

# Empirical Test of the Relationship Between Exchange Rate and Inflation in Zimbabwe

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## Abstract

This research looks into the empirical relationship between exchange rate and inflation in Zimbabwe during the period 1980 to 2007. Using Granger Causality test estimated results reveal that both the exchange rate and inflation have long run relationship. On the other hand, inflation and exchange rate are found to Granger-cause each other during the period under consideration. Based on results of the research, appropriate policies can then be drawn given insight to how exchange rate can perform its roles without necessarily leading to inflation and we recommend the policy makers should try to cushion the effect of inflation on the economy when the need arises so that rise in exchange rate will not lead to inflationary pressure.

**Key Words:** Exchange rate, Inflation, Granger Causality test, Policy

## INTRODUCTION

Inflation and exchange rate are the two important elements of measuring macroeconomic performance of a country. Increase in prices of goods and services and foreign exchange are two important aspects which are deemed responsible for such potholed fluctuations in the economic growth. The volatility of the nature of prices is a major source of concern in all countries since 1970s. The issue is of a more serious nature in the developing countries where inflation in foreign countries known as “imported inflation” is seen to be driving “domestic inflation”; making domestic policies to control inflation ineffective. Continuous devaluation of currency and inflation in the 1980s seems to suggest a correlation between the two variables.

Inflation can be grouped into four types, according to its magnitude: Creeping inflation, Walking Inflation, Running Inflation and Hyper Inflation. Inflation affects different people or economic agents differently. Broadly, there are two economic groups in every society, the fixed income and the flexible income group. During inflation, those in the first group lose while those in the second gain. This is because the price movement of different goods and services are not uniform. During inflation, most prices rise, but the rates of increase of individual prices differ. Prices of some goods and services rise faster than others while some may remain unchanged.

Surging inflation in the economy poses the greatest challenge to any nation’s economic growth prospects because by eroding the real value of money, inflation reduces the worth of saving or investment. Such erosion frustrates business and investment planning, thereby destroying the capacity to generate wealth in the economy. The prevailing high levels of inflation also negatively impact a country’s low-wage earners and others on fixed income, leading to worsened levels of poverty. Consequently, as a self-protective measure, economic agents often resort to foreign currencies, which action ultimately results in widespread unofficial dollarization and black exchange markets, especially in the presence of legal restrictions on foreign exchange transactions and high demand for foreign currencies

The influence of exchange rate towards inflation itself depends on the choice of exchange rate regime in the country. Changes in the exchange rate will have a great impact on the economy as a whole. In the system of floating exchange rates, exchange rate fluctuations can have a strong impact on the level of prices through the aggregate demand (AD) and aggregate supply (AS). On the aggregate supply, depreciation (devaluation) of domestic currency can affect the price level directly through imported goods that domestic consumers pay. However, this condition occurs if the country is the recipient countries of international prices. Non direct influence from the depreciation (devaluation) of currency against the price level of a country can be seen from the price of capital goods (intermediate goods) imported by the manufacturer as an input. The weakening of exchange rate will cause the price of inputs more expensive, thus contributing to a higher cost of production. Manufacturers will certainly increase the cost to the price of goods that will be paid by consumers. As a result, the price level aggregate in the country increases or if it continues it will cause inflation.

**Background:** The inflation rate in Zimbabwe since 1980 to 1990 ranged from 7% to 19% and during that period the economic management was towards state controls. The controls covered prices and the allocation of domestic

credit and foreign exchange. After 1990 the government adopted trade liberalisation policy as policy prescription by World Bank (WB) and International Monetary Fund (IMF). During the period 1990 to 2000 the inflation rate averaged from 20% to 56%. And after that to 2006 it ranged from 112, 1% to 1281, 11% which indicates that inflation rate is increasing despite different exchange rate regimes. Since 1980 high and persistent inflation has been a source of much concern and it was attributed by major devaluation of exchange rate. The high rates of inflation were a result of political instability and lack of commitment to economic policies implemented for example Economic Structural Adjustment programme (ESAP). Private sector price speculation was also the root cause of inflation although the authorities in Zimbabwe maintain that negative aid shocks and international sanctions have contributed to economic decline since the year 2000.

The first Zimbabwe dollar which replaced the Rhodesian dollar in 1980 was exchange rate was pegged ZW \$1 to US\$1.47 and the second dollar redenomination of the first dollar was revalued at a rate of ZW\$1 to ZW\$1000 old dollars. The black market rate was now unofficially used to determine the exchange rate for the country.

The period between 1991 and 1993 saw the introduction of less restrictive exchange control environment in order to improve allocative efficiency in the foreign exchange market. Reform measures supportive of a move towards a market based exchange rate regime were implemented such as the Export Retention Scheme (ERS) which was aimed at approximating the market value of the Zimbabwean dollar. This scheme had however its disadvantages. Firstly its market was thin and segmented as it was restricted to exporters of goods and services. Secondly, the use of the Export Retention Scheme market exchange rate and the rate quoted by the RBZ implied use of the multiple currencies which in essence was distortionary.

In 1994 Exchange Rate Policy introduced a two tier exchange rate system – one quoted by the RBZ and the other one determined in the interbank market. The two tier exchange rate regime was however only required for a transitional period since use of two rates was bound to cause distortions.

Managed Float Exchange Rate Regime was introduced in July 1994 and led adverse balance of payments developments in 1997, particularly from the last quarter, combined with rising domestic inflation, exerted immense pressure on the exchange rate. As market confidence declined, speculative behaviour about probable currency depreciations intensified. This led to prepayment of lines of credit, hoarding of foreign exchange and further attacks on the Zimbabwe dollar. These developments intensified from October 1997, as evidenced by significant build up of foreign exchange balances of companies at banks. Finally the currency collapsed on 14 November 1997, depreciating sharply by 31.4% from Z\$13.7/US\$ on 13 November to Z\$18/US\$.

During the first half of 2000, the foreign currency situation deteriorated further and this led to development of a parallel market, accounting for a greater part of foreign exchange transactions. Significant build up in foreign payment arrears, from US\$109 million in December 1999 to US\$424.7 million by end of July 2000. This resulted in the suspension of BOP support to Zimbabwe and compounded the foreign currency situation. In light of the above factors, maintenance of the exchange rate at Z\$38/US\$ became unsustainable.

Fixed exchange rate was introduced from 2000 to 2003, with the exchange rate, which was pegged at Z\$38 against the US dollar, for over twelve months was adjusted to Z\$50 in August 2000, against the US dollar and was later adjusted to Z\$55 in 2000. This exchange rate policy was introduced because of a breakdown of the informal arrangement between the Reserve Bank and Authorized Dealers to peg the exchange rate at Z\$38 to the US dollar and closure of several gold mines, as a result of a combination of rising production costs and declining revenues, escalating foreign payment arrears; and rising domestic inflation.

The Foreign Currency Auction System commenced on the 12th of January 2004 and the system involved the auctioning of foreign exchange through a currency exchange – an independent body supervised by the Reserve Bank. Nevertheless, the system was abandoned in October 2005 because it failed to achieve its intended objective of enhancing export viability.

**Statement of the problem:** The Zimbabwean government have been continuously manipulating the exchange rate up to abandonment of the Zimbabwe dollar and adoption of multi-currency in April 2009. The policy objective was to manage inflation but still there is hyperinflation in Zimbabwe and this is major concern. Moreover the policy makers ignore that inflation can have an effect on exchange rate and need to be managed to control exchange rate fluctuations. Lastly there is persistent increase in inflation coupled with higher exchange rates.

**Delimitation of the study:** The study used time series data from 1980 to 2007 and data on Zimbabwe's exchange rates and inflation have been used throughout the research.

## EMPIRICAL LITERATURE

Inflation is usually viewed in two broad forms monetarist and structuralist. Monetarists assert that the empirical study of monetary history shows that inflation has always been a monetary phenomenon. In case of Zimbabwe both monetary and structural factors were considered as root cause of inflation carried out by Chhibber et al (1989) macroeconomic effects of devaluation in Zimbabwe a CGE analysis. Makochekamwa (2007) employed annual time series data in Zimbabwe to test the relationship between inflation and black market exchange rate using 1975 to 2006 data. He empirically found that granger causality is bidirectional for the statistical significance of the variables that relate inflation to black market foreign exchange.

M.O. Odedokun (1995) identifies in his studies causes of inflation in sub-Sahara Africa. By employing econometrics to analyse annual reports data for 35 countries from 1971 to 1990. The findings suggest that monetary growth, the rate of domestic currency depreciation, and the expectation of inflation have positive effects on inflation, while expansion of per capita food production as well as overall economic growth serve to reduce inflation rates. B Imimole, A Enoma (2011) examined the impact of exchange rate depreciation on inflation in Nigeria for the period 1986–2008, using Auto Regressive Distributed Lag (ARDL) Cointegration Procedure. The research found that exchange rate depreciation, money supply and real gross domestic product are the main determinants of inflation in Nigeria, and that Naira depreciation is positive, and has significant long-run effect on inflation in Nigeria. This implies that exchange rate depreciation can bring about an increase in inflation rate in Nigeria.

Adetiloye, Kehinde Adekunle (2010) The paper adopted the techniques of correlation and find the significance of the relationships between the consumer price index and the exchange rates in Nigeria using 1986 to 2007 data. It found out that there is higher positive relationship between the ratio of imports and the index than exist between the parallel and official rates. The coefficient between autonomous exchange rates and the consumer price index (CPI) is less significant than official rate, while the import ratio in the economy shows a near two-way balance causality with the consumer price index. Ndungu (1993) estimated a six-variable VAR money supply, domestic price level, exchange rate index, foreign price index, real output, and the rate of interest. In an attempt to explain the inflation movement in Kenya. He observed that the rate of inflation and exchange rate explained each other. A similar conclusion was also reached in the extended version of this study (Ndungu 1997).

Kamas (1995) study on Colombia extended the works of Montiel (1989) and Dornbusch, Sturzenegger and Wolf (1990) observed that exchange rates did not play an important role in explaining the variation in inflation in Colombia and that inflation appeared to be primarily inertial with respect to the exchange rate but largely determined by demand shocks.

Greene and Canetti (1991) evaluated the relative strength of exchange and monetary expansion in propagating inflation in ten Africa countries, that exchange rate movement explains the inflationary trend in these countries. London (1989) examined on money supply and exchange rate, in the inflationary process of twenty three Africa countries. The application of pure monetarist model on supply, expected inflation and real income were significant determinants of inflation for the period between 1974 and 1985. The exchange rate was later included as one of the explanatory variables in pure monetarist model and the result shows that exchange rate movement had remarkable influence on the inflationary process in 1980s.

H Berument and M Pasaogullari( 2003) assesses the effects of real depreciation on the economic performance of Turkey by considering quarterly data from 1987 to 2001. Using the Granger causality method the empirical evidence suggests that, contrary to classical wisdom, the real depreciations are contractionary, even when external factors like world interest rates, international trade, and capital flows are controlled. Moreover, the results obtained from the analyses indicate that real exchange rate depreciations are inflationary

Rana and Dowling (1983) suggest that foreign inflation is the most influencing factor in explaining the change in local price level in nine less-developed countries of Asia during the period 1973-79. This study suggests that these countries cannot exercise much control over domestic inflation; however, the policies of their major trading partners through exchange rate had a significant impact on their domestic prices. However, Sowa and Kwakye (1993) claim that Chhibber and Shafik (1992) emphasize monetary factors at the expense of supply factors in Ghana and conclude that the supply constraint (output) was the main force behind inflation.

A Rashid and F Husain(2010) investigated the effects of capital inflows on domestic price level, monetary expansion and exchange rate volatility. To proceed with this, linear and nonlinear cointegration and Granger causality tests are applied in a bi-variate as well as in multivariate framework using 1990 to 2007 time series data. The findings suggest that the capital inflows in such a way that they should neither create an inflationary pressure in the economy nor fuel the exchange rate volatility.

Canetti and Greene (1991), using vector autoregression analysis to separate the influence of money supply growth from exchange rate changes on prevailing and predicted rates of inflation in Africa, find that both exchange rate movements and monetary expansion affect consumer price changes in a number of sub-Saharan African countries. In particular, the authors find a significant causal impact of exchange rates on prices in Sierra Leone, Tanzania, and the Congo.

Hakan Kara and Fethi Ögünç(2005) using a vector auto-regression (VAR) setup, estimated the pass-through from exchange rates and import prices to domestic inflation in Turkey, and produce some stylized facts regarding the degree and the adjustment speed of the pass-through on several price measures. Estimations for two distinct periods, before and after the adoption of floating exchange rate regime yield both good and bad news. The good news is our impulse responses confirm the common conjecture that pass-through has weakened and slowed down after the adoption of floating exchange rate regime. The bad news is, surprisingly low pass-through in recent years partly owes to the fact that exchange rate shocks were not persistent in direction. In other words, total pass-through might have been sizable had the economy been hit by one-sided shocks such as a persistent depreciation

## MATERIALS AND METHODS

In this section we present the methodology of the link between the exchange rate and inflation in Zimbabwe using Granger causality test.

**Model specification:** The Granger causality test assumes that the information relevant to the prediction of the respective variables, inflation and exchange rate, is contained solely in the time series data on these variables. The test involves estimating the following pair of regressions: (Based on Gujarati, 2003). This study used  $Y_t$  representing inflation and  $X_t$  to representing exchange rate. All variables were transformed into natural logarithm for the analysis throughout the study. The study adopted a methodology of granger causality test that is presented as follows;

$$Y_t = \sum_{i=1}^m \alpha_i X_{t-i} + \sum_{i=1}^m \beta_i Y_{t-i} + \mu_{1t} \dots\dots\dots(1)$$

$$X_t = \sum_{i=1}^m \gamma_i X_{t-i} + \sum_{i=1}^m \delta_i Y_{t-i} + \mu_{2t} \dots\dots\dots(2)$$

Where;  $\mu_{1t}$  and  $\mu_{2t}$  are white noise error term and are assumed to be stationary,  $Y_t$  represent current level of inflation,  $Y_{t-i}$  previous level of inflation,  $X_t$  represent current level of exchange rate,  $X_{t-i}$  past value of exchange rate,  $\alpha, \beta, \gamma$  and  $\delta$  are positive constants,  $m$  are the number of lags to be specified and  $t$  is time. Equation (1) postulates that current inflation is related to past values of itself as well as that of exchange rate. Equation(2) proposes a similar behaviour for exchange rate. The aim of this section is test whether there exist along run relationship between inflation and exchange rate and the nature of the relationship. The data was obtained from Zimbabwe Statistical Agency and Reserve Bank of Zimbabwe bulletin which are reliable sources at domestic level.

## RESULTS AND INTERPRETATION

In this section, we present and interpret results of the unit root and co-integration tests which we performed before conducting the causality test to measure the existence and direction of causality. The empirical results are presented and interpreted below.

### Results

**Table 1:** ADF for testing unit roots in levels

Variable	coefficient	t-statistic	Decision
INF	1.985686	-3.7076	Non stationary
EXCH	-1.017201	-3.7204	Non stationary

The table above presents the estimates of Augmented Dickey Fuller (ADF) test. If the ADF test statistic is less in absolute value than the Mackinnon critical t-values, the null hypothesis of a unit root cannot be rejected for the time series and hence we conclude that the series in non-stationary at their levels. Evidence from the results shown

in the table confirms that, all the variables (inflation and exchange rate) were not stationary at level at 1% level of significance.

**Table 2 :** ADF for testing unit roots at first difference

Variable	coefficient	t - Statistic	Decision
INF	4.714936	-3.7204	Stationery(1)
EXCH	-6.773667	-3.7076	Stationery(1)

However to determine the stationery property of the variable, the same test was applied to the first difference. Results from table 2 above revealed that the ADF value is greater than the t- critical value at 95% level of significance. Based on these results the null hypothesis that the series have unit roots in their differences is rejected, meaning that the two series are stationery at their first difference.

**Table3:** Cointegration test

Hypothesised no. of CE(s)	Eigenvalue	Likelihood Ratio	5% critical value	1% critical value
None**	0.973784	97.22342	15.41	20.04
At most 1	0.093348	2.547900	3.76	6.65

\*(\*\*) denotes rejection of the hypothesis at 5%(1%) significance level.

Having confirmed the stationarity of the variables at I(1), we proceed to examine the presence or non-presence of cointegration among the variables. When cointegration is present, it means inflation and exchange rate share a common trend and long run equilibrium as suggested theoretically. In our case our mission is to determine whether or not long run inflation(LINF) and long run exchange rate(LEXCH) variables have a long run relationship in the bivariate framework.

The results of the co-integration in table3 above confirm that there is at most one co-integration relationship among the macro economic variables in the model. Specifically, the result of the co-integration test suggests that inflation has equilibrium condition with exchange rate, which keep them in proportion to each other in the long run. This evidence of the cointegration among the variables rules out spurious correlations and applies that one direction of influence can be established among variables.

The normalized Cointegration Coefficient is as follows:

$$LEXCH = -7.127775 - 0.003403LINF$$

The normalized cointegration equation reveals that there is a negative relationship between exchange rate and inflation as shown by table 4 below.

**Table 4:** Normalized Cointegrating Coefficients: 1 Cointegrating Equation(s)

Exchange rate	Inflation	Constant
1.000000	-0.003403 (0.00013)	-7.127775

**Table 5:** Pairwise granger causality test between exchange rate and inflation

NULL Hypothesis	Observations	F-Statistic	Probability
EXCH does not Granger Cause INF INF does not Granger Cause EXCH	26	5048.70 106.910	0.00000 9.8E-12

The Granger causality test is used to determine the nature of causality between changes in the exchange rate and inflation rate in Zimbabwe. The Granger causality tests presented in table 5 discloses that the direction of causality in annual tests is generally bi-directional, from inflation rate to exchange rate and vice versa. Thus for Zimbabwe, these two series feed each other, and any meaningful monetary policy targeting the rates has to be modelled in such a way that these two problems can be simultaneously dealt with.



## CONCLUSION AND POLICY RECOMMENDATIONS

In this research we have investigated the causal relationship of exchange rate and inflation using annual data for Zimbabwe from 1980 to 2007. The review showed that while vast growing volumes of research were being carried out in the developed countries, little attention has been paid to the issue of causality and direction of causality between exchange rate and inflation in Zimbabwe

The review showed that while vast growing volumes of research were being carried out in the developed countries, little attention has been paid to the issue of causality and direction of causality between exchange rate and inflation. Our empirical analysis does not support the results of Ahmad and Ali (1999) that exchange rate has a significant impact on inflation, the results confirmed a unidirectional causality between inflation and exchange rate in Zimbabwe. Based on this empirical analysis, appropriate policies can then be drawn given insight to how exchange rate can perform its roles without necessarily leading to inflation. In order to achieve high and sustained long run economic growth, exchange rate is used as fiscal policy instrument, relevant measures to enhance policy coordination among various arms of government should be put in place. Most especially, monetary policy should be made to complement fiscal policy measures. Also fiscal discipline should be strongly adhered to at every level of government.

The empirical results provides the following few policy recommendations. Given that trade liberalization policies and the auction systems to date have failed to rescue the economy from the evils of this market, it means that other policy strategies have to be employed. One possible policy strategy is the development of a more vibrant economy, as GDP growth normally improve exchange rate in the long run. That is, economic growth which encompasses activities such as increased exports and foreign direct investments, means they is a possibility of more foreign currency inflow, assuming other things constant.

A more predictable exchange rate will reduce the uncertainty associated with frequent devaluations of the domestic currency, given the positive impact of the expected rate of devaluation on the level of the inflation. A situation where firms and other investors are unable to make their decisions on the basis of a stable currency will cause difficulties in attracting investment, whether domestic or foreign, depriving the economy of foreign exchange that would ease pressure on demand for foreign exchange.

It is also a well known economic fact that exports are one of the nearly endogenous variables that any country can manipulate and use for its benefit to earn foreign exchange. Though export prices are exogenously determined on the international market, a country can still be able to reduce the scarcity of foreign currency by increasing its exports, both in quantity and quality terms through relevant export promotion strategies and state of the art production techniques, respectively. If Zimbabwe could be able to revive her export sector, much of the pain brought by black market may be reduced to a greater extent.

Another important factor which is a prerequisite for these policies to succeed is the restoration of the country's long-term macroeconomic and political stability. Even if the authorities were willing to implement the trade and exchange rate reforms that are necessary for a successful unification policy, it will be difficult to achieve and maintain macroeconomic discipline in a hyper inflationary, politically polarized and sanctioned country. Taking steps to mend the battered relations with the international community would not only lay the basis for long-term development initiatives, but will also reactivate international cooperation with the country and boost confidence in Zimbabwe's economy. Other countries have capitalized on expatriates, created systems and structures credible enough to attract investment by their own citizens living abroad.

The policy maker should try to cushion the effect of inflation on the economy when the need arises so that rise in exchange rate will not lead to inflationary pressure in the short run even though inflation and exchange rate have long term relationship. Lastly, although the study have pressed much attention on the policies suggested by material reviewed as well as the empirical results of the model, there are many more measures that will need to accompany in Zimbabwe. Other measures should include the government fostering a more competitive banking sector as well as general financial stability in order to increase efficiency in the use of the country's limited financial resources.

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