruments. As such, there were no interventions that the Reserve Bank

of Zimbabwe could introduce to influence the initially very high interest rates in a dollarized economy and the exchange rate developments that continued to make imports cheaper and exports uncompetitive. Further, the results suggest that the cost of borrowing eventually subsided and that the price levels of tradable goods and services between Zimbabwe and South Africa were converging partly as a result of depreciation of the Rand against the greenback.

6.2 Recommendations

If Zimbabwe continued with the monetary sector on auto-pilot, then deflation was likely to persist. The monetary authorities needed to be in control of all monetary policy tools and instruments, to influence the four variables that are significant in the model and change the general price level trajectory. By way of recommendation, Zimbabwe had two options to pursue other than adoption of a multicurrency regime.

The first option was that Zimbabwe needed to have its own currency like any other economy so that it would have the monetary policy tools under the control of the Reserve Bank of Zimbabwe. However, this option had its shortcomings given that in 2009, Zimbabwe come out of a hyperinflation that officially recorded a year on year rate of inflation of 231 million percent in July 2008 (ZimStat, 2008). After July 2008 ZimStat ceased to produce inflation figures and inflation probably got much higher by December 2008. As such acceptance of the reintroduction of a local currency remained difficult, first due to loss of confidence in the monetary system by economic agents in Zimbabwe. Also the economic fundamentals to support a local currency were not in place given declining growth rates and balance of payments crisis emanating from a persistent negative trade balance.

The second and recommended option, was for Zimbabwe to have formally dollarised. This would have entailed formally engaging a foreign Central Bank, either of South Africa, United States of America or any other country whose currency was in Zimbabwe's basket of currencies. By allowing Zimbabwe to officially use its currency, it would imply the monetary policy of that economy would filter to Zimbabwe as well. This arrangement would leave the Zimbabwe economy cushioned from the vagaries of economic volatilities. There would have been a monetary authority

to intervene and respond to particular undesirable monetary developments in the Zimbabwe economy.

6.3 Suggestions for Further Research

While the results in this study are encouraging, the study is not exhaustive as it left other phenomena worth studying by future researchers. The study expected a clear significant relationship between money supply and deflation. However, the money supply variables was not significant. One of the limitations of this study was the lack of monthly GDP data hence use of the VMI as a proxy variable for income. Future researchers could use GDP figures and use various statistical techniques to break the annual data into monthly.

Further study could be done to establish the effect of the persistent trade balance deficit on the general price level. Bearing in mind that the capital account of the BOP was not very active to offset the negative current account position, the trade deficit trends that resulted in a negative current account balance, were bound to affect the monetary sector in general. The negative current account balance was bound to mop up liquidity in the economy forcing the economy to be on a monetary diet. Hence, the need to investigate the impact of persistent current account deficits.

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Appendix A

Table A.1: Breusch-Godfrey Serial Correlation LM Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.402440	Prob. F(4,11)	0.8031
Obs*R-squared	4.723254	Prob. Chi-Square(4)	0.3169

Table A.2: Test for Cointegration

Wald Test:
Equation: LAGFOURPLUS

Test Statistic	Value	df	Probability
F-statistic	3.390961	(7, 17)	0.0187
Chi-square	23.73673	7	0.0013

Null Hypothesis: C(14)=C(15)=C(16)=C(17)=C(18)=C(19)=
C(20)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(14)	-0.509847	0.152147
C(15)	-0.068069	0.026832
C(16)	-5.31E-07	3.45E-07
C(17)	1.13E-09	1.08E-09
C(18)	0.422314	0.285503
C(19)	-0.003597	0.004320
C(20)	0.046654	0.024258

Restrictions are linear in coefficients.

Figure A.1 CUSUM Test

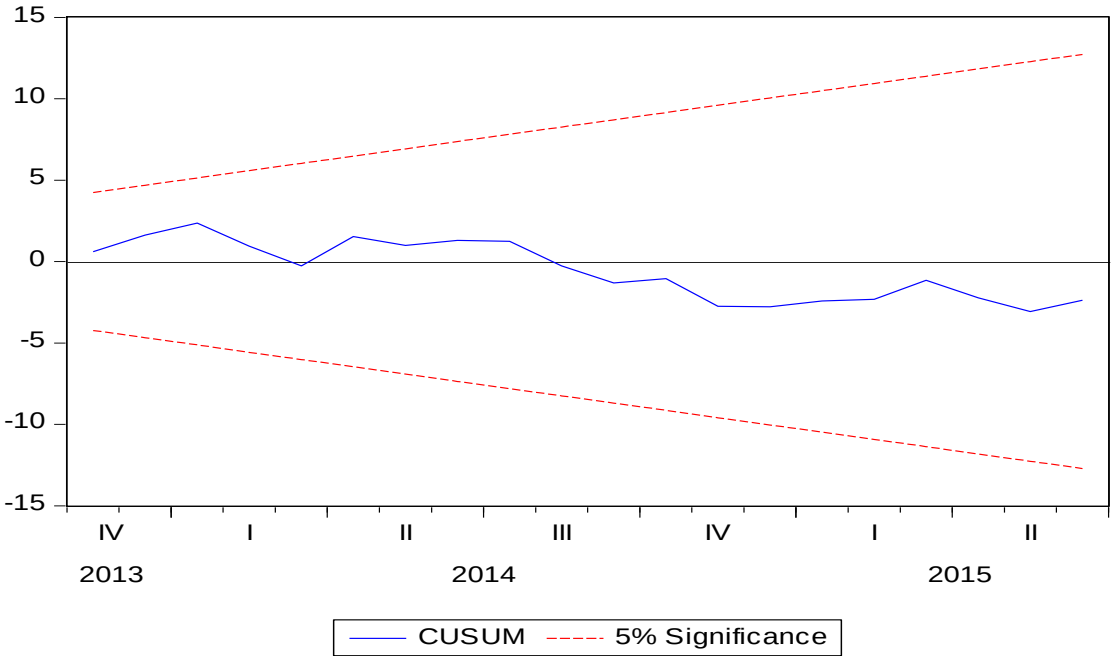
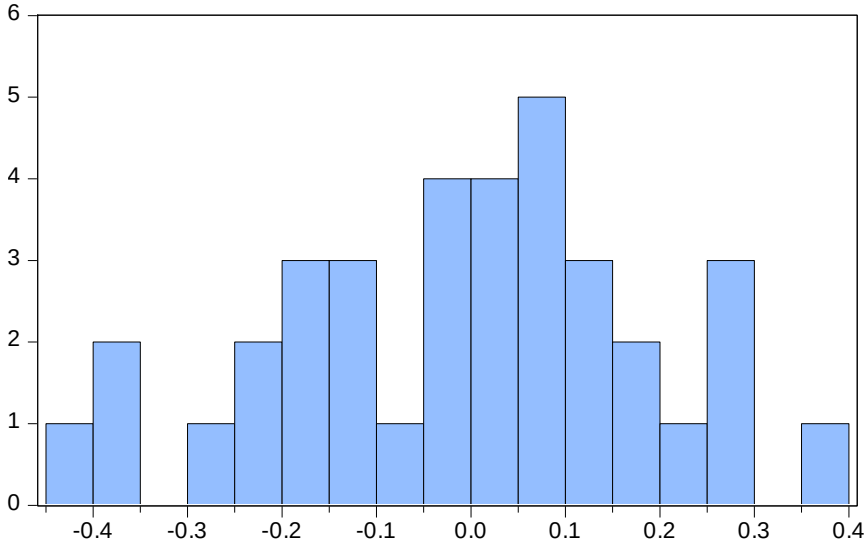


Table A.3: Heteroscedasticity Test

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.982403	Prob. F(16,19)	0.5090
Obs*R-squared	16.29866	Prob. Chi-Square(16)	0.4323
Scaled explained SS	3.784911	Prob. Chi-Square(16)	0.9992

Figure A.2: Normality Test



Series: Residuals
Sample 2012M07 2015M06
Observations 36

Mean	-0.010505
Median	0.005995
Maximum	0.377690
Minimum	-0.404015
Std. Dev.	0.195130
Skewness	-0.190122
Kurtosis	2.460338
Jarque-Bera	0.653732
Probability	0.721180

Table A.4: Ramsey RESET Test

Ramsey RESET Test
Equation: ECMRESULTS
Specification: D(DEFL) D(DEFL(-1)) D(VMI(-1)) D(VMI(-2)) D(VMI(-3)) D(VMI(-4)) D(M3(-1)) D(M3(-2)) D(M3(-3)) D(M3(-4)) D(MPORTS(-1)) D(INT(-1)) D(OIL(-1)) D(BNEER(-1)) ECT(-1)
Omitted Variables: Squares of fitted values

	Value	df	Probability
t-statistic	0.812739	19	0.4264
F-statistic	0.660544	(1, 19)	0.4264
Likelihood ratio	1.230294	1	0.2673

F-test summary:

	Sum of Sq.	df	Mean Squares
Test SSR	0.044907	1	0.044907
Restricted SSR	1.336624	20	0.066831
Unrestricted SSR	1.291717	19	0.067985
Unrestricted SSR	1.291717	19	0.067985

LR test summary:

	Value	df
Restricted LogL	8.198903	20
Unrestricted LogL	8.814050	19

Appendix B

Table B.1: Results of the ECM with all Variables

Dependent Variable: D(DEFL)
Method: Least Squares
Date: 04/24/16 Time: 17:00
Sample (adjusted): 2012M07 2015M06
Included observations: 36 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DEFL(-1))	0.269174	0.127249	2.115327	0.0460
D(VMI(-1))	0.000155	0.008046	0.019273	0.9848
D(VMI(-2))	-0.012456	0.008461	-1.472241	0.1551
D(VMI(-3))	-0.006940	0.008548	-0.811917	0.4255
D(VMI(-4))	-0.021192	0.008082	-2.622254	0.0156
D(M3(-1))	-1.12E-08	5.88E-07	-0.019022	0.9850
D(M3(-2))	9.56E-08	5.60E-07	0.170762	0.8660
D(M3(-3))	2.69E-07	5.36E-07	0.502668	0.6202
D(M3(-4))	1.08E-06	5.69E-07	1.889879	0.0720
D(MPORTS(-1))	-4.21E-10	4.95E-10	-0.850305	0.4043
D(INT(-1))	0.818589	0.182567	4.483771	0.0002
D(OIL(-1))	0.006332	0.008450	0.749276	0.4616
D(BNEER(-1))	0.065365	0.023643	2.764654	0.0113
ECT(-1)	-0.837719	0.324065	-2.585039	0.0169

R-squared	0.694316	Mean dependent var	-0.188889
Adjusted R-squared	0.513685	S.D. dependent var	0.384543
S.E. of regression	0.268166	Akaike info criterion	0.490879
Sum squared resid	1.582084	Schwarz criterion	1.106692
Log likelihood	5.164183	Hannan-Quinn criter.	0.705814
Durbin-Watson stat	2.216220		

Table B.2: Results of the ECM without the MPORTS variable

Dependent Variable: D(DEFL)
Method: Least Squares
Date: 04/21/16 Time: 12:55
Sample (adjusted): 2012M07 2015M06
Included observations: 36 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DEFL(-1))	0.242966	0.122715	1.979930	0.0598
D(VMI(-1))	-0.001081	0.007866	-0.137382	0.8919
D(VMI(-2))	-0.011690	0.008362	-1.398018	0.1754
D(VMI(-3))	-0.008617	0.008267	-1.042346	0.3081
D(VMI(-4))	-0.018545	0.007413	-2.501706	0.0199
D(M3(-1))	-1.07E-07	5.74E-07	-0.185866	0.8542
D(M3(-2))	1.97E-07	5.44E-07	0.362841	0.7200
D(M3(-3))	3.19E-07	5.30E-07	0.601646	0.5533
D(M3(-4))	1.05E-06	5.65E-07	1.858710	0.0759
D(OIL(-1))	0.006840	0.008378	0.816435	0.4226
D(INT(-1))	0.847186	0.178359	4.749893	0.0001
D(BNEER(-1))	0.068299	0.023248	2.937812	0.0074
ECT(-1)	-0.797933	0.318732	-2.503459	0.0198

R-squared	0.684270	Mean dependent var	-0.188889
Adjusted R-squared	0.519541	S.D. dependent var	0.384543
S.E. of regression	0.266546	Akaike info criterion	0.467659
Sum squared resid	1.634078	Schwarz criterion	1.039485
Log likelihood	4.582135	Hannan-Quinn criter.	0.667242
Durbin-Watson stat	2.251316		

Table B.3: Results of the ECM without the OIL variable

Dependent Variable: D(DEFL)
Method: Least Squares
Date: 04/21/16 Time: 12:54
Sample (adjusted): 2012M07 2015M06
Included observations: 36 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(DEFL(-1))	0.270604	0.126016	2.147375	0.0425
D(VMI(-1))	0.000450	0.007959	0.056576	0.9554
D(VMI(-2))	-0.013905	0.008157	-1.704628	0.1017
D(VMI(-3))	-0.007963	0.008357	-0.952853	0.3506
D(VMI(-4))	-0.021781	0.007966	-2.734182	0.0118
D(M3(-1))	-2.46E-08	5.82E-07	-0.042253	0.9667
D(M3(-2))	7.30E-08	5.54E-07	0.131803	0.8963
D(M3(-3))	2.68E-07	5.31E-07	0.505631	0.6179
D(M3(-4))	1.08E-06	5.64E-07	1.907341	0.0690
D(MPORTS(-1))	-4.48E-10	4.89E-10	-0.914378	0.3700
D(INT(-1))	0.808209	0.180297	4.482661	0.0002
D(BNEER(-1))	0.070597	0.022372	3.155645	0.0044
ECT(-1)	-0.838446	0.320958	-2.612320	0.0156

R-squared	0.686515	Mean dependent var	-0.188889
Adjusted R-squared	0.522958	S.D. dependent var	0.384543
S.E. of regression	0.265597	Akaike info criterion	0.460522
Sum squared resid	1.622457	Schwarz criterion	1.032348
Log likelihood	4.710607	Hannan-Quinn criter.	0.660105
Durbin-Watson stat	2.291500		