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FOREIGN EXCHANGE RATE AND INFLATION IN ZIMBABWE: 2009 – 2019

Tariro Chivige*, Johannes P S Sheefeni

ABSTRACT The loss of an independent monetary policy in Zimbabwe brought about by the introduction of a multicurrency system in 2009 deprived the country of monetary and exchange rate instruments. This meant that the country could not react to asymmetric shocks as well as fluctuations in the business cycle not in line with the anchor. Using the Autoregressive Distributed Lag (ARDL) model of estimation, this study analysed the relationship and effects of foreign exchange rate on local inflation rate. The period of study was broken down into two parts, the first being from 2009:02 up until 2014:11 before the introduction of the fiat currency while the second was from 2014:12 up until 2019:02 when the fiat currency was at par with the USD. Overall, exchange rates influenced the inflation rate more during the period that Zimbabwe was solely using a foreign multicurrency economy as compared to the period when it had introduced its pseudo currency in the currency basket.

KEYWORDS: *Exchange rate, Inflation rate, Multicurrency*

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1. INTRODUCTION

When the Zimbabwean government introduced the multicurrency system in 2009, it meant that the country extinguished all the rights it had in determining its exchange rate as it did not have its own local currency within the currency basket (Matanda, et al., 2018). The loss of an independent monetary policy deprived the country of monetary and exchange rate instruments to react to asymmetric shocks as well as fluctuations in the business cycle not in line with the anchor country (Kavila and Le Roux, (2016). Multiple currencies were now accepted as legal tender in Zimbabwe though the use of the United States Dollar (USD) and the South African Rand (ZAR) was higher compared to all the other currencies (Pindiriri 2012).

By using multiple currencies in Zimbabwe, the country's economy could easily be affected by the changes in the purchasing power of the other currencies it considered as legal tender. The appreciation or depreciation of such currencies would easily reflect on the local prices that were in the market during such periods (Matanda, et al., 2018). The issue of trade also brings into light the effects of the appreciation or depreciation of foreign currencies had on the local prices in the economy (Munyawiri, 2014). Zimbabwe, being a small open economy was prone to both the appreciation and or depreciation effects of the currencies of those countries that it traded with, be it in exports or imports. These exchange rates of the foreign currencies had a huge bearing on the steadiness of the Zimbabwean economy as these economies had a huge bearing on the price levels mainly via imported inflation (Pasara and Garidzirai, 2020).

When a large fraction of a country's trade is denominated in foreign currencies as was the case in Zimbabwe, its rate of inflation is more strongly affected by exchange-rate fluctuations (Whitten, 2016). These fluctuations can affect domestic inflation rates indirectly via the exchange rate pass through effect and the indirect effect of currency fluctuations dwarfs the direct effect because of the huge influence it exerts on the economy in both the near term and long term. The pass through of the exchange rates was therefore expected to be high as Zimbabwe is an import dependent country (Matanda, et al., 2018).

Statistics from ZIMTRADE (2021) have shown that South Africa, Zambia, Mozambique, China are among the countries that Zimbabwe mostly traded with during the period under review. This was established while assessing to

establish countries that are found in both the top ten of Zimbabwe's imports and exports. In the last decade, in terms of the direction of trade flows, the EU which used to be the top traditional trading partner of Zimbabwe for both imports and exports accounting for two thirds of total trade, during the pre-dollarisation era, has since been overtaken by South Africa and China. South Africa is now Zimbabwe's largest trading partner. China has also increasingly become a significant trading partner of Zimbabwe in recent years (CZI, 2020).

The introduction of the multicurrency system, to a greater extent improved the country's trading patterns, both for personal consumption, production, and retail purposes. (Chanakira, 2019). With most of the general populace now earning in mainly USD, this meant that even individuals could now easily import goods for their own personal use (Nkomazana, 2014). This was mainly because during this period, the country was a rather importing country with not much production going on, hence most people ended up opting to import goods from neighboring countries, South Africa, Botswana, Mozambique, and Zambia. The same could also be observed in the production sector where producers and retailers now had the purchasing power to import their raw materials and merchandise and this, to a certain extent also improved the country's exports. Countries like China were also seen to contribute a lot in the amounts of imports that were recorded in the country with imports from China to Zimbabwe totaling USD3 926 204 000.00 between 2009 and 2019. Increases in the country's exports were also recorded during this period (ZIMTRADE, 2020).

The situation of increased spending and importation can be linked to Keynes theory of consumption. With increased incomes, people have more disposable income to spend hence they increase their consumption levels (Keynes, 1936). This also has feed in effects to the industry sector where the demand for goods and service also increases due to an increase in the spending patterns in the economy. Since local industry cannot meet the local demand levels, both consumers and producers hence look at filling this gap by imports.

With Zimbabwe being an open economy as it is, it is then imperative to study how its trading patterns given the then prevailing exchange rates affected the general price levels in the country during the period under scrutiny. Such trading patterns therefore mean that fluctuations in the trading partner countries could also have a spillover effect in the general price levels in Zimbabwe. Given the tenets of the exchange rate pass through theory, it is imperative to know the

feed in effects of the changes in the exchange rates of the country's trade partners in order to analyse how much these changes affected the domestic price levels. This trading, coupled with the use of foreign currencies as legal tender, therefore had some sort of a definite effect on the general price levels in the country. It therefore becomes essential to study how the individual exchange rates of the then widely used currencies as well as those of its major trading partners affected the price levels in Zimbabwe, also given that, all the currencies of the countries included in this study were seen as legal tender.

To clearly elaborate on the issue at hand, the major goal of this paper is to then investigate the effects of the changes in the foreign exchange rates on the price level in a multicurrency economy.

2. LITERATURE REVIEW

In this section of the Chapter, an analysis of the theories that constitute the gamut of literature on the effect of changes in the foreign exchange rates on inflation is examined. An analysis of previous research conducted on the subject matter is also given.

2.1. Theoretical Literature

There are a number of theories that endeavour to explain and to shed light on the determination of exchange rate. Some of these theories include the Purchasing Power Parity and Quantity Theory of Exchange Rate, Balance of Payment Theory, the Mundell-Fleming model and the Portfolio Balance model. Though there may be a number of theories as highlighted, this study does not seek to explore how exchange rates are determined. It rather confines its scope to the exploration of how the exchange rates may have an effect on the price levels, thus it is the Purchasing Power Parity (PPP) and the Quantity Theory of the Exchange Rate which best explain the motives of this particular study.

The traditional PPP theory put forward by Cassel (1921) states that two countries' currencies exchange rate is in equilibrium when their purchasing power is the same between the two countries. What this means is that the countries' exchange rates should be equal to the proportion of the two countries' price levels of a similar fixed basket of goods and services. This can be represented by the following equation:

$$P_a = E P_b \dots\dots\dots (1)$$

Where P_a represents the price of a basket in country A, P_b is the same basket's price in country B and E is the exchange rate of the two countries' currencies.

From the above equation, we therefore can deduce that the exchange rate is determined as the ratio of the two countries price ratio.

$$E = P_a / P_b \dots\dots\dots (2)$$

What this therefore implies is that when a nation's domestic price of goods and services increases (i.e., when the country is experiencing inflation), that nation's exchange rate will have to depreciate for it to return to the PPP level (Kallianiotis, 2013). The foundation of the PPP is premised on the "law of one price" which states that in the absence of transportation costs plus any added transactional costs, competitive markets will equalise the price of similar goods or service in the two countries and this occurs when the prices are stated in the same currency.

The key highlight of the PPP theory is that nominal exchange rate is bound to change when the price level change. Just as the Quantity Theory of Money states, price changes are affected by changes in the money supply in an economy (Piersanti, 2012). The same can be said about the nominal exchange rate as it exhibits that it is depended on the money supply and demand in each country as it depends on price levels. This can be explained when a country's central bank increases its money supply and causes the price levels to increase. It also causes its country's currency to depreciate as compared to other currencies.

Mankiw (1998) stressed that the Quantity Theory of Exchange rate also sometimes referred to as the Classical Theory of Exchange Rate is the monetary approach to exchange rate. This approach uses the Quantity Theory of Money and strict PPP to arrive at the theory of exchange rate. It is formulated by combining the Theory of Monetary Equilibrium and the exchange rate determination (Achieng, 2009). This theory shows the long run relationship linking money, exchange rates and prices. What this theory states is that the long run equilibrium exchange rate between two countries is determined by the relative supplies of and demands for those national money stocks. This model embodies the Quantity Theory of Money and the Purchasing Power Parity

relationships, the former linking money supplies, and demand to prices and the latter linking prices to the exchange rate, the conclusion being that the exchange rates are determined largely by relative money demands and supplies operating through the price levels especially of foreign traded goods (Kallianiotis, 2013).

To understand this Classical Theory of Exchange Rate the starting point is to understand the Quantity Theory of Money as given by the Cash Balance Approach. To explain the link between PPP and the Quantity Theory of money, the monetary approach to the Exchange rate makes certain assumptions as follows:

- In the long run prices are perfectly flexible though however output can still vary.
- Following the Cambridge approach to the QTM, real money balances depend only on Y i.e.

$$M^d = PkY \dots\dots\dots(3)$$

M^d being the demand for money, Y is the income, P is the price level and k is a constant.

From the above equation we can then get the real money demand equation expressed below:

$$\frac{M^d}{p} = kY \dots\dots\dots(4)$$

- The assumption of equilibrium therefore comes to play where it is assumed that money demand is equal to money supply : $M^d = M^s$ giving the following equation:

$$M^s = PkY \dots\dots\dots(5)$$

Which also gives the following equation for real money supply balances as:

$$\frac{M^s}{p} = kY \dots\dots\dots(6)$$

- The last assumption is that PPP always hold

Now from the above equations, looking at equation 1 assuming P_a represents domestic prices and P_b represents foreign prices, solving for the price level in each country, it will then be shown that :

$$P_a = M^s_a / k_a Y_a \text{ (Domestic economy) and } P_b = M^s_b / k_b Y_b \text{ (Foreign economy)}$$

The above expressions show that the price level P is determined by the ratio of nominal money supplied M_s to nominal money demanded (kY). Prices rise if there is “more money chasing fewer goods” (James, et al., 2012).

Now from the explanation earlier, recall that PPP shows the relationship between prices and the exchange rates equation 2. Substituting the prices using the money market equilibrium conditions enables us to get the fundamental equation of the monetary model of the exchange rates which is:

$$E = \frac{P_a}{P_b} = \frac{\left(\frac{M_a^s}{k_a Y_a}\right)}{\frac{M_b^s}{k_b Y_b}} = \left(\frac{M_a^s}{M_b^s}\right) / (k_a Y_a / k_b Y_b) \dots\dots\dots(7)$$

Now from the above equation we can see that if the domestic money supply increases, E, the exchange rate increases which as well shows a depreciation of the currency (James, et al., 2012). Also, if local Y, the income increases, E decreases which shows an appreciation of the local currency. On the other hand, if P_b increases, E will also decrease, showing an appreciation of the local currency.

2.2. Empirical Literature

It is generally common knowledge that the levels of inflation in a country usually have an impact on how the currency of that particular country behaves on the world market. When the value of a currency depreciates usually because of inflation, the effects will usually spill over and affect the strength of the currency on the world market. In a fully dollarized or multicurrency system, the system is somewhat different from the normal one. However, the effect of the exchange rates on the domestic price levels is hence assumed to be the same in almost all dollarised countries.

Dollarised economies

Phiakao (2017) studied the effects of the exchange rate on domestic prices in dollarized economies in Southeast Asia from 2000 to 2015. The study used the dynamic panel model with fixed effects estimation. From the study's results, it was indicated that there is an indirect impact of the exchange rate pass-through in dollarized economies to domestic inflation and economic growth via the interaction term variable between exchange rate depreciation and dollarization degree. However, though the impact was indirect, changes in the exchange rates ultimately affect the inflation rates in the countries included in the study.

Sean, et al., (2018) also investigated the relationship between inflation, exchange rate as well as money supply in Cambodia by using a Bayesian VAR approach. Monthly data for the period between October 2009 and April 2018

was used. The paper based its study on the money in utility function as well as the Purchasing Power Parity (PPP) theories. The results revealed that money supply was mainly affected by its previous period. At the same time, the exchange rate illustrated a positive correlation with inflation. Depreciation of the exchange rate resulted in the increased inflation in Cambodia. Kou and Hongsakulvasu (2018) also obtained similar results for the Cambodian economy. Using GARCH modelling approach the authors found that dollarization does depreciate the Riel per US dollar and induces the exchange rate volatility which has an effect on the price levels. On top of that, the exchange rate movements brought about by dollarisation also had a negative effect on the inflation rate in the country.

Srithilat, et al., (2018) found a bidirectional causality between the exchange rate and the inflation rate in Southeast Asian countries. Using a panel VECM, the study analysed the relationship between inflation, exchange rate and currency substitution in five highly dollarised Asian countries. The study also showed an association between all the variables and that the inflation rate had a positive and significant impact on the currency substitution in the long run meaning that economic uncertainty and economic instability led to the loss of confidence in holding domestic currency in Southeast Asia economies in the long run. Similarly, Nigeria, a dollarised economy also experienced a high exchange rate pass through as compared to its counterpart South Africa (the two economies are regarded as the highest in Africa) ascertaining the view that exchange rate pass through is higher in dollarised countries as compared to non dollarised economies. This is according to Balcilar, et al, (2019) study on the exchange rate pass through in these two countries using the Autoregressive Distributed Lag (ARDL) model. For Nigeria, the pass-through effect was quite visible with the exchange rate variations causing changes in the inflation rate. For South Africa, the result was quite different as prices proved to a bit stickier as compared to Nigeria.

Park and Son (2020) also conducted a cross country study which sought to understand the determinants of dollarization as well as to investigate the relationship between exchange rates and inflation rates in countries with differing levels of dollarization. The study's aim was to see whether the degree of dollarization also had an impact on the effect of exchange rate on inflation rate. The study made use of twenty-eight countries with differing levels of dollarization for the period 1995 to 2016. The variables included in the analysis were foreign liabilities over saving deposits (dollarization), inflation rate, growth

in foreign exchange rate, real exchange rate, real GDP growth, degree of openness and degree of government effectiveness. The study used the fixed effects model in analyzing the causes of deepening dollarization. Just like in the cross-country dollarised economies studies mentioned above, it was also concluded that high inflation, low flexibility exchange rate, depreciation of the real economy and a decline in trade openness are the main causes of high degrees of dollarization. Among other reasons, these were also part the causes that led Zimbabwe to a multicurrency use economy (Pindiriri and Nhavira, 2011). As for the analysis of the effect of exchange rate on inflation rate, it was found that the higher the level of dollarization, the greater the penetration effect of the exchange rate pass through to inflation in the economy. Also, the depreciation of the domestic currency had strong negative effects on the inflation rate through the rise in the price of imported goods. Lastly, the external variables related to the foreign exchange markets, such as foreign exchange rate, were found to have significant effects on inflation in dollarized countries.

Safi and Mashal (2020) analyzed the exchange rate pass through in Afghanistan, a highly dollarized economy. Using a simple regression model with two variables namely exchange rate and the inflation rate, a least squares method was used to estimate the model. Monthly data for the period March 2018 to March 2020 were used. Findings from this study revealed that exchange rate influenced the inflation rate by 44%, while the rest of the influence was from the other variables that were excluded from the study. To test for the causal effect between the two variables, Granger causality tests were also run. The results revealed that the exchange rate did cause inflation and was a significant variable in determining the inflation rate. The study hence recommended that the monetary authority in the country intervenes in managing the exchange rate as it was found to influence the exchange rate. Quite on the contrary, Mundaca (2018) in his study on the effects of the central bank interventions in managing the exchange rate in the dollarised Peru however argues the fact that the involvement in the exchange rate matters by the central bank increased Peru's local currency volatility against the US Dollar. However, there has been some improvements on the exchange rate pass through in Peru. Since the Government embarked on a de-dollarisation path in 2002, there has been some significant decrease in the inflation rate and the country has been experiencing low and stable inflation.

In import dependent countries, the exchange rate pass through as well as the strengths of the domestic currencies in such economies is easily affected by the

changes in the foreign currencies that are of much use to the economies just as the situation in dollarised economies. Safi and Mashal (2020) found that for Afghanistan, an import dependent country, the demand of the US Dollar is very high which depreciates the Afghani exchange rate and with the depreciation of the domestic currency, the prices of imported products rise. The study revealed a highly correlated relationship between the exchange rate and the inflation rate. However, according to the pair-wise Granger Causality tests it was indicated that the exchange rate does cause inflation.

Non dollarised economies

The results for the non dollarised economies are a bit conflicted and are not as direct as those for the import dependent and dollarised economies.

Liu and Chen (2016) examined the relationship between import prices, inflation, and exchange rate in China. The study sought to explore the effect that exchange rate has on domestic prices in the country between 2003 and 2012. The study's variables included the Chinese CPI, broad money supply, GDP, import price index, producer price index, nominal effective exchange rate, domestic demand, and foreign supply. The study used a VEC model. Granger causality tests were also conducted. Among the six variables of study all the variables were seen to granger cause CPI individually and jointly except the money supply variable. The study revealed that a shock on the imported price has positive impact on the CPI. The results of the study showed that a shock on the nominal effective exchange rate in China had negative effects on that country's consumer price index (CPI) which meant that an appreciation of the RMB caused the CPI to decrease. However, this was contrary to what other empirical studies had found. Jixiang et al, (2011) suggested that RMB appreciation would cause the domestic prices in China to increase. Through a granger causality test they conducted for period 2005-2010, Zhu and Liu (2012) also came to the same conclusion of a positive relationship between RMB appreciation and the domestic inflation, implying that China's domestic inflation fluctuations are a domestic issue rather than imported.

Sen et al, (2019) attempted to establish a long run interrelationship between, inflation, exchange rates and interest rates in the five fragile emerging market economies (South Africa, Brazil, Indonesia, India and Turkey). The study used the Autoregressive Distributed Lag test for threshold cointegration as the method of estimation. The study argued that in an open economy, which most

likely depend on imports such as the countries they were studying, it is probable that an appreciation or depreciation in exchange rates could influence the domestic price levels. Results from the study revealed that exchange rate and the inflation rates in the countries under study move along together in the long run. This implies that the depreciation of their currencies creates an inflationary effect on domestic prices through raising the prices of imported goods. The findings make theoretical sense as all the countries in the sample study are import-dependant and have persistent current account deficits.

Using a SVAR modelling approach, Ha, Stocker and Yilmazkuday (2020) studied how exchange rate movements in 34 developed countries affected the countries inflation rates. The study found that the source of the shock on the exchange rate matters in effecting any changes to the inflation rate. Domestic shocks on the exchange rate were seen to be a major cause of variance of inflation and exchange rates in most countries as compared to global shocks. The results of the study affirmed what other researchers allude to that country characteristics, structural factors, monetary policy frameworks as well as the nature of shocks all play an important role in determining the direction and magnitude of the exchange rate effects on the price levels. In Egypt the effect of the exchange rate on the domestic prices was seen to be substantial however slow and incomplete. Changes in the exchange rates were seen to mainly affect the consumer price index (CPI) the most as compared to the other indices (Helmy, et al., 2018). The structural factors in Egypt were seen a factor of how the changes in the exchange rates affected the domestic price levels. Price and import controls were responsible for the way in which the exchange rate pass through affected the different indices in the country.

Zimbabwean Economy

Coming to the Zimbabwean economy. The country, due to its adoption of a full multicurrency system and its heavy reliance on imports makes it prone to the global shocks that pass through the foreign currencies it had adopted as legal tender. Just like in most developing countries, the monetary policy strongly responded to exchange rate movements because these have relevant effects even on the commercial trade in the country. Pindiriri (2012) analysed the determinants of inflation in a post dollarized Zimbabwe for the period January 2009 up until December 2011. The influence on inflation by factors such as GDP, imports, consumer's expectation about future inflation, interest rates, output, exchange rates and money supply among others was analysed. The study made

use of the USD/ZAR exchange rate as these were the major currencies that were being used in the country before the reintroduction of its local currency. Results of the study were more or less similar to some other pre-dollarized studies conducted for the same country. The findings supported the claim that the exchange rate, money supply, consumer's expectations about future inflation and imports were the major determinants of inflation during the period under review.

It was revealed that the variations in inflation and the exchange rate had sharply decreased and taken a nosedive following dollarization, as compared to the pre-dollarization era. Prior to the adoption of the multicurrency era, there existed a long run relationship as well as a bi-directional causality between the exchange rate and the inflation rate and vice versa. The results found by Pindiriri (2012) were also supported by Kavila and Le Roux (2016) who studied how inflation in a post-dollarized Zimbabwe reacted to macroeconomic shocks using monthly data between the periods 2009:01 and 2012:12. The study made use of the VECM approach to analyse the objectives of study. The variables used in the study were the inflation rate, ZAR/USD exchange rate, international oil and food prices, money supply and the South African inflation rate. The study revealed that, the inflation rate in Zimbabwe during the period under review was mainly influenced by international oil prices, as well as the ZAR/USD exchange rate. The observed relationship was strong and positive. The studies conducted in Zimbabwe for the multicurrency use era however just looked at the USD/ZAR exchange rate effect on the inflation rate as these were the two major currencies that were in circulation. Makena (2017) also used the same exchange rate and found the same results as to those that were done during the multicurrency era. It is however important to note that there were other currencies that were in use during the multicurrency era in Zimbabwe which meant that the direction the feed in effects from the exchange rates came from different directions.

2.3. Literature Gap

The literature discussed above exhibit that quite a number of studies have been conducted to explore the relationship between inflation rate and exchange rates. However, it is important to note that of the studies conducted on the subject matter, focus was mainly given to economies that use their own local currency as legal tender as well as those countries that had fully dollarized or partially dollarized. From such studies, the exchange rates used were those of the local currencies against the USD.

However, according to the researcher's knowledge there has not been a single study that sought to address the exact subject matter in the magnitude that was explored in this paper. Particularly, that of a multicurrency economy. This leaves a yawning gap that needs to be explored. This study therefore studies the relationship that exist between inflation rates and foreign exchange rates in a multicurrency economy, not a mono or dual currency economy. This study also goes a step further to include not just one exchange rate, but three exchange rates in a bid to examine if their effects are just the same as in mono or dual currency economies. Studies that have so far focused on the Zimbabwean multicurrency use economy, have almost always used only the ZAR/USD exchange rates, ignoring the effects of the other currency exchange rates that were in circulation during the multicurrency use era. By doing so, an analysis of the different exchange rates and their possible impact on the domestic inflation rate is made possible.

By addressing this gap, this study contributes significantly to literature on the effects of inflation rates and the exchange rates in multicurrency economies.

3. MATERIALS AND METHODS

In analysing the relationship between inflation rates and the exchange rates, scholars have employed a diverse range of econometric techniques. This study makes use of the Auto Regressive Distributed Lag (ARDL) model as it suits the study's overall objectives. The Eviews econometric software was used for the econometric analysis. This study seeks to assess the effects of the exchange rates on the inflation rate as well as their long run relationship. The nature of the data available also made the use of the ARDL modelling technique as most suited.

3.1 Analytical framework

In 2009 after suffering a ruthless hyperinflation for many years, Zimbabwean authorities decided to adopt a multicurrency system in which a bunch of foreign currencies were now seen as legal tender in the country. From 2009:02 up until 2014:11, the currency basket in the country comprised of only foreign currencies. However, in 2014:12, the government introduced a local surrogate currency, the bond coins which were followed by the bond notes in 2016 which were purportedly at par with the US dollar, which was the major currency in circulation (RBZ, 2014; RBZ, 2016). Their reason was that the introduction of

this surrogate money would ease up business operations. In early 2019, the monetary authorities however announced that the Bond currency (local fiat currency) would no longer be at par with the USD but was now going to be rated against all other currencies (RBZ, 2019).

For this reason, this study is going to separate the study into two time periods. The first period is going to be from 2009:02 up until 2014:11 before the introduction of the fiat currency while the second period is from 2014:12 up until 2019:02 where the fiat currency was at par with the USD before the introduction of the legal local currency.

The ARDL model is used to study the effects of foreign exchange rates and the interest rate on the price level. The model was implicitly introduced by Davidson et al. (1978) and later popularised by Pesaran and Shin (1995). The ARDL model is an OLS based model which can be used for both nonstationary and mixed order of integration time series which is an advantage as compared to other modelling techniques which requires all the variables to be integrated of the same order before the estimation.

A dynamic Error Correction Model (ECM) can be derived from ARDL through a simple linear transformation. Likewise, the ECM integrates the short-run dynamics with the long-run equilibrium without losing long-run information and avoids problems such as spurious relationship resulting from non-stationary time series data (Shrestha and Bhatta, 2018). The model is also capable of simultaneously displaying both the short run and long run parameters.

The ARDL model can be presented as follows (ARDL p, q):

$$y_t = \alpha + \delta_t + \phi_1 y_{t-1} + \dots + \phi_p y_{t-p} + \beta_0 x_t + \dots + \beta_q x_{t-q} + \epsilon_t \dots\dots\dots (8)$$

In the model above,

Y is the dependant variable, and it depends on p lags of itself.

Y also depends on the current value of the explanatory/ independent variable X as well as q lags of X.

X are the independent variables.

ϵ_t is a random disturbance term

The model assumptions are:

$$\text{Cov}(\epsilon_t, \epsilon_s) = 0, \text{ for } t \neq s \text{ and } \text{Var}(\epsilon_t) = \sigma^2$$

Now expressing equation 1 in error correction form we get:

$$\Delta y_t = \alpha_0 + \sum_{k=1}^p \forall_j \Delta y_{t-k} + \sum_{k=1}^q \partial_j \Delta x_{t-k} + \sum_{k=1}^p \varepsilon_i \Delta z_{t-1} + \lambda_1 y_{t-1} + \lambda_2 x_{t-1} + \lambda_3 z_{t-1} + \mu_t \dots \dots \dots (9)$$

The first part of the equation from α , \forall up until ε represents the short run dynamics of the model while the second part with the λ represents the long run dynamics of the model.

However, there are a few estimation techniques that should be performed prior to the actual final estimation of the ARDL. First, the unit root tests were run prior to the estimation because macro variables are usually known for their non-stationarity. Unit roots tests were thus performed to check for stationarity. The Phillips-Perron (PP) tests was used to test for the existence of unit root. Second, the ARDL Bound-test to co-integration technique was preferable when dealing with variables that are integrated of different order, $I(0)$, $I(1)$ or combination of both and robust when there is a single long run relationship between the underlying variables in a small sample size (Wickens, 2011). Third, the selection of an appropriate lag structure using the information criteria for lag length is very important for the ARDL modelling. Fourth, after ascertaining that there was cointegration and long run relationship between the independent and the dependent variables, the next step was to run an Error Correction Model (ECM). This is a time series model that is run when variables are evidently cointegrated and it manages to reveal both short-term and long-term effects of one time series on another (Harrell, 2015). From the EC model results, the cointegration equation and the associated coefficient shows the speed at which the dependant variable returns to equilibrium after a change in the other variables. Last but not least, in a bid to further validate the study's data, residual diagnostic tests were conducted. The diagnostic tests that were conducted included the stability test, the serial correlation test as well as the heteroscedasticity test. For the stability test, the CUSUM test for stability was conducted.

3.2 Data sources and characteristics

Data that was used in this study was obtained from the Zimbabwe Reserve Bank (RBZ), the South African Reserve Bank, World Bank, and the International Monetary Fund. The period of study is from 2009:02 up until 2019:02, hence the

study made use of monthly data for its regression analysis. The dependent variable remains the Consumer Price Index (CPI), the independent variables being the interest rate (lending interest rate) and foreign exchange rates. In this study, the exchange rates represent the rate at which the currencies of South Africa, Mozambique and China were exchanged for the US Dollar. Hence, these were the major currencies that were in use during the multicurrency era were included as variable. Therefore, the exchange rate of the US Dollar against South African Rand (USD/ZAR), the USD against the Chinese Yuan (USD/CNY) and the Mozambique Metical (USD/MZN). These currencies were included in the variables study because according to ZIMTRADE, apart from South Africa, Mozambique and China were among the top countries that traded with Zimbabwe the most during this period. In this study the assumption that the exchange rate movements of the currencies that were in circulation in the country affect the inflation rates in the country is taken. This is done due to the fact those currencies were the legal tender in the country hence their appreciation or depreciation will be noted in the price levels. It is expected that with the depreciation of the mentioned currencies against the USD the prices of both imported products from the countries and also the local prices rise as shown by the studies of Maune, et al., (2020) and Safi and Mashal (2020). This is in line with the Exchange rate pass through theory as backed by the law of one price in the PPP Theory, price changes due changes in the exchange rate of a country and also in the currencies of the trading partner currencies can filter through into the domestic price levels.

4. RESULTS INTERPRETATION AND ANALYSIS

The variables were denoted as follows. Zimbabwe Inflation rates (denoted by LCPI), Zimbabwe average lending rate (LLR), and exchange rates of US Dollar against Chinese Yuan (LUSDCNY), South African Rand (LUSDZAR) and Mozambique Metical (LUSDMZN). The data was converted into log forms first before the estimation. The Eviews estimation software was used to run the regression model.

4.1 Stationarity Test

The stationarity test was conducted using the Phillips Peron (PP) to determine the order of integration. Table 1 reveals that for the first period all the variables are integrated of order 1 with the exception of LUSDZAR. Therefore, there is a mixture of $I(0)$ and $I(1)$. On the contrary, the results for the second period shows the same order of integration which is $I(1)$. Thus, it is appropriate to apply the

ARDL since there is no variable integrated of order 2.

Table 1: Stationarity test using the PP.

Variable	2009: 02 to 2014: 11			2014: 12 to 2019: 02		
	Level	First Difference	Conclusion	Level	First Difference	Conclusion
LCPI	-1.916 (0.388)	-10.219** (0.000)	I (1)	2.224 (1.000)	-3.904** (0.019)	I (1)
LLR	-2.595 (0.296)	-6.442** (0.000)	I (1)	-1.880 (0.650)	-5.834** (0.000)	I (1)
LUSDCNY	-1.542 (0.778)	-4.576** (0.003)	I (1)	-1.848 (0.666)	-3.817** (0.024)	I (1)
LUSDZAR	-3.986** (0.017)	-6.080** (0.000)	I (0)	-2.093 (0.537)	-5.076*** (0.001)	I (1)
LUSDMZN	-1.9414 (0.621)	-5.475** (0.001)	I (1)	-1.266 (0.885)	-4.577*** (0.003)	I (1)

Source: Author's computations. Note: *** and ** means H0 is rejected at 1% and 5% level of significance respectively. Probability values are in parentheses (--)

4.2. Bound test: Determining the Long Run Relationship Between the Variables.

Tables 2a and 2b shows the results for the Bound test to cointegration. For the first period, the F statistic value of 4.699 is greater than I (1) of 4.57 at 5%, similarly, the F-statistic value of 6.024 is also greater than both bounds. Therefore, the null hypothesis of no levels relationship is rejected and it is concluded there is long run relationship between inflation, lending rate and foreign exchange rates.

Table 2a: Bounds test for cointegration – 2009: 02 to 2014: 11.

Test Statistic	Value	Signif.	I (0)	I (1)
F-statistic	4.699	10%	3.03	4.06
K	4	5%	3.47	4.57
		2.5%	3.89	5.07
		1%	4.4	5.72

Source: Author's computations

4.1 ARDL and ECM Estimations

After running the model pre-estimation tests above and being guided by their results, the ARDL regression model as well as the Error Correction model were run. The results from the regressions are shown below.

Table 3: Summary of long and short run results (LCPI as regressand)

	LLR		LUSDCNY		LUSDMZN		LUSDZAR	
	First Period	Second Period	First Period	Second Period	First Period	Second Period	First Period	Second Period
ARDL – long run coefficients	0.006** (2.502)	0.035 (0.634)	-0.024 (-0.159)	0.444 (1.145)	0.033 (1.431)	-0.100 (-0.989)	0.029 (1.617)	-0.026 (-0.221)
ECM – short run coefficients		0.035 (0.750)	-0.024 (-0.128)	0.444 (1.568)	0.033 (1.667)	-0.100 (-1.313)	0.029* (1.757)	-0.026 (-0.323)
ECT	First Period -0.166** (-5.014)	Second Period -0.472** (-5.946)						

Source: Authors computations. Note: ** and * shows level of significance at 5% and 10% respectively. In parenthesis (--) are the t-statistics.

The purpose of the study was to ascertain the relationship between Zimbabwe Inflation rate (denoted by CPI), Zimbabwe average lending rate (LR), and exchange rates of US Dollar against Chinese Yuan (USD/CNY), South African Rand (USDZAR) and Mozambique Metical (USDMZN) during the multicurrency use era.

It has been shown that during both period of dollarisation (first period) and when Zimbabwe introduced a fiat currency to the currency basket (second period), there was a long run relationship between the aforementioned variables. For the first period, table 3 shows that the USD/Chinese Yuan exchange rate is negatively affects inflation, though statistically insignificant. This is to say a depreciation in the USD/CNY caused inflation. The USD/MZN and the USD/ZAR exchange rates positively affects inflation which was also statistically insignificant. The finding on the USD/ZAR are in line with that of Kavila and Le Roux (2016) where a positive relation was established between the USD/ZAR exchange rate and the inflation rate. Lastly, the variable interest rate is statistically significant and positively affects inflation. This meant an increase in lending rate was passed on say as a cost to the production and sell of goods and services immediately, hence increases in the price levels as well. Therefore, one can conclude that the overall inflation cause in the first period is the USD/CNY exchange rate. Similar results were also found for the short run estimates except that the USD/ZAR was statistically significant.

For the second period, it was also shown that there was a long run relationship that was exhibited by the variables during the period Zimbabwe had introduced its fiat currency in the currency basket and it was purportedly deemed to be at par with the USD (between December 2014 and February 2019). The long run estimates shows that USD/MZN and USD/ZAR negatively affects Zimbabwe's inflation, though statistically insignificant. The foreign exchange rates with negative effect on the CPI implies that the depreciation of the currencies against the USD causes the inflation rate to increase. On the contrary, the USD/CNY positively affects inflation but statistical insignificant. This scenario could be because of a trade imbalance between the two nations with Zimbabwe being the net importer in most instances. Statistics show that China was the second highest country Zimbabwe imported most of its goods from during the period of the study. The result is in tandem with what most literature on dollarised economies state. Sadeghi et al (2015), Sean et al (2018) and Carranza et al (2011) exhibited a positive relationship between exchange rate appreciation and the domestic inflation. The authors state this phenomenon is mostly found in highly dollarised economies. Lastly, the variable interest rate also positively affects inflation in Zimbabwe but also statistical insignificant. The phenomenon is justified because lending rates were largely stagnant during the first few years after the introduction of the multicurrency system. Similar results were obtained under the error correction model. The error correction terms for both periods are negative and statistically significant.

Overall, the results of this study are in line with the research by Park and Son (2020). Just like the Zimbabwean case before the adoption of the multicurrency system, inflation was seen as the common factor for the adoption and or the deepening of dollarization. The study found that there was a relationship between the exchange rate and inflation in dollarised countries and that the depreciation of the domestic currency against the USD had a significant positive effect on the price levels.

5. CONCLUSION

The overall objective was to study the effects of foreign exchange rates on the inflation rate in a multicurrency economy. The variables of the study were the CPI, interest rates as well as the foreign exchange rate of the US Dollar against the South African Rand, Mozambique Metical and the Chinese Yuan. There has not been much literature that has been published with regards to the relationship between foreign exchange rates and the inflation rate in a multicurrency

economy, especially one without its own local currency in the currency basket. This study thus, went on to fill this gap by analysing how the variables in question relate and affect each other.

The study made use of the Autoregressive Distributed Lag model (ARDL). This was the best method of estimation given that the relationship, both short run and long run among the variables needed to be studied. The nature of the data also made it prudent to apply the use of the ARDL model. Such a modelling technique has been used before to study almost similar research though a different number of other modelling techniques have also been used. The study period was divided into two separate analyses and similar estimation techniques were applied to the time periods in order to give a clear and fair analysis as well as comparisons.

From the regression analysis conducted, results from the first period showed that all the independent variables in the study except for the USD/CYN were significant in affecting the inflation rate during the period under study. There was also evidence of cointegration among the variables and signs of a long run relationship between inflation rate and the independent variables were observed. The diagnostic tests conducted confirmed that the model was a good fit for the study. Overall, inflation was determined by movement in foreign currency exchange rates during the first period of the study and lending rates also contributed to inflation outturn. This result concurs with other studies such as Pindiriri (2012) and Kavila and Le Roux (2016) that were previously conducted during the same time period (before the introduction of the pseudo currency) though the other previous studies only used the USD/ZAR exchange rate.

During the second period of study, the interest rates did not significantly affect the inflation rate. All the other variables, however had a significant effect on the inflation rate though normally after some passage of some lag. The bounds test for cointegration revealed that there was evidence of cointegration between the dependant variable CPI and the independent variable hence there was evidence of a long run relationship as well.

Results for the second period however differ slightly from those of the first period. Some of the foreign exchange rates were now significant in affecting the inflation rates though there was no evidence of such during the first period.

Overall, exchange rates influenced inflation rate more during the period that Zimbabwe was solely using a foreign multicurrency economy as compared to the period where it has introduced its pseudo currency in the currency basket. The effects of the exchange rates on the inflation rates differ between the two periods, some of the used exchange rates having a negative relationship with the inflation rates, while others have a positive relationship as supported by previous literature.

DISCLOSURE OF CONFLICT

The authors declare that they have no conflicts of interest.

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