DOLLARIZATION AND ECONOMIC DEVELOPMENT IN ZIMBABWE: AN INTERRUPTED TIME-SERIES ANALYSIS

Raphael Tabani Mpofu*

Abstract

This paper examines the impact of dollarization on the performance of the Zimbabwean economy from 2003 to 2014 using an interrupted time-series analysis. In Zimbabwe's case, dollarization was the official replacement of the Zimbabwean dollar with the U.S. dollar. Rapid dollarization in the economy was accelerated by the exogenous shock caused by the injection of cash dollars into the Zimbabwean economy, mostly from international transfers. Since the official adoption of dollarization, Zimbabwe is largely a cash-based economy, with a huge amount of U.S. dollars that are in circulation outside the banking system. A hands-off approach to currency management has served Zimbabwe well since 2009, but a number of risks are beginning to emerge as the economy has slowly regenerated itself and the need for large capital injections has increased. Macroeconomic data obtained from the World Bank and from the Reserve Bank of Zimbabwe's Monthly Economic Review is analysed. According to the tests conducted, it was found that dollarization did introduce some macroeconomic stability in Zimbabwe although a few key macroeconomic variables showed a sustained improvement. Statistical analysis shows that increased dollarization had positively affected reversed the spiralling effects of hyperinflation that were prevalent prior to 2009, although inflationary pressures still continued, albeit at a slower pace. This research has implications not just for Zimbabwean policy makers as they grapple with decisions pertaining to re-adoption of a local currency and/or the continuation of the use of the US dollar and/or the adoption of a regional currency, for example, the South African rand. The African Union and specifically, the Southern Africa Development Community should look at these policy issues very closely in order to provide policy direction to its member states.

Keywords: Zimbabwe, SADC, African Union, Hyperinflation, Dollarization, Economic Development

* *Department of Finance & Risk Management and Banking, University of South Africa, PO Box 392, Pretoria, 0003, South Africa*

1 Introduction

The core of the policy framework of a country's economic development is its monetary and exchange rate policy. These are proven policy interventions for sustainable economic performance. The level of government intervention in the monetary space has been debated at great length but there is still no consensus in the literature about just how much government intervention is necessary. What is beginning to emerge is that pure market forces do not lead to a sustainable economic growth but the answer lies somewhere between the two extremes. What researchers seem to agree about is that the level of intervention depends largely on country-specific circumstances. It is these circumstances that Zimbabwe found itself in post-2009.

Previous studies that have looked at the impacts of changing a monetary regime as well as studies that have looked at the performance of countries that have implemented different monetary regimes can enlighten the study. This study analysed the impact of official dollarization on certain macroeconomic variables in Zimbabwe, variables that are believed to have an impact on economic development. The study focused on analysing what the impact of dollarization from the previous monetary regime would be. It is noted that from 1980 through 2009, Zimbabwe generally operated under a managed exchange rate regime with the domestic currency of the time, beginning with the Zimbabwe dollar with an exchange rate to the US dollar of almost 1 ZWD = 1.47 USD in April 1980. The Zimbabwe dollar existed until March 2009, when Zimbabwe essentially adopted a multiple currency system. Despite the country not having an official agreement with the United States Federal Reserve to use its currency, Zimbabwe is viewed as a dollarized economy given the dominance of the currency among the other currencies used in the country and the fact that the Zimbabwean Government conducts all its business using the US dollar. In the same month that the multi-currency regime was introduced in 2009, the Zimbabwean government suspended the use of the Zimbabwe dollar as legal tender and decreed that all wages, prices of all goods and services and

transactions be done in U.S. dollars. They further decreed that all Zimbabwe dollars be removed from circulation with no compensation provided to currency holders, a decision that was viewed as indicating that the currency had no store of value.

Dollarization is typically preceded by high inflation, followed by hyperinflation. Between 1998 and 2000, the country experienced increased pressure on its treasury, caused mainly by a depressed economic climate and a large liquidity shortage. The liquidity shortage led to a government decision to print Zimbabwean dollars in order to meet government salary obligations that were worsened at the time by the deployment of more than 10,000 Zimbabwean troops to the Democratic Republic of the Congo. At the time, inflation was high at 20% but soon escalated to 48% by beginning of 2001 (Games, 2005). With spiralling inflation, worsened by a foreign war that Zimbabwe was involved in and a badly implemented government land reform programme introduced in Zimbabwe in 2000, the economy totally collapsed. We are mindful of the fact that as much as 40% of foreign exchange earnings came from farming activities, mainly flue cured tobacco exports (Games, 2005). The land reform programme in itself does not seem to have had many arguments against it but the implementation programme led to a massive exodus of skilled and experienced farmers, leading to many farms and farm equipment lying derelict for many years. This in itself had a major impact on the economy. However, the way the land reform process was implemented increased political instability and drove away the third largest foreign currency earner, tourism. The western nations were quick to impose sanctions on Zimbabwe and that led to the drying up of yet another source of foreign currency and capital as financial aid and Foreign Direct Investment dried up. These activities together put great pressure on the supply side of the economy, leading to further fuelling of inflation, which reached 100% in March 2001. This led to a period of hyperinflation whereby, in June 2008, the Zimbabwe Central Statistics Offices took a decision to longer release inflation figures. The depressed economy resulted in a reduction in output, with businesses operating at about 20% of their capacity by the end of 2008, resulting in huge shortages of goods and services (Games, 2005). This is a neoclassic relationship of demand-driven inflation where a few goods are being chased by a lot of "printed dollars" leading to an even worse position with hyperinflation hitting the 1 trillion mark in 2009 (Paradza, 2011). This spelt the demise of the Zimbabwe dollar and its eventual collapse.

In the literature, some arguments in favour of dollarization have been that dollarization can lead to an improvement of a country's economic relations with the U.S. economy and thereby spur U.S. based foreign direct investment, trade, and economic growth (Swiston, 2011; Hinds, 2004). One of the objectives of this paper was to determine if indeed Zimbabwe's transition from a managed exchange rate regime to adopting an official multi-currency policy regime, which soon became de facto dollarization did lead to an improvement of U.S. based foreign direct investment. In order to measure the effects of dollarization, this paper looks at macroeconomic data over four periods; these periods being 1994 to 1998; 1999 to 2003; 2004 to 2008 and 2009 to 2013. The only basis for determining these periods is the year 2009 when Zimbabwe officially adopted a multi-currency policy. Since this has been in place over the last five years, it was therefore decided to compare the effects of dollarization over a five year period and compare that to previous five year periods when the Zimbabwe dollar was in use.

It is expected that dollarization has significantly reduced currency risk exposure but this has not dented the challenges of liquidity that Zimbabwe faces given the money supply pressure; meaning that there was no cash available for bank lending or borrowing and yet, the demand for capital injection increased drastically soon after dollarization in March 2009. This led to an increase in lending interest rates, which is an anomaly when compared to other countries that have dollarized. This is an important point as the reasons for dollarization for Zimbabwe were unique – the economy had collapsed!

Despite the foregoing, there is some anecdotal evidence that adopting "a multi-currency" position for Zimbabwe (dollarization) has brought about economic stability to an economy that had a sustained period of hyperinflation. The negative effects of dollarization on the Zimbabwean economy were mostly the reduction of the competitiveness of local products on the international market and the liquidity shortage that was the key to the failure of companies due to dried-up capital investors necessary for improving productivity. On the positive side, dollarization helped to give price stability to the economy and ensure that this was sustained. There are also instances of improved savings ability at present, although quite limited. The evidence is in the revival of the banking system, where banks have begun to perform their lending function and the Reserve Bank of Zimbabwe is now able to perform one of its core functions, to be the lender of last resort! Zimbabwe's debt with external, for example, the International Monetary Fund (IMF) and the World Bank, is still high and in repayments are in arrears (IMF, 2015) with no immediate solution in sight to make it possible for these organisations to extend new sources of finance. Unemployment remains extremely high at 75%, although it improved slightly from 80% in 2010 (Bulawayo24, 2015).

In this study, we looked at four hypotheses. The following hypotheses were investigated:

- Hypothesis 1: Dollarization will lead to an increase in net foreign assets
- Hypothesis 2: Dollarization will lead to an increase in net domestic assets
- Hypothesis 3: Dollarization will lead to an increase in net domestic credit
- Hypothesis 4: Dollarization will lead to an increase in broad money supply
- Hypothesis 5: Dollarization will lead to a reduction in monthly inflation
- Hypothesis 6: Dollarization will lead to a reduction in yearly inflation
- Hypothesis 7: Dollarization will lead to a reduction in minimal lending rates
- Hypothesis 8: Dollarization will lead to a reduction in maximum lending rates

Before testing these hypotheses, it is important to conduct literature and policy reviews that are relevant to this research.

2 Review of Related Literature

Zimbabwe is one of the few countries to dollarize in Africa, however, a number of Latin American countries have adopted the U.S. dollar as a currency for monetary transactions. "Dollarization" is defined as "the replacement of a local currency with the U.S. dollar in both local and international monetary transactions" (Quah:65). Official dollarization occurs when a country gives up its currency and adopts the US dollar as its official currency. There are instances when there is a partial or unofficial adoption of the U.S. dollar, and that occurs when a country make use of foreign currency deposits in domestic banks (Reinhart, Rogoff and Savastano, 2003). There are also instances when private individuals use foreign currency for local transactions (Quispe-Agnoli, 2002). In their study, Edwards and Magendzo (2001) looked at the relationship between inflation, economic growth, gross domestic product, price and macroeconomic volatility as measured by GDP growth rates. They focused on a number of independent and non-independent dollarized countries that had dollarized between 1970 and 1998. They found that inflation in dollarized countries was, statistically, significantly lower than inflation in non-dollarized countries, while per capita GDP growth was significantly lower.

There is also literature on causes and implications of dollarization worldwide (Ortiz, 1983; Porter and Judson, 1996; Petrossyan and Harouthyunyan 2001; Piontkivsky, 2001). Tobin (1980) argued that excessive variability caused by floating exchange rates may have contributed to the adoption of dollarization in developed countries. The determinants and characteristics of dollarization in developing countries have been investigated by (Ortiz, 1983; Canto, 1985; Ramirez-Rojas, 1985; Sahay and Vegh, 1995; Catao and Terrones, 2000). It is also noted that while the measurement of dollarization is a topical issue and has been since the last decade, most researches have rather focused on the volume of currency in circulation outside issuing countries (Porter and Judson, 1996; Feige 1996, 1997). Several researchers seem to have taken the position that currency substitution is unobservable (Calvo and Vegh, 1992).

Dollarization studies are relatively new but are increasingly becoming important as many countries are either dollarizing or considering a move towards adopting an official dollarized economy. Examples of dollarized economies are Panama (since 1904), Ecuador (since 2000), Guatemala and El Salvador (since 2001) and Zimbabwe (since 2009). Quispe-Agnoli, 2002) state that Bolivia, Uruguay, Nicaragua and Peru have adopted an unofficial dollarization stance.

Campbell (2003) found that dollarization helps in attracting foreign direct investment and usually leads to lower interest rates. Singh (2005) confirmed this with findings that trade was made easier, especially for smaller economies in Central America. These countries coincidentally have the United States as a major trading partner.

Dollarization is generally believed to lead to more stable exchange and interest rates, as well as lower transaction costs for international corporations doing business in foreign countries. This encourages international investment and promotes economic growth and development. There are also many disadvantages to dollarization which include the loss of monetary policy and the decline of national identity (Castillo, 2006; Jameson, 2003; Feige, 2002; Feige, Faulend, Sonje and Sosic, 2000; Feige, Faulend, Sonje and Sosic, 2001). Other countries that have considered dollarizing are Argentina, Peru, the Dominican Republic, Mexico, Venezuela, and Guatemala. Despite the good research results coming from dollarized countries, adoption of dollarization seems to be slow and countries are treading carefully as there is no clear direct link to economic prosperity and dollarization. There is an understanding that the dollarization strategy requires an open and competitive economy and a strong commitment to rigorous fiscal policies (O'Brien, 2001). Moron and Winkelried (2005) find that highly dollarized countries' inflation targeting policies are compromised. Jameson, (2003) found that countries that continue to use their national currency, despite major losses of confidence in those currencies, find that more and more transactions are conducted in U.S. dollars unofficially. Only a handful of studies have examined whether increased dollarization does contribute positively to greater financial stability and economic growth. Since many dollarized economies are very small and extremely open, Edwards and Magendzo (2003) use three different methods to

achieve the comparisons: (1) propensity score, (2) simple-average nearest neighbor estimator, and (3) local linear regressions. Using these three methods for the matching estimators' technique, Edwards and Magendzo found that the inflation rate was significantly lower in dollarized countries compared to non-dollarized countries. They also found that dollarized economies had a significantly lower per capita GDP growth rate than non-dollarized economies.

While there are few empirical studies on dollarization and its measurement, in this study, various macroeconomic indicators for Zimbabwe from 2003 to 2014 were used to determine the impact of dollarization on the Zimbabwean economy. It is hoped that the results from the study will be important for policy questions such as: whether the phenomenon of dollarization is expected to have a long-run positive impact on the Zimbabwean economy.

3 Materials and Methods

To assess the impact of dollarization, a data set of Zimbabwe macroeconomic variables for the period January 2003 to February 2014 was used in the analysis. Data was collected from the World Bank's World Development Indicators (World Bank, 2015) and from the Reserve Bank of Zimbabwe's Monthly Economic Review electronic publication. The choice of variables used was based on available macro-economic data. From an initial starting list of 30 variables, these 8 variables remained as they provided a full data set. For completeness of results, variables such as GDP and domestic manufacturing data would have been useful, however, these remaining monetary variables have been found to contribute significantly to economic activity. The 8 variables used in the study were:

- broad money stock (M3);
- net foreign assets;
- net domestic assets;
- monthly inflation;
- annual inflation;
- domestic credit;
- monthly lending rates; and
- annual lending rates.

a. The theory and model

It is crucial to examine the implementation of monetary policy in order to evaluate the benefits and costs of dollarization. Sanctions against Zimbabwe by Western countries, which included the European Union countries and the United States of America may have negatively affected the impact of dollarization in Zimbabwe due to extremely reduced liquidity, hence a supply side shock. In order to get an understanding of the impact of dollarization on the performance of the Zimbabwe economy, the methodology used was an interrupted time series or segmented regression analysis. This time-series technique allows us to evaluate longitudinal effects of specific interventions. This type of regression analysis allows us to assess the impact an intervention has had on a specific variable of interest, whether the impact was immediate or happened over time and whether factors other than the intervention could explain the change. It requires data that has been measured on a continuous scale at regular, evenly spaced intervals.

When interpreting interrupted time-series results, one can immediately observe the graphs generated. If the graph of the dependent variable shows an abrupt shift in direction precisely at the point of intervention, then the likelihood of the intervention having caused the effect on the dependent variable is high. The effect of an intervention on an outcome variable will vary. When using interrupted time-series analysis, it is advisable to know possible outcomes or some hypothesis about how the graph of the dependent variable as a result of the intervention. This helps in ensuring that one does not make incorrect conclusions from some other external influences and chance occurrences.

Despite the foregoing, interrupted time-series analysis provides a convincing proposition for analysing time-series data where specific events or interventions may have occurred. In order to accomplish this, we will look at specific statistical approaches to interrupted time series analysis using the statistical package SAS®.

b. Data sources and measures

Interrupted time series analysis requires data collected regularly over time, and organized at equally spaced intervals. A sufficient number of time points before and after the intervention is needed to conduct interrupted time series analysis. A general recommendation is for 12 data points before and 12 data points after the intervention although a minimum of 100 observations is desirable in order to achieve an acceptable level of variability of the estimate at each time point. Before conducting interrupted time series analysis, it is important that the data is tested for stationarity. It is easier to detect an impact arising from an intervention when the time series is stationary than nonstationary. In nonstationary time series, it is important to identify the random movements of the time series from the ones caused by the intervention. If a process is basically nonstationary, one needs to establish that fact and, furthermore, be able to estimate the degree of nonstationarity before one can decide how much displacement of the curve precisely at the point of intervention is convincing evidence of an effect. Nonstationarity is a reality and must be dealt with, not wished away. The analysis was performed using SAS® ***PROC ARIMA***. An extract of the steps

followed is presented below (*SAS, 2015, SAS® 9.4 Product Documentation, Available at http://support.sas.com/documentation/94/, Accessed on 21 May 2015*):

1. In the identification stage, the IDENTIFY statement reads time series that are to be used in later statements, differencing the data, and calculating autocorrelations, inverse autocorrelations, partial autocorrelations, and cross-correlations. Stationarity tests were then performed to determine if differencing is necessary. The output or outcome of this suggested that one or more ARIMA models should be used to better fit the data.

2. In the estimation and diagnostic checking stage, the ESTIMATE statement was used to specify the ARIMA model to best fit the variable specified in the previous IDENTIFY statement and to estimate the parameters of that model. The ESTIMATE statement also produces diagnostic statistics to help judge the adequacy of the model.

3. Significance tests for parameter estimates were used to indicate whether some terms in the model might be unnecessary.

4. Goodness-of-fit statistics aided us in comparing this model to others.

5. Tests for white noise residuals were used to indicate whether the residual series contains additional information that might be used by a more complex model.

6. The OUTLIER statement provided another useful tool to check whether the currently estimated model accounted for all the variation in the series. Where the diagnostic tests indicated problems with the model, one would then try another model and then repeat the estimation and diagnostic checking stages.

7. In the forecasting stage, we used the FORECAST statement to forecast future values of the time series and to generate confidence intervals for these forecasts from the ARIMA model produced by the preceding ESTIMATE statement.

The following section presents the results and discussion of the findings.

4 Results and Discussion

This objective of this study was to examine the effects of Zimbabwe's transition to official dollarization from a managed currency regime and aimed at looking at whether this change in March 2009 had a significant impact on some macroeconomic variables. The variables under study are money supply statistics such as broad money stock (M3), net foreign assets, net domestic assets, monthly and annual inflation rates, monthly and annual lending rates and domestic credit. Figure 1 below illustrates monthly time series of all the variables under study from January 2003 to February 2014. De-facto Dollarization took place in March 2009 and for this study, this decision is taken as the interruption in the time series.

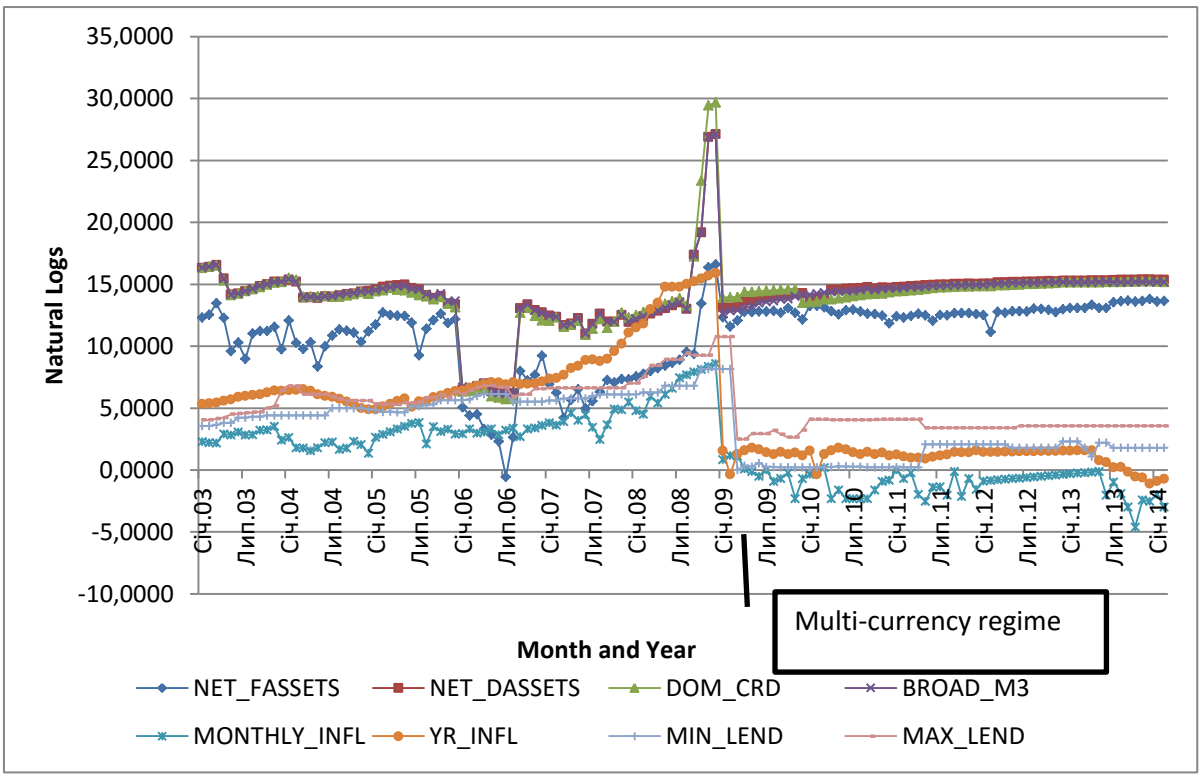

Figure 1. Time-series plots of variables

The effect of introducing a multi-currency regime in Zimbabwe was expected to change the behaviour of the 9 variables under study. The questions are whether the changes were significant or chance occurrences; whether the impact was immediate or over time; and whether factors other than the intervention could explain the change. The next section looks at each of the variables in turn.

c. Intervention model

Interrupted time series analysis begins with identification, estimation, and diagnosis of the observations before intervention. The model, including the indicator variable, is then re-estimated for the entire series and the results diagnosed. The effect of the intervention is assessed by interpreting the coefficients for the indicator variable. This section therefore seeks to do exactly that for the eight variables under study. Detailed tables and graphs will be used to analyse the variable ***Net Foreign Assets*** (NET_FASSETS) and thereafter, only summary statistics will be given for the remaining variables.

Table 1. ARIMA Procedure and White Noise

The ARIMA Procedure: Name of Variable = NET_FASSETS	
Mean of Working Series	10.84898
Standard Deviation	3.034384
Number of Observations	134

Autocorrelation Check for White Noise										
To Lag	**Chi-Square**	**DF**	**Pr > ChiSq**	**Autocorrelations**						
6	440.76	6	<.0001	0.904	0.808	0.731	0.662	0.619	0.585	
12	633.13	12	<.0001	0.536	0.496	0.472	0.451	0.430	0.417	
18	706.59	18	<.0001	0.375	0.336	0.291	0.248	0.213	0.188	
24	723.11	24	<.0001	0.167	0.150	0.126	0.118	0.119	0.091	

The chi-square test statistic for the residuals series indicate whether the residuals are uncorrelated (white noise) or contain additional information that might be used by a more complex model. In this case, the white noise hypothesis is rejected very strongly, indicating that the series is nonstationary. The p-value for the test of the first six autocorrelations is <0.0001, which is statistically significant.

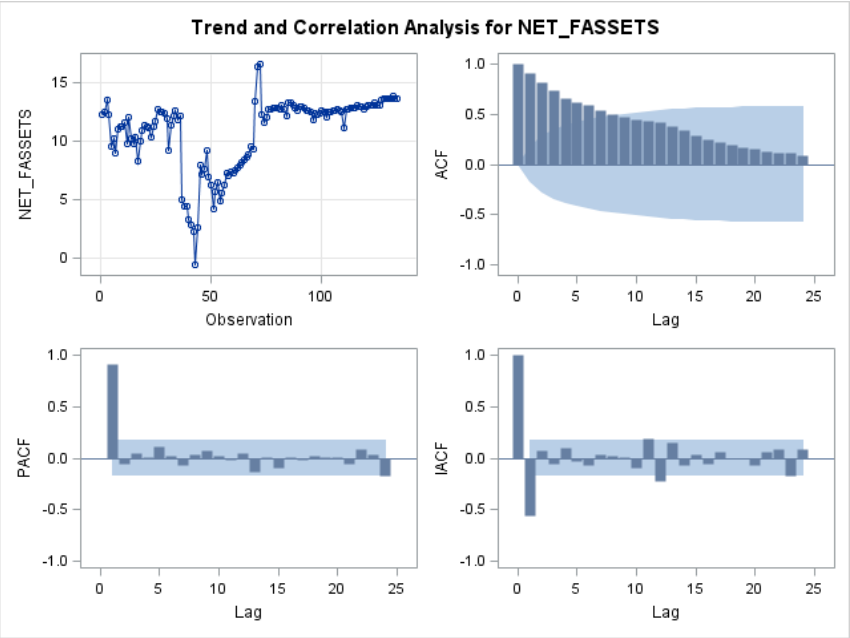

Figure 1. Autocorrelations

Figure 2 gives trend and correlation analysis for the variable Net Foreign Assets. The above autocorrelation plots show the degree of correlation of the variable Net Foreign Assets as a function of the number of periods in the past at which the correlation is calculated (SAS, 2015). By examining the above, the trend analysis shows that the series is not a random walk and is confirmed by the ACF plots that show that the series is ***non-stationary*** since the ACF plots decay very slowly. Since the series is non-stationary, it is necessary to transform it to a stationary series by differencing. The results of the first differencing led to the model being rejected and the final model, AR(1,1) was accepted as is shown in Table 2.

Table 2. Conditional Least Squares Estimation

Conditional Least Squares Estimation							
Parameter	**Estimate**	**Standard Error**	**t Value**	**Approx Pr > |t|**	**Lag**	**Variable**	**Shift**
MA1,1	0.99794	0.01115	89.47	<.0001	1	NET_FASSETS	0
AR1,1	0.92291	0.04094	22.54	<.0001	1	NET_FASSETS	0
NUM1	0.66681	1.27974	0.52	0.6032	0	Program	0
Variance Estimate	1.539443						
Std Error Estimate	1.240743						
AIC	437.7822						
SBC	446.4533						
Number of Residuals	133						

Both the moving-average and the autoregressive parameters have significant t values with Pr > t being significant at <0.0001. The normality plots in Figure 3 below also shows no departure from normality. This indicates that the ARMA(1,1) model fits the data better.

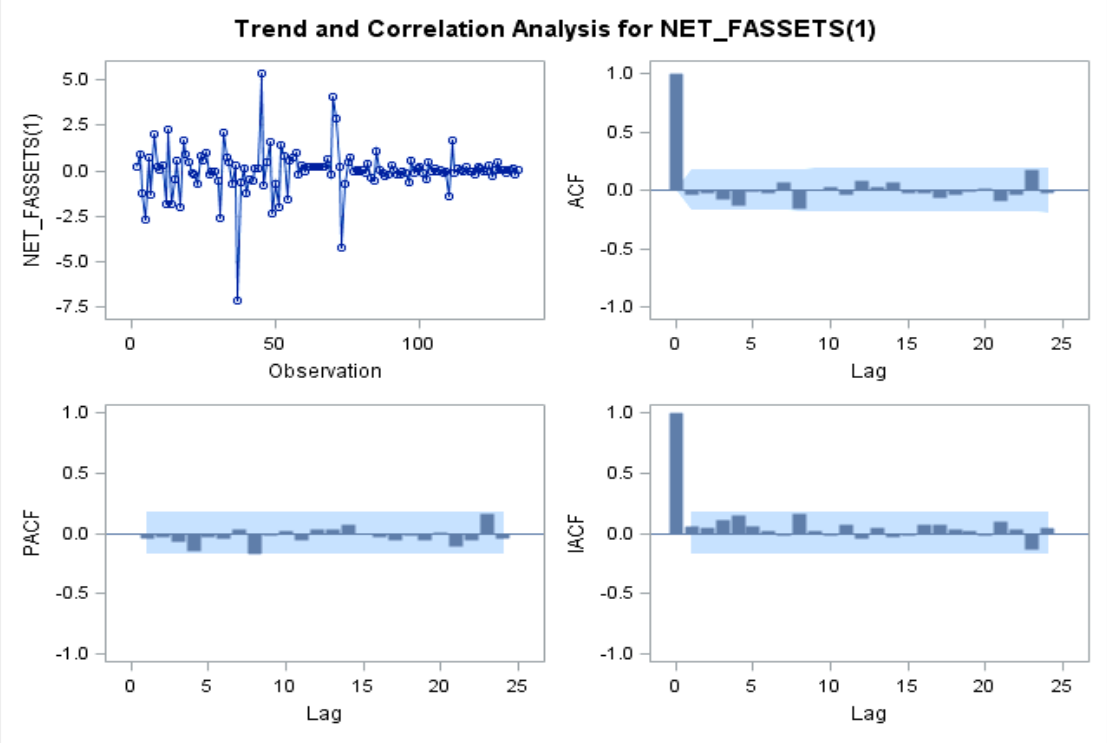

Figure 2. Trend and Correlation - ARIMA(1,1)

It is useful to check whether there are any changes in the time series that are not accounted for by the currently estimated model. In this model, no outliers were detected.

d. Intervention and its effects

The section below presents summary statistics for all the variables. This is summarised in Table 3.

Table 3. Summary of parameter estimates for all variables

Conditional Least Squares Estimation						
Parameter	**Estimate**	**Standard Error**	**t Value**	**Approx Pr > |t|**	**Lag**	**Variable**
MA1,1	0.99794	0.01115	89.47	<.0001	1	NET_FASSETS
AR1,1	0.92291	0.04094	22.54	<.0001	1	NET_FASSETS
NUM1	0.66681	1.27974	0.52	0.6032	0	Program
MA1,1	-0.9596	0.03471	-27.65	<.0001	1	NET_DASSETS
AR1,1	-0.75713	0.0802	-9.44	<.0001	1	NET_DASSETS
NUM1	-2.04279	1.39417	-1.47	0.1453	0	Program
MA1,1	-0.89683	0.07602	-11.8	<.0001	1	DOM_CRD
AR1,1	-0.70769	0.12537	-5.64	<.0001	1	DOM_CRD
NUM1	-3.23295	1.99012	-1.62	0.1067	0	Program
MA1,1	-0.96725	0.02972	-32.55	<.0001	1	BROAD_M3
AR1,1	-0.75111	0.07514	-10	<.0001	1	BROAD_M3
NUM1	-2.28334	1.34846	-1.69	0.0928	0	Program
MA1,1	0.09805	0.50158	0.2	0.8453	1	MONTHLY_INFL
AR1,1	-0.14938	0.48888	-0.31	0.7604	1	MONTHLY_INFL
NUM1	-0.38659	1.349	-0.29	0.7749	0	Program
MA1,1	0.07153	1.68153	0.04	0.9661	1	YR_INFL
AR1,1	0.18376	1.68097	0.11	0.9131	1	YR_INFL
NUM1	1.9265	2.87453	0.67	0.5039	0	Program
MA1,1	0.42654	1.16248	0.37	0.7143	1	MIN_LEND
AR1,1	0.36981	1.19461	0.31	0.7574	1	MIN_LEND
NUM1	-8.13773	0.27704	-29.37	<.0001	0	Program
MA1,1	0.88426	0.10599	8.34	<.0001	1	MAX_LEND
AR1,1	0.94758	0.07278	13.02	<.0001	1	MAX_LEND
NUM1	-8.39604	0.27185	-30.89	<.0001	0	Program

Net Foreign Assets

The output from the Autoregressive procedure in Table 3 includes Parameter Estimates. The parameter estimates for "Program" and "NET_FASSETS" are the main coefficients of interest. In our study, the trend of the variable "**Net Foreign Assets**" was consistent before and after the interruption. The moving average parameter estimate, labelled "MA1,1" and the autoregressive parameters, labelled "AR1,1" have significant t values for variables NET_FASSETS. There was an immediate reaction at the time of the interruption but thereafter, the variable resumed its original trend. This is confirmed by the "Program" coefficient of 0.666 which is not significant at 0.603, indicating that the apparent upward trend after the interruption was not significant. In this case, dollarization did not lead to a sustainable improvement in **Net Foreign Assets**.

Net Domestic Assets

The parameter estimates for "Program" and "NET_DASSETS" are the main coefficients of interest. In our study, the trend of the variable "**Net Domestic Assets**" was consistent before and after the interruption. The moving average parameter estimate, labelled "MA1,1" and the autoregressive parameters, labelled "AR1,1" have significant t values for variables NET_DASSETS. There was an immediate reaction at the time of the interruption but thereafter, the variable resumed its original trend. This is confirmed by the "Program" coefficient of -2.04279 which is not significant at 0.1453, indicating that the apparent upward trend after the interruption was not significant. In this case, dollarization did not lead to a sustainable improvement in **Net Domestic Assets**.

Domestic Credit

The parameter estimates for "Program" and "DOM_CRD" are the main coefficients of interest. In our study, the trend of the variable "**Domestic Credit**" was consistent before and after the interruption. The moving average parameter estimate, labelled "MA1,1" and the autoregressive parameters, labelled "AR1,1" have significant t values for variables DOM_CRD. There was an immediate reaction at the time of the interruption but thereafter, the variable resumed its original trend. This is confirmed by the "Program" coefficient of -3.23295 which is not significant at 0.1067, indicating that the apparent upward trend after the interruption

was not significant. At the 10% confidence interval, this is close to significant. In this case, dollarization did not lead to a sustainable improvement in **Domestic Credit**.

Broad Money Supply

In our study, the trend of the variable "**Broad Money Supply**" was consistent before and after the interruption. The moving average parameter estimate, labelled "MA1,1" and the autoregressive parameters, labelled "AR1,1" have significant t values for variables BROAD_M3. There was an immediate reaction at the time of the interruption but thereafter, the variable resumed its original trend. This is confirmed by the "Program" coefficient of -2.28334 which is not significant at 0.0928, indicating that the apparent upward trend after the interruption was not significant at the 1% or 5% level. This is significant at the 10% level. In this case, dollarization did not lead to a sustainable improvement in **Broad Money Supply** but showed a significant change as a result of the interruption, albeit at a 10% significance level.

Monthly Inflation

The parameter estimates for "Program" and "MONTHLY_INFL" are the main coefficients of interest. The moving average parameter estimate, labelled "MA1,1" and the autoregressive parameters, labelled "AR1,1" do not have significant t values for variables MONTHLY_INFL. There was an immediate reaction at the time of the interruption but thereafter, the variable resumed its original trend. In this case, dollarization did not lead to any significant changes in **Monthly Inflation** before or after the intervention.

Yearly Inflation

The parameter estimates for "Program" and "YEARLY_INFL" are the main coefficients of interest. The moving average parameter estimate, labelled "MA1,1" and the autoregressive parameters, labelled "AR1,1" do not have significant t values for variables YEARLY_INFL. There was an immediate reaction at the time of the interruption but thereafter, the variable resumed its original upward trend. However, the programme intervention is also not significant as shown by a significance value of 0.5039 In this case; dollarization did not lead to any significant changes in **Yearly Inflation** before or after the intervention.

Minimum Lending Rates

The parameter estimates for "Program" and "MIN_LEND" are the main coefficients of interest. The moving average parameter estimate, labelled "MA1,1" and the autoregressive parameters, labelled "AR1,1" do not have significant t values for variable Minimum Lending Rates. However, the programme intervention is significant as shown by a significance value of <.0001. In this case, dollarization did lead to significant changes in Minimum Lending Rates.

Maximum Lending Rates

The output from the Autoregressive procedure includes Parameter Estimates. The parameter estimates for "Program" and "MAX_LEND" are the main coefficients of interest. In our study, the trend of the variable "Maximum Lending Rates" was consistent before and after the interruption. The moving average parameter estimate, labelled "MA1,1" and the autoregressive parameters, labelled "AR1,1" have significant t values for variables MAX_LEND. There was an immediate reaction at the time of the interruption but the variable continued to improve and not worsen. This is confirmed by the "Program" coefficient of -8.39604 which is very significant at <.0001, indicating that the downward trend after the interruption was significant and sustainable.

Conclusion

Dollarization is a term used when a country adopts the U.S. dollar for local and international monetary transactions. Many economists believe that dollarization is one way to create macroeconomic stability for developing countries. After conducting statistical analysis using the macroeconomic variables obtained from World Bank Development Indicators and the Zimbabwe Monthly Economic Indicators, it was shown that dollarization did contribute to the stabilization of the Zimbabwean economy to varying degrees. Some indicators were positively affected by the interruption, most of them immediately but disappointingly, most variables resumed their trend prior to the interruption. The variables that were found to have had statistically significant changes are discussed below.

Maximum lending rates – There was a very significant and sustainable downward trend after the interruption. This variable has remained steady since the interruption, albeit with signs of a slight upward trend.

Minimum lending rates – There was an immediate reaction at the time of the interruption but thereafter, the variable resumed its original upward trend.

Broad Money Supply – This variable's trend was consistent before and after the interruption; it had an immediate reaction at the time of the interruption but thereafter, the variable resumed its original trend. In this case, although the impact of dollarization did not lead to a sustainable improvement in Broad Money Supply, there seems to be a positive benefit, albeit at a 0.09 significance level.

Domestic Credit – This variable was consistent before and after the interruption. There was an immediate reaction at the time of the interruption but thereafter, the variable resumed its original trend, albeit slowly. In this case, dollarization did not lead to a sustainable improvement, although slightly significant at 0.10.

In conclusion, a summary of the results of the hypotheses tested is presented in Table 4.

Table 4. Summary of hypotheses testing outcome

Hypotheses	Result
Hypothesis 1: Dollarization will lead to an increase in net foreign assets	This was temporary but not sustained. **Rejected**
Hypothesis 2: Dollarization will lead to an increase in net domestic assets	This was temporary but not sustained. **Rejected**
Hypothesis 3: Dollarization will lead to an increase in net domestic credit	There was a minimal positive change. **Accepted**
Hypothesis 4: Dollarization will lead to an increase in broad money supply	There was a minimal positive change. **Accepted**
Hypothesis 5: Dollarization will lead to a reduction in monthly inflation	This was temporary but not sustained. **Rejected**
Hypothesis 6: Dollarization will lead to a reduction in yearly inflation	This was temporary but not sustained. **Rejected**
Hypothesis 7: Dollarization will lead to a reduction in minimal lending rates	This was a significant and sustained change. **Accepted**
Hypothesis 8: Dollarization will lead to a reduction in maximum lending rates	This was a significant and sustained change. **Accepted**

While largely consistent with general findings from previous studies, this analysis is not easily comparable to previous studies as most of the variables under study were different. However, these findings are important for individual countries considering full dollarization, especially countries in Southern Africa that are continuously facing downward pressure on their domestic currencies and upward pressure on inflation rates. An interruption as that introduced by Zimbabwe under severe economic constraints may not be ideal to fully realise the benefits of dollarization because of a myriad of reasons affecting the success of programs and measures geared towards reversing the trend of some macroeconomic variables. A managed approach to dollarization might greatly benefit the economy.

References:

1. Bulawayo24, Zimbabwe's unemployment rate tops 70%. Business reporter, 22 April 2013, Available at http://bulawayo24.com/index-id-business-sc-economy-byo-29277.html
2. Calvo G. A., Vegh C. A. (1992), 'Currency Substitution in Developing Countries – An Introduction', IMF Working Paper No. 40.
3. Canto V. (1985), 'Monetary Policy, Dollarization and Parallel Market Exchange Rates: The Case of the Dominican Republic', Journal of International Money and Finance, 4, 507-21.
4. Catao L., Terrones M. (2000), 'Determinants of Dollarization: The Banking Side', IMF Working Paper No. 146.
5. Singh, Anoop. Stabilization and reform in Latin America: a macroeconomic perspective on the experience since the early 1990s. Vol. 238. Lippincott Williams & Wilkins, 2005.
6. Edwards, Sebastian, and I. Igal Magendzo. Dollarization, inflation and growth. No. w8671. National Bureau of Economic Research, 2001.
7. Edwards, Sebastian, and I. Igal Magendzo. "Dollarization and economic performance: what do we really know?." International Journal of Finance & Economics 8.4 (2003): 351-363.
8. Feige E. (1996), 'Overseas Holdings of U.S. Currency and the Underground Economy', downloaded at http://econwpa.wustl.edu/eps/mac/papers/0501/0501022.pdf
9. Feige E. (1997), 'Revised Estimates of the Size of the U.S. Underground Economy: Implications of U.S. Currency Held Abroad', in Lippert O. and Walker M. (eds), The Underground Economy, Fraser Institute, Vancouver.
10. Feige E. (2002), 'The Dynamics of Currency Substitution, Asset Substitution and De facto Dollarization and Euroization in Transition Countries', paper presented at the 8th Dubrovnik Economic Conference Monetary Policy and Currency Substitution in the Emerging Markets.
11. Feige E., Faulend M., Sonje V., Sosic V. (2000), 'Currency Substitution, Unofficial Dollarization and Estimates of Foreign Currency Held Abroad: The Case of Croatia', Paper presented at 6th
12. Feige E., Faulend M., Sonje V., Sosic V. (2001), Unofficial Dollarization in Latin America: Currency Substitution, Network Externalities and Irreversibility, Westview Press, New York.
13. Games, Dianna, 2005, Accessed from http://dspace.africaportal.org/jspui/bitstream/123456789/30178/1/NO.30-THEZIMBABWEECONOMY-WHASITSURVIVEDANDHOWWILLITRECOVER.pdf?1 on 12 August 2015.

14. Paradza, Gaynor, 2011, Accessed from http://dspace.africaportal.org/jspui/bitstream/123456789/30621/1/pia23_1.pdf?1, accessed 12 Auvust 2014
15. Swiston, Andrew J. "Official dollarization as a monetary regime: its effects on El Salvador." IMF Working Papers (2011): 1-25.
16. Hinds, Manuel. "Is Dollarization a Worthwhile Option for Developing Countries?." International Finance 7.2 (2004): 287-309.
17. IMF, Zimbabwe—IMF Management Completes First Review of Staff-Monitored Program, IMF Press Release No. 15/175, April 21, 2015, Available at https://www.imf.org/external/np/sec/pr/2015/pr15175.htm
18. Jameson, Kenneth P. "Dollarization in Latin America: Wave of the Future or Flight to the Past?." Journal of economic issues (2003): 643-663.
19. Castillo, Sofia. "Dollarization and macroeconomic stability in Latin America." Oshkosh Scholar Volume I, 2006 (2006): 6.
20. Morón, Eduardo, and Diego Winkelried. "Monetary policy rules for financially vulnerable economies." Journal of Development economics 76.1 (2005): 23-51.
21. Ortiz, G. (1983) 'Currency Substitution in Mexico: The Dollarization Problem', Journal of Money Credit and Banking, 15, 174-185
22. Petrossyan V., Harouthyunyan V. (2001), 'Currency Circulation in Shadow Economy in Armenia' Banber Q2, 2001, Central Bank of Armenia, Yerevan (in Armenian).
23. Piontkivsky R. (2001), 'Dollarization and Undeveloped Capital Markets in Transition Economies', Working paper of the International Centre for Policy Studies and National of Kiev-Mohyla Academy.
24. Porter, E., Judson, R. (1996), 'The Location of U.S. Currency: How Much is Abroad?', Federal Reserve Bulletin, 82, 883-903 .
25. Quah, Chee-Heong. "The feasibility of East Asian monetary union as an optimum currency area." International Journal of Asia-Pacific Studies 5.2 (2009): 65-90.
26. Quispe-Agnoli, Myriam, and Elena Whisler. "Official dollarization and the banking system in Ecuador and El Salvador." Economic Review-Federal Reserve Bank of Atlanta 91.3 (2006): 55.
27. Ramirez-Rojas, C.L., (1985), 'Currency Substitution in Argentina, Mexico and Uruguay'. IMF Staff Papers, 32, 627-667.
28. Reinhart, Carmen M., Kenneth S. Rogoff, and Miguel A. Savastano. Debt intolerance. No. w9908. National Bureau of Economic Research, 2003.
29. Sahay R., Vegh C. A. (1995), 'Dollarization in Transition Economies: Evidence and Policy Implications', IMF Working Paper No. 96.
30. Reserve Bank of Zimbabwe, 2015, Monthly Review, 2003-2014, Available at http://www.rbz.co.zw/publications/monthlyeb.asp, Accessed on 12 August 2014.
31. SAS, 2015, SAS® 9.4 Product Documentation, Available at http://support.sas.com/documentation/94/, Accessed on 21 May 2015.
32. Tobin J., (1980), 'The Short-Run Macroeconomics of Floating Exchange Rates: An Exposition', Tobin J. and Braga de Macedo J. (eds), Flexible Exchange Rates and the Balance of Payments, North-Holland.
33. World Bank, 2015, World Bank's World Development Indicators, Available at http://data.worldbank.org/country/zimbabwe, Accessed on 21 May 2015.