Inflation Dynamics in a Dollarised Economy: The Case of Zimbabwe

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Abstract

This paper explores the dynamics of inflation in the dollarised Zimbabwean economy using the Autoregressive Distributed Lag Model (ARDL) with monthly data from 2009:1 to 2012:12. The main determinants of inflation were found to be the US dollar/South African rand exchange rate, international oil prices, inflation expectations and South African inflation rate. During the local currency era, inflation dynamics in Zimbabwe were explained by excess growth in money supply, changes in import and administered prices, unit labour costs and output (Chhibber, Cottani, Firuzabadi and Walton, 1989). According to Makochekanwa (2007), hyperinflation during the same era was attributed to excess money supply growth, lagged inflation and political factors. Coorey, Clausen, Funke, Munoz and Ould-Abdallah (2007) affirmed these findings by identifying excess money supply growth as a source of high inflation in Zimbabwe during the local currency era. In essence, the findings of this study point to a shift in inflation dynamics in Zimbabwe. This shift in inflation dynamics means that policies, which were used to respond to both internal and external shocks that have an impact on price formation, might not be applicable in a dollarised economy.

Keywords: Inflation, dollarisation, Autoregressive Distributed Lag Model

JEL Classification: E31, E42, C50

1 Introduction

The objective of this paper is to analyse the dynamics of inflation in the dollarised Zimbabwean economy. In the context of the Southern African Development Community (SADC), Zimbabwe presented a problem in respect of the

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*Disclaimer: The views expressed in this paper are those of the authors and do not necessarily coincide with those of the Reserve Bank of Zimbabwe or Nelson Mandela Metropolitan University, Port Elizabeth.

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region’s quest for attaining macro-economic convergence, because of the high inflation episodes experienced between the years 2000 and 2008. Cagan (1956: 25) arbitrarily defines “hyperinflation as beginning in the month the rise in prices exceeds 50 per cent and as ending in the month before the monthly rise in price drops below that amount and stays there for at least a year”. Using this definition, Zimbabwe slid into hyperinflation when month-on-month inflation peaked at 50.5 per cent in March 2007.

In essence, the rapid and sustained loss in value of the Zimbabwean dollar, which began in the last quarter of 1997, led to its rejection as a medium of exchange during the second half of 2008, as inflation soared. Annual inflation reached a record 200 million per cent in July 2008. Thereafter, the Central Statistical Office was ordered to stop publishing inflation figures.

Hyperinflation, however, ended abruptly when the country abandoned the use of the local currency and adopted a multicurrency system in February 2009. The abandonment of the local currency and adoption of the multi-currency system weakened parallel market activities and arbitrage opportunities and dissipated inflationary pressures. During 2009 to 2012, annual inflation averaged below 5 per cent and monthly inflation was, on average, less than 0.5 per cent. Zimbabwe began to perform better than its counterparts in SADC, particularly in respect of inflation.

This study analyses the dynamics of inflation in the dollarised Zimbabwean economy, using the Autoregressive Distributed Lag (ARDL) bounds testing estimation approach. The ARDL approach was introduced by Pesaran et al. (2001) and applied in studies by Pahlavani and Rahimi (2009); Irefin and Yaaba (2011); Khatun and Ahamad (2012); and Shittu, Yemitan and Yaya (2012). This study used monthly data from 2009:1 to 2012:12 to analyse the inflation dynamics and the relationships between the consumer price inflation and key variables, both in the short term and in the long term. The key variables include the US dollar/South African rand exchange rate, money supply, international oil and food prices and the index of manufacturing output as a proxy for gross domestic product.

The rest of this paper is presented as follows: section 2 discusses relevant economic developments in Zimbabwe, while section 3 reviews the related literature and section 4 describes the inflation model and methodology used; section 5 discusses the empirical results, while section 6 describes the diagnostic and stability tests. The summary and policy recommendations of the study are discussed in section 7.

2 Economic Developments

The Zimbabwean economy dollarised informally during the second half of 2008, when the local currency continued to lose value against the background of rising inflation. Economic agents began to covertly conduct business in foreign currency and consequently, basic goods disappeared from formal markets only to resurface in the thriving black market earning foreign currency. The Re-
The Reserve Bank of Zimbabwe, in September 2008, responded to this development by partially formalising dollarisation through licensing selected wholesalers and retailers to sell goods in foreign currency. The initiative was dubbed the Foreign Currency Licensed Warehouses and Retail Shops (FOLIWARS) programme. While the unlicensed traders were officially supposed to continue selling goods and services in local currency, payments were mostly made in foreign currency.

Following the disputed June 2008 presidential elections, a global political agreement was signed on 15 September 2008. This led to the formation of a Government of National Unity in February 2009. The Government of National Unity formally adopted a multicurrency system because it realised the futility of forcing some economic agents to trade in a worthless currency, while others (the licensed ones) traded in foreign currency. In addition, in order to stabilise the economy, the new government launched the Short Term Emergency Recovery Programme (STERP) in March 2009 as its economic blue print.

STERP was implemented over a period of nine months from March 2009 to December 2009. It focused on political and governance issues, social protection programs, supply side reforms, and macro-economic reform. The implementation of the economic stabilisation program resulted in significant positive benefits such as inflation reduction and positive real gross domestic product growth in the economy. Real gross domestic product rose from 5.4 per cent in 2009 to 9.6 per cent in 2010; 10.3 per cent in 2011 and 4.4 per cent in 2012, as shown in Figure 1.

In line with the economic stabilisation programme, fiscal authorities adopted a strict cash budgeting system that sought to ensure that Government only spent what it would have collected in revenues. The cash budget system resulted in fewer expenditure overruns and promoted fiscal austerity. In this regard, it can be postulated that fiscal dynamics could not have explained inflation during the study period.

Reflecting higher US dollar prices that existed during the unofficial use of the multicurrency system in December 2008, year on year inflation stood at -7.7 per cent by the end of December 2009. However, as shown in Figure 2, the year-on-year inflation crept into positive territory and ended the years 2010, 2011 and 2012 at 3.2 per cent, 4.9 per cent and 2.9 per cent, respectively.

While the economy had stabilised, the country’s balance of payments position remained under severe pressure, largely due to the adverse effects of the global financial crisis on international trade and global capital flows. Consequently, the country’s current account balance worsened from a deficit of US$775.3 million in 2008 to US$1 140 million in 2009; US$1 918 million in 2010; and US$3 127 million in 2011. A lower current account deficit of US$2 370 million was registered in 2012.

The country’s foreign exchange reserves remained low, adversely affecting its capacity to service debt or meet critical import payments. Import cover stood at 1.2 months in 2009; 1 month in 2010; and 0.6 months each for 2011 and 2012. This inhibited the importation of critical raw materials for industry, adversely affecting the country’s production capacity and leading to further inflationary pressures.
Capacity utilisation declined to 44.2 per cent in 2012. Concomitantly, the growth in real GDP fell from 5.4 per cent in 2011 to 4.4 per cent in 2012. The deceleration in real growth in GDP probably had some influence on inflation, despite the fact that the annual inflation rate remained at single digit levels and below 5 per cent.

Government remained in debt distress as its public debt increased by 73.4 per cent - from US$3 269 million in 2008 to US$5 687 million as at 31 December 2009. The country’s external debt reached unsustainable levels with the ratio of external debt to GDP of 85 per cent by the end of 2012. This was significantly above the desired international benchmark of 50 per cent. Total external payment arrears increased by 793.6 per cent from US$471.1 million in 2000 to US$5 205 million by the end of 2012, which undermined the country’s creditworthiness, exacerbated the liquidity situation and further negatively impacted upon productive activity. This reinforced the negative impact of the lack of balance of payments support, with some influence on price formation in the economy.

The Zimbabwean case is unique in that economic agents abandoned the local currency altogether, with the authorities formally endorsing its rejection and stopping its use as legal tender after the adoption of the multicurrency system. Zimbabwe adopted dollarisation as a way of dealing with hyperinflation, which was characterised by the significant loss of credibility of the country’s political and monetary institutions. In addition, dollarisation was not formalised by any agreement between Zimbabwe and the Federal Reserve Bank or the South African Reserve Bank. The lack of a formalised dollarisation regime posed challenges which affected inflation.

3 Literature Review

3.1 Theoretical Aspects of Dollarisation

Dollarisation refers to a situation where residents of a country hold a significant share of their assets in the form of foreign currency denominated assets (IMF, 1999). It can also occur when residents of a country use foreign currency exclusively or together with their own currency for transactions (Schuler, 2000). Official dollarisation (de jure dollarisation) occurs when a government adopts a foreign currency as the exclusive legal tender, while unofficial dollarisation (de facto dollarisation) also known as partial dollarisation occurs when the dollar is used alongside the national currency to perform the three classical roles of money (Calvo, 1999).

3.2 Empirical Literature Review

The literature on inflation dynamics in a dollarised environment is largely divided into two groups. The first, which is highly researched (Bahmani-Oskooee and Domac, 2002; Goujon, 2006; Del Cristo and Gomez-Puig, 2012) covers inflation dynamics and stabilisation measures in partially but highly dollarised
environments. The second group of literature pertains to inflation in fully dollarised economies and is limited; probably reflecting the relatively few countries that are fully dollarised.

The empirical literature on dollarisation and inflation suggests that dollarisation could affect the inflation process through several channels. Rojas-Suarez (1992), suggested that dollarisation exacerbates the resulting inflation rate for a given fiscal deficit. In addition, McNelis and Asilis (1992) argued that dollarisation increases the volatility of inflation for a given budget deficit, while Akçay, Alper and Karasulu (1997) concluded that a high degree of currency substitution renders the exchange rate not only more volatile, but also more responsive to credibility issues.

Bahmani-Oskooee and Domaç (2002) argued that the above highlighted channels do not suggest that dollarisation is the cause of inflation, but rather that dollarisation is an endogenous response of economic agents to economic instability and high inflation.

3.2.1 Inflation Dynamics in Partially Dollarised Economies

Partial dollarisation may take the form of foreign currency deposits and this is often referred to as financial dollarisation. Studies by Oomes and Ohnsorge (2005); Goujon (2006); and Bahmani-Oskooee and Karacal (2008) were done to determine the impact of this type of dollarisation on inflation. The studies concentrated on countries that have experienced high inflation episodes as well as currency crises; these countries are Latin American countries, Asian countries, former Soviet Union countries as well as Turkey.

Goujon (2006) used the two-step estimation method developed by Juselius (1992); Metin (1995) and Hendry (2001), to study the determinants of inflation under partial dollarisation of the Vietnamese economy. The author concluded that inflation is explained by exchange rate changes and excess money, thereby confirming the results of earlier studies of other dollarised economies in which broad monetary aggregates show a close link to inflation. Importantly, in a dollarised economy, the relevant concept of money should include foreign currency deposits held in the domestic banking system as it increases the level of broad money and hence inflation (Goujon, 2006).

Bahmani-Oskooee and Karacal (2008) estimated an inflation equation for Turkey using the autoregressive distributed lag (ARDL) modelling and bounds testing approach to co-integration analysis. Study results indicated that dollarisation had a pass-through effect on prices for both the short and long run. Exchange rate depreciation was also found to result in an increase in prices in the short run. Money supply growth that largely emanated from the monetisation of fiscal deficits also explained inflation dynamics in Turkey for both the short and long run periods. The authors posit that the monetisation of fiscal deficits which resulted in monetary expansion would cause an increase in prices in the presence of dollarisation.

Bahmani-Oskooee and Domaç (2002) also investigated the role of dollarisation in the dynamics of inflation in Turkey and found that dollarisation was
important in determining inflation. The researchers employed a vector auto-
regression (VAR) model that incorporates, as its endogenous variables, the
consumer price index, base money, exchange rate, dollarisation ratio (foreign
currency to broad money) and public sector prices. The VARs were estimated
using monthly data from January 1990 through December 2001. The study
concluded that shocks to the dollarisation ratio had a positive and statistically
significant impact on prices in the first 29 months. The largest statistically sig-
nificant impact on price occurred after 29 months with a one per cent standard
deviation shock to the dollarisation ratio of foreign currency to broad money,
increasing prices by approximately two per cent.

In a study by Oomes and Ohnsorge (2005) to determine the relationship
between money demand and inflation in the dollarised Russian economy for
the period April 1996 to January 2004, the researchers stated that a long run
error correction model that includes foreign cash holdings in the definition of
money is important in understanding the relationship between money growth
and inflation. The authors employed a standard approach for estimating a
long run inflation equation and concluded that nominal effective depreciation
accounts for approximately 50 per cent, while growth in labour costs constitutes
40 per cent, and utility charges account for 10 per cent of inflation. The short run
dynamics revealed that excess supply of effective broad money is inflationary,
and that changes in effective broad money growth have the strongest and most
persistent effect on short run inflation.

Bailey (2007), conducted research using a vector auto-regression (VAR)
model to analyse the influence of financial dollarisation on inflation dynamics in
Jamaica. The study incorporated monthly data from March 1996 to December
2004 on the exchange rate, consumer price Index, base money, an index of public
sector prices (PSP) and the dollarisation ratio (as a ratio of foreign currency to
broad money) as its endogenous variables. The study confirmed that financial
dollarisation influences inflation. This occurs when exchange rate depreciation
pressures arising from increased foreign currency holdings stimulate inflationary
impulses due to the relatively high exchange rate pass-through to inflation.

3.2.2 Exchange Rate Pass-through and Inflation in Dollarised Economies

Del Cristo and Gómez-Puig (2012) studied the exchange rate pass-through ef-
fect on inflation in Ecuador. The researchers estimated a structural vector error
correction model (VECM) and obtained the impulse responses of inflation to a
real effective exchange rate shock. Results from the study indicated that there
was a higher exchange rate pass-through on inflation. In this regard, the higher
the real exchange rates of Ecuador’s trading partners appreciated, the greater
would be the inflationary pressures generated by the pass through effect. The
authors noted that the currencies of Ecuador’s major trading partners appreciated
as the price of the oil they imported from Ecuador increased. Appreciation
of the currencies of Ecuador’s major trading partners in turn resulted in im-
ported inflation in Ecuador, since the latter also sourced some of its imports
from them.
Carranza, Galdon-Sanchez and Biscarri (2008) utilised quarterly data of 124 countries with different levels of dollarisation for the period 1996-2004 to check for the exchange rate pass-through on inflation. The study concluded that highly dollarised economies present higher pass-through coefficients, but, when the nominal depreciation is large, this relationship changes. Large deprecations tend to reduce the extent of the pass-through.

Reinhart, Rogoff and Savastano (2003) utilised annual panel data for 89 countries from 1996 to 2001 to estimate exchange pass-through effect. The variables comprised the consumer price index, real exchange rate, gross domestic product and proxies to control for the openness of countries and other variables such as seignorage and the level of dollarisation of each country. The exchange rate pass-through to prices was greatest in economies where the degree of dollarisation was high.

3.2.3 Inflation Dynamics in Fully Dollarised Economies

Gachet, Maldonado and Perez (2008) studied the determinants of inflation in Ecuador. Ecuador implemented full dollarisation in 2000, following a major economic crisis, including high levels of inflation and a severe devaluation of its currency. An estimated structural vector auto-regression (SVAR) model to identify the main causes of inflation at the aggregate level in Ecuador was used. The SVAR methodology was used to account for endogenous relationships between the variables in the model, and to summarise these empirical relationships without placing too many restrictions on the data. The variance decomposition also provided information about the relative importance of each shock to the variables in the VAR. The Gachet et al. (2008) study tested the impact of seven variables on inflation, including international prices, exchange rate, public policy, weather, freight and politics. The study found that international prices, exchange rate and public policy explained 62.04 per cent, 18.49 per cent and 7.75 per cent, respectively, of inflation in Ecuador. The main conclusion drawn from the study was that in a fully dollarised environment, inflation is caused mainly by international prices, exchange rates and public policy.

3.2.4 Conclusion

The empirical literature reviewed leads to the general conclusion that in both partially and fully dollarised economies inflation is largely explained by exchange rate movements, international prices and excess money. The exchange rate pass-through to prices is also greatest in economies that are highly dollarised. It is important to note that dollarisation is in most cases a response to economic instability, characterised by high levels of inflation and influences inflation in both partially and fully dollarised economies.
4 The Data, Inflation Model and Methodology

4.1 Data

The data set used in this study covers the period 2009:1 to 2012:12 and was obtained from the Zimbabwe National Statistics Agency (ZIMSTAT), the Reserve Bank of Zimbabwe, IMF World Economic Outlook and South African Reserve Bank.

4.2 The Inflation Model and Estimation Method

The estimation method draws on the recent developments in Co-integration analysis and the Error Correction Model (ECM) that have been used to explore several economic phenomena. However, the investigation of long run relationship using approaches such as Engle and Greenger (1987) and Johansen (1991), which assume that underlying variables need to be integrated of order 1 or I(1) are cumbersome. To solve this problem, the bounds test approach introduced by Pesaran et al. (2001) which is applicable irrespective of the order of integration of regressors is applied to establish the long-run relationship between inflation and the explanatory variables. The autoregressive distributed lag (ARDL) bounds testing approach is desirable because it is applicable irrespective of whether the regressors are I(1) or I(0).

A general long run inflation model is developed by hypothesising that in a small open economy - a price taker on the international market, the general price level is influenced by the average price of tradable and non-tradable goods (Goujon, 2006; Nguyen and Nguyen, 2010; Akinbobola, 2012; Nguyen, Cavoli and Wilson 2012; and Bhattacharya, 2013). This can be illustrated as follows:

\[ \log P_t = \phi \log P^{T} + (1 - \phi) \log P^{N} \quad 0 < \phi < 1 \]  

Where \( P_t \) is the general price level in the economy, \( P^{N} \) is the general price for non-tradable goods, \( P^{T} \) is the general price for tradables and \( \phi \) represents the proportion of tradable goods in the total consumption basket. The price of tradable goods depends on foreign prices, particularly of major trading partners and the exchange rate between the local currency and that of trading partners. The price of tradable goods is, therefore, expressed in local currency terms as follows:

\[ \log P^{T}_t = \log e + P^{f}_t \]  

The price of tradable goods, thus, depends on the exchange rate \( e \) between the local currency and that of trading partners and foreign prices \( P^{f}_t \), while the price of non-tradable goods is determined by demand and supply of money in the economy. In equilibrium, real money supply, \( \frac{M^{S}}{P^{*}} \) equals real money demand, \( \frac{M^{d}}{P^{*}} \) as illustrated in equation 3 below:

\[ \frac{M^{S}}{P^{*}} = \frac{M^{d}}{P^{*}} \]
The demand for real money balances \((m^d)\) is assumed to be a function of real output \((y)\) and expected inflation \((\pi^e)\) and the nominal interest rate \((i)\).

\[
\frac{M^d}{P} = m^d = f(y, \pi^e, i)
\]  

(4)

Accordingly, equation 3 can also be expressed as follows:

\[
\frac{M^S}{P} = m^d = f(y, \pi^e, i)
\]  

(5)

Equilibrium in the non-tradable goods sector can be expressed as follows:

\[
\log P^N_t = \beta \left( \log M^s_t - \log (m^d) \right)
\]  

(6)

The parameter, \(\beta\) is a scaling parameter showing the relationship between aggregate demand in the economy and the demand for non-tradable goods.

Assuming adaptive expectations, the expected rate of inflation is determined by inflation in the previous period as follows:

\[
\pi^e = \Delta \log P_{t-1}
\]  

(7)

Through substitution and rearrangement, equations 1 to 7 can be reduced to the relationship between the general price level (dependent variable) and independent variables as follows:

\[
\log P_t = \beta_0 + \beta_1 \log M^s_t + \beta_2 \log Y_t + \beta_3 \log P_{t-1} + \beta_4 \log e_t + \beta_5 \log P^f_t + \beta_6 \log i_t + \varepsilon_t
\]  

(8)

Where

- \(P_t\) is the general price level or consumer price index
- \(\beta_0\) is a constant
- \(M^s_t\) is money supply
- \(Y_t\) is real output
- \(P_{t-1}\) is the lagged general price level
- \(e_t\) is exchange rate
- \(P^f_t\) is foreign prices
- \(i_t\) is nominal interest rate
- \(\varepsilon_t\) is the error term.

In equation 8, it is hypothesised that inflation is explained by fluctuations in money supply, real output, inflation expectations, exchange rate, foreign prices and nominal interest. Theory asserts that an increase in money supply and foreign prices and an appreciation of the exchange rate results in a rise in inflation. High inflation expectations would also drive up inflation. An increase in real output would result in a decrease in inflation. Zimbabwe uses multiple currencies, with the US dollar being the dominant currency and sources more than 60 per cent of its imports from South Africa. This renders the fluctuation of US dollar/rand nominal exchange rate \((Sexc_t)\) an important determinant of

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price formation. In this regard, a depreciation of the US dollar against the South African rand would result in an increase in inflation in Zimbabwe as the price of imports from South Africa become relatively expensive, compared to domestic goods.

Other control variables such as oil \((Oil_t)\) and food \((Food_t)\) prices are included as proxies for foreign prices. Oil and food imports accounted for an average of 20 per cent and 10 per cent of Zimbabwe’s total imports, respectively, between 2009 and 2013 (ZIMSTAT, 2013). Furthermore, taking into consideration that Zimbabwe sources close to 60 per cent of imported commodities from South Africa (ZIMSTAT, 2013), equation 8 is further augmented by including the South African consumer price index \((Scpi_t)\) as one of the explanatory variables. Changes in the South African consumer price index are expected to influence price formation in Zimbabwe. The real output as an explanatory variable was proxied by the volume of the manufacturing sector index \((VMI)\) because monthly real output data are not available. However, the VMI was later dropped as it was found to be statistically insignificant.

The modified equation 8 is expressed as follows:

\[
\log P_t = \beta_0 + \beta_1 \log P_{t-1} + \beta_2 \log M^*_t + \beta_3 \log Oil_t + \beta_4 \log Sexc_t + \beta_5 \log Food_t + \beta_6 \log Scpi_t + \epsilon_t
\]  

(9)

### 4.2.1 The Unrestricted Error Correction Model

Equation 9 can be expressed as an Unrestricted Error Correction Model (UECM) representation of the ARDL for Zimbabwe, following the approach taken by Pesaran, Shin and Smith (2001) as follows:

\[
\Delta \ln P_t = \alpha + \sum_{i=1}^{p} \beta_{0,i} \Delta \ln P_{t-i} + \sum_{i=0}^{p} \beta_{1,i} \Delta \ln M_{t-i} + \sum_{i=0}^{p} \beta_{2,i} \Delta \ln Oil_{t-i} + \sum_{i=0}^{p} \beta_{3,i} \Delta \ln Sexc_{t-i} + \sum_{i=0}^{p} \beta_{4,i} \Delta \ln Food_{t-i} + \sum_{i=0}^{p} \beta_{5,i} \Delta \ln Scpi_{t-i} + \epsilon_t
\]  

(10)

Under this methodology, the null hypothesis of no cointegration, that \(\delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = 0\), against the hypothesis that \(\delta_0 \neq \delta_1 \neq \delta_2 \neq \delta_3 \neq \delta_4 \neq \delta_5 \neq \delta_6 \neq 0\) is to be tested. The test for co-integration is conducted using the Wald F test Pesaran et al. (2001) provide two adjusted critical values that establish lower and upper bounds of significance. According to this methodology, if the computed Wald F-statistic exceeds the upper critical value, it can be concluded that a long-run relationship exists. If the F-statistic falls below the lower critical value, the null hypothesis of no co-integration cannot be rejected. A value of the F-statistic that lies within the bounds makes the test inconclusive.

According to Pesaran and Shin (1999), the long-run model derived from estimation of the conditional ECM specified above is derived as follows:

\[
\ln P_t = \phi_1 + \phi_2 \ln M_{t} + \phi_3 \ln Sexc_{t} + \phi_4 \ln Oil_{t} + \phi_5 \ln Food_{t} + \phi_6 \ln Scpi_{t} + \epsilon_t
\]  

(11)
Where: $\phi_1 = \frac{\alpha}{\beta_0}, \phi_2 = \frac{\delta}{\beta_0}, \phi_3 = \frac{\delta}{\beta_0}, \phi_4 = \frac{\delta}{\beta_0}, \phi_5 = \frac{\delta}{\beta_0}, \phi_6 = \frac{\delta}{\beta_0}$.

### 4.3 Unit Root Tests

The order of integration of the dependent and independent variables was investigated using the Augmented Dickey Fuller (ADF) and Phillips Peron tests. The results in Table 1 show that all variables in equation 9 became stationary after differencing once, that is, they are integrated of order 1.

### 4.4 Wald coefficient

The Wald coefficient test was applied to test for co-integration. The results reject the hypothesis of no co-integration as shown by a low probability of 0.00 in Table 2.

### 5 Analysis of Results

As shown in Table 3, the lagged consumer price index, international oil prices, the US dollar/South African rand exchange rate and South African inflation are significant determinants of inflation in the dollarised Zimbabwean economy in the long run. In the short run, inflation is determined by international oil prices, the US dollar/South African rand and South African inflation.

Given that South Africa is Zimbabwe’s major trading partner, accounting for about 60 percent of the country’s imports, the price formation mechanism in Zimbabwe is directly related to exchange rate and inflation developments in South Africa. An appreciation of the South African rand against the US dollar implies that Zimbabwe will require more US dollars to purchase one unit of the rand. Other things being equal, the appreciation of the South African rand against the US dollar directly translates into increased costs of business for Zimbabwean companies, which are then passed onto domestic consumers to maintain profit margins. This implies that the South African rand/US dollar exchange rate may easily pass through into inflation in Zimbabwe. Conversely, a depreciation of the South African rand against the US dollar would make imports from South Africa cheaper, assuming that the price of South African goods remains unchanged.

The long-run elasticities of the model variable for inflation are calculated from the estimated coefficients of the respective lagged independent variables divided by the lagged coefficient of CPI multiplied by $a^{-1}$, following Bardsen (1989) and Hoque and Yusop (2010). The long-run elasticities are shown in Table 4.

In the long-run, a one per cent increase in South African inflation leads to a 0.315 per cent increase in inflation in Zimbabwe. Changes in the South African rand/US dollar exchange rate also show a relatively high elasticity impact on the overall inflation level. An appreciation of one per cent in the South African rand/US dollar exchange rate, results in an increase in the general price level
by 0.098 per cent. In the short run, an appreciation of the exchange rate will result in smaller changes in the inflation rate (± 0.06 per cent).

The results also show that changes in oil prices have an impact on the inflation level in the long run. A one percent increase in oil prices will result in an increase in the general price level of about 0.054 per cent. These results imply that in the multiple-currency environment, the South African rand/US dollar exchange rate, international oil prices, South African inflation and the lagged inflation for Zimbabwe have a bearing on Zimbabwe’s inflation dynamics in the long-run.

The short-run coefficient estimates shown in Table 5 were obtained from the error correction model of the ARDL. The error correction (ECM-1) coefficient, which shows the speed of adjustment of the relationship to the equilibrium is negative and highly significant. This is further proof of the existence of a stable relationship between the variables in the model as stated by Banerjee et al. (1998). In this particular case, the estimated error correction coefficient is -0.5352, implying that deviation from the long-term inflation trajectory corrects itself by about 54 per cent in the following year.

6 Diagnostic and Stability Tests

The structural stability of the inflation equation is examined using the CUSUM and CUSUM SQUARE tests which detect systematic change in the regression coefficients. The tests fall within the critical bound lines at the five per cent level of significance, implying that the coefficients in the inflation model are stable over the period under review. As such, the evidence revealed from the estimated model can be used for practical policy making purposes. The Ramsey Reset test for model specification and CUSUM with CUSUMSQ stability tests were employed to check the validity and robustness of the standard econometric model. Figure 3 presents the plot of CUSUM and CUSUMSQ test statistic.

7 Summary and Policy Recommendations

This study uses the ARDL approach on monthly time series data from 2009:1 through 2012:12 to determine the major factors that influenced inflation in the dollarised Zimbabwean economy. The existence of co-integrating relationships among the variables was confirmed by the Wald Coefficient test which rejected the null hypothesis of no co-integration.

According to the empirical findings, the South African rand/US dollar exchange rate has a significant impact on inflation in the dollarised Zimbabwean economy. A one per cent appreciation in the South African rand/US dollar exchange rate results in a 0.098 per cent increase in inflation. The findings also show that a one per cent increase in the international price of oil leads to a 0.054 per cent increase in inflation. These results indicate that policy makers do not have any control over price formation in the dollarised economy, as this
is largely dependent on external factors.

The loss of monetary policy autonomy typified by the lack of the exchange rate as a tool at the authorities’ disposal constrains the available policy options on the exchange rate front. This notwithstanding, the country can cushion itself from the vulnerabilities associated with the fluctuations of the South African rand/US dollar exchange rate through an internal devaluation mechanism, in the absence of a nominal exchange rate devaluation. Internal devaluation mimics the nominal exchange devaluation, by improving productivity which reduces the overall cost of doing business.

A reduction in the cost of production will result in domestic consumers substituting foreign goods for cheaper domestically produced goods. In this regard, inflationary pressures emanating from imports of finished consumer goods such as cooking oil, soap, beverages and other food items can be significantly reduced.

The country also needs more investment to increase output across all sectors of the economy. In this regard, it is imperative that the Government of Zimbabwe creates an environment conducive for business to enable the private sector to increase production. These policy measures will reduce reliance on imported finished goods from neighbouring countries.

Furthermore, the need to improve efficiency remains critical if the country’s goods are to maintain their competitiveness in both the domestic and international markets. Improvement in efficiency, however, entails the adoption of modern production technologies as well as accessing external lines of credit at internationally competitive interest rates. In essence, the expeditious resolution of the country’s debt overhang remains critical in efforts geared at unlocking affordable credit lines from international capital markets. Improving the country’s productive efficiency can significantly reduce production costs and offset the negative repercussions of the appreciation of the US dollar against the South African rand. Relatedly, the meaningful attraction of both debt and non-debt creating capital flows, notably foreign direct investment, requires that supportive measures be adopted pro-actively in Zimbabwe. In this regard, the need for the alignment of the country’s investment laws and procedures to international best practices cannot be over-emphasised.

The attraction of foreign direct investment entails the review of the country’s indigenisation and economic empowerment laws in such a manner that achieves the twin objectives of attracting the much-needed capital and advanced technology as well as integrating the indigenous people in mainstream economic activity. The attraction of foreign direct investment remains the cog that underpins the attainment of efficiency and export competitiveness; the effective plugging of attendant supply gaps; the permanent shedding of import dependency and the diversification of the country’s export basket away from over reliance on primary products to finished products. It is also imperative that the country creates a land market to resuscitate the agricultural sector, which is the backbone of the economy, through its forward and backward linkages with the manufacturing sector.
References


Figure 1: Real GDP Growth 2000-2012 (per cent)

Source: ZIMSTAT

Figure 2: Annual Inflation (per cent)

Source: ZIMSTAT
Figure 3: Plot of CUSUM and CUSUMSQ test statistic.

Table 1: Stationary Tests

<table>
<thead>
<tr>
<th>Variable</th>
<th>Augmented Dickey Fuller Test</th>
<th>Phillips Peron Test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Level</td>
<td>First Difference</td>
</tr>
<tr>
<td>Food</td>
<td>-1.2849</td>
<td>-5.0206***</td>
</tr>
<tr>
<td>Ms</td>
<td>-1.8476</td>
<td>-9.1765***</td>
</tr>
<tr>
<td>Sexc</td>
<td>-2.5641</td>
<td>-4.5982***</td>
</tr>
<tr>
<td>Zcpi</td>
<td>0.2240</td>
<td>-5.2828***</td>
</tr>
<tr>
<td>Scpi</td>
<td>-1.5515</td>
<td>-6.8527***</td>
</tr>
<tr>
<td>Oil</td>
<td>-1.8344</td>
<td>-5.7901***</td>
</tr>
</tbody>
</table>

Note: * significant at 10 per cent, ** significant at 5 per cent, *** significant at 1 per cent
Table 2: Wald Coefficient

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>DF</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>14.98482</td>
<td>(5, 33)</td>
<td>0.0000</td>
</tr>
<tr>
<td>Chi-square</td>
<td>74.92410</td>
<td>5</td>
<td>0.0000</td>
</tr>
<tr>
<td>Normalized Restriction (= 0)</td>
<td>Value</td>
<td>Std. Err.</td>
<td></td>
</tr>
<tr>
<td>C(8) - C(13)</td>
<td>-0.593492</td>
<td>0.079278</td>
<td></td>
</tr>
<tr>
<td>C(9) - C(13)</td>
<td>0.055955</td>
<td>0.010455</td>
<td></td>
</tr>
<tr>
<td>C(10) - C(13)</td>
<td>0.069515</td>
<td>0.015954</td>
<td></td>
</tr>
<tr>
<td>C(11) - C(13)</td>
<td>0.121142</td>
<td>0.020177</td>
<td></td>
</tr>
<tr>
<td>C(12) - C(13)</td>
<td>0.027010</td>
<td>0.011398</td>
<td></td>
</tr>
</tbody>
</table>

Table 3: Estimated coefficients using ARDL approach

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>t –Statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>CONSTANT</td>
<td>1.670738</td>
<td>0.238211</td>
<td>7.013682</td>
<td>0.0000</td>
</tr>
<tr>
<td>DLOG(ZCPI(-1))</td>
<td>-0.105092</td>
<td>0.095145</td>
<td>-1.104540</td>
<td>0.2773</td>
</tr>
<tr>
<td>DLOG(MS)</td>
<td>0.004962</td>
<td>0.11628</td>
<td>0.426747</td>
<td>0.6723</td>
</tr>
<tr>
<td>DLOG(OIL)</td>
<td>0.029491</td>
<td>0.11270</td>
<td>2.616748</td>
<td>0.0133**</td>
</tr>
<tr>
<td>DLOG(SEXC)</td>
<td>0.059412</td>
<td>0.019347</td>
<td>3.070799</td>
<td>0.0043**</td>
</tr>
<tr>
<td>DLOG(FOOD)</td>
<td>0.001966</td>
<td>0.020467</td>
<td>0.096041</td>
<td>0.9241</td>
</tr>
<tr>
<td>DLOG(SCPI)</td>
<td>0.128139</td>
<td>0.059951</td>
<td>2.137382</td>
<td>0.0401**</td>
</tr>
<tr>
<td>LOG(ZCPI(-1))</td>
<td>-0.680787</td>
<td>0.081940</td>
<td>-8.308327</td>
<td>0.0000**</td>
</tr>
<tr>
<td>LOG(MS(-1))</td>
<td>0.008257</td>
<td>0.007091</td>
<td>1.164317</td>
<td>0.2526</td>
</tr>
<tr>
<td>LOG(OIL(-1))</td>
<td>0.036627</td>
<td>0.009156</td>
<td>4.000315</td>
<td>0.0003**</td>
</tr>
<tr>
<td>LOG(SEXC(-1))</td>
<td>0.067613</td>
<td>0.016604</td>
<td>4.072100</td>
<td>0.0003**</td>
</tr>
<tr>
<td>LOG(FOOD(-1))</td>
<td>0.02751</td>
<td>0.009317</td>
<td>0.295214</td>
<td>0.7697</td>
</tr>
<tr>
<td>LOG(SCPI(-1))</td>
<td>0.214709</td>
<td>0.062329</td>
<td>3.444752</td>
<td>0.0016**</td>
</tr>
</tbody>
</table>

Note: Significant at 5 per cent level.
### Table 4: Long Run Elasticities

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Variable</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\varnothing_1$</td>
<td>Constant</td>
<td>2.454</td>
</tr>
<tr>
<td>$\varnothing_2$</td>
<td>Broad money supply</td>
<td>0.012</td>
</tr>
<tr>
<td>$\varnothing_3$</td>
<td>Rand/US dollar exchange rate</td>
<td>0.098</td>
</tr>
<tr>
<td>$\varnothing_4$</td>
<td>Oil prices</td>
<td>0.054</td>
</tr>
<tr>
<td>$\varnothing_5$</td>
<td>Food prices</td>
<td>0.004</td>
</tr>
<tr>
<td>$\varnothing_6$</td>
<td>South African inflation</td>
<td>0.315</td>
</tr>
</tbody>
</table>

### Table 5: Short Run Error Correction Model (ECM)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. error</th>
<th>t-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>C</td>
<td>0.001473</td>
<td>0.000660</td>
<td>2.232786</td>
<td>0.0321</td>
</tr>
<tr>
<td>DLOG(SCPI)</td>
<td>0.091357</td>
<td>0.046118</td>
<td>1.980965</td>
<td>0.0555</td>
</tr>
<tr>
<td>DLOG(SEXC)</td>
<td>0.065665</td>
<td>0.016622</td>
<td>3.950427</td>
<td>0.0004</td>
</tr>
<tr>
<td>DLOG(OIL)</td>
<td>0.030247</td>
<td>0.008827</td>
<td>3.426838</td>
<td>0.0016</td>
</tr>
<tr>
<td>DLOG(MS(-1))</td>
<td>0.017538</td>
<td>0.008122</td>
<td>2.157627</td>
<td>0.0379</td>
</tr>
<tr>
<td>DLOG(ZCPI(-1))</td>
<td>-0.161629</td>
<td>0.105206</td>
<td>-1.536308</td>
<td>0.1335</td>
</tr>
<tr>
<td>DLOG(SCPI(-1))</td>
<td>0.059605</td>
<td>0.050613</td>
<td>1.177655</td>
<td>0.2469</td>
</tr>
<tr>
<td>ECM(-1)</td>
<td>-0.535223</td>
<td>0.135971</td>
<td>-3.936306</td>
<td>0.0004</td>
</tr>
</tbody>
</table>

|            |            |            |             |       |
| R-squared  | 0.598130   | Mean dependent variable | 0.003132 |
| Adjusted R-squared | 0.517756 | S.D. dependent variable | 0.003851 |
| S.E. of regression | 0.002675 | Akaike info criterion | -8.843866 |
| Sum squared resid | 0.000250 | Schwarz criterion | -8.516201 |
| Log likelihood | 198.1431 | Hannan-Quinn criterion | -8.723033 |
| F-statistic | 7.441839   | Durbin-Watson statistic | 2.164013 |
| Prob. (F-statistic) | 0.000017 |             |             |