

Is Money Supply the Cause of Inflation in Zimbabwe? An Empirical Examination

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Abstract: In this article, we used a multiple linear regression model to empirically examine the nexus between money supply and inflation in Zimbabwe during the period 1980 to 2019. To obtain an in depth analysis of that relationship, data were obtained from IMF – International Financial Statistics, World Bank and other credible, reliable and valid sources. Our empirical results show that inflation was directly related to money supply and inversely related to exchange rates and fiscal deficits in Zimbabwe for the period understudy. We, therefore, recommend that the growth of money supply should be made to match real economic growth as this was the basis of Milton Friedman’s monetary rule that holds inflation as a purely a monetary phenomenon that can only be produced by expanding the money supply at a faster rate than the growth of capacity output. This article is valuable to monetary authorities, economists, researchers and the public.

Keywords: Money Supply; M3; Inflation; Monetary policy; Empirical Examination; Zimbabwe

JEL Classification: E31; E51; E52; P24; P44; O42

1. Introduction

Inflation as a topic has received a lot of attention from economists though with varied definitions with a common theme being established across all. Many economists do concur to the fact that inflation explains a general creep up in price levels overtime (Ofori, Danquah & Zhang, 2017) with Austrian economists view this (general creep up in price levels) as the symptom of inflation and not the cause. In every economy, high inflation is a serious disturbing development due to its negative consequences on purchasing power. A highly inflationary economic environment dissuades capital accumulation activities and is catalytic to high poverty levels, a feature that describes a number of African economies (Bleaney & Francisco, 2016). For these reasons and

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others, central banks around the globe, including the Reserve Bank of Zimbabwe (RBZ), formulate and implement monetary policy aimed at stabilising inflation levels among other goals.

As an economic phenomenon, inflation has attracted a lot of both theoretical and empirical effort to explain its possible causes. Some authorities argue that three major aspects namely fiscal, monetary and balance of payments are the source of inflationary pressures (Obi & Uzodigwe, 2015). Based on the quantity theory of money, the monetarist view holds that inflation is a function of disproportional increase in money supply relative to expansion of the gross domestic product (GDP). On the other hand, persistently high budget deficit is fundamental to explaining inflationary expectations in an economic system (Nguyen, 2015). Exchange rate volatility is a major explanatory variable under the balance of payment view especially for those countries with structural production rigidities where imports are important to satisfy domestic demand. A collapse of the local currency increases inflation expectations as the import prices of goods and services increases (Monfared & Akin, 2017). However, of the three, the widely accepted proposition is that inflation is largely a monetary phenomenon since a number of empirical tests in different countries substantiate this fact (Bawa, Abdullahi & Ibrahim, 2016; Gatawa, Abdulgafar & Olarinde, 2017 & Jariwala, 2018).

The rest of the article is organised as follows: Section 1 provides an overview of money supply and inflation in Zimbabwe. Section 2 (literature review) delves into the theoretical and empirical arguments of the nexus between money supply and inflation. Section 3 looks into the research design and sources of data. Section 4 presents the research findings, analysis and discussions and section 5 concludes the article, providing recommendations along with it. Section 6 provides the references.

1.1. An overview of Money Supply and Inflation in Zimbabwe

Over the period spanning 1980 to 1990, Zimbabwe enjoyed a period of relatively stable inflation levels averaging around 13% (Figure 1). This was against a background of economic system characterised by price controls under a heavily regulated business environment. The introduction of the International Monetary Fund (IMF) supported economic reform in 1991 enhanced the influence of market forces in resource allocation with the pricing mechanism becoming more fundamental in reflecting underpinning economic developments. Inflation averages, due to relaxation of price controls as well as monetisation of fiscal deficit, creped upwards from an average of 13% to 28% over the years 1991 to 1995 which was the first phase of Economic Structural Adjustment Programme (ESAP) (Kavila & Roux, 2017). In August 1997, the government, in order to appease the grown disquiet that was developing from a politically influential grouping of war veterans, conceded to demands for gratuities and monthly pension (Ellyne & Dally, 2016).

Consequentially, this development had a dramatic incremental effect on the government budget deficit. From 1998, M3 growth spiked to 68% year on year from the previous averages of 25% between 1989 and 1997. The decision by the government to be active militarily in the Democratic Republic of Congo (DRC) in 1998 largely explains the spike. Heavy budget overruns were encountered on the DRC military engagement. With a shaky economy, balancing the budget through tax increase was not feasible mainly due to resistance from the then potent trade union movement, a reason cited for the government's turn to the printing machine (fiat currency) to finance the war in DRC (Ellyne & Dally, 2016). Inflation averages increased from 18.7% in 1997 to 140% in 2002. By the year 2002 growth rate of money supply was well above 150%.

The land redistribution program that was pioneered in 2000 created a heavy negative shock to an agriculture dependent economy. The RBZ, as a strategy to reverse the sustained deterioration of the economy embarked on quasi-fiscal programs. The quasi-fiscal activities entailed provision of concessionary financing to strategic sectors of the economy especially agriculture under the conviction that when funded, the newly resettled farmers would increase agricultural output. Quasi-fiscal activities which intensified between the years 2005 to 2008 resulted in the level of money creation that was highly divergent to the level of economic activity, a feature that is highly inflationary according to the quantity theory of money (Mandishara & Mupamhadzi, 2016). Between 2007 and 2008, the inflation spiral eventually got out of control as unprecedented levels of inflation of 231.2 million percent were recorded (International Monetary Fund, 2009). Broad money growth shared the same trend with inflation hovering around 431% by December of 2008 (Kavila & Roux, 2017).

However, Zimbabwe witnessed a fundamental shift in inflation and money supply growth in 2009, due to the decision by fiscal and monetary authorities to operationalise the policy of dollarisation. Respectively, the broad money supply M3 and the monthly inflation growth rates receded to 30% and 2% from the peaks of hyperinflation in 2008 (Pindiriri, 2017). The steady state of inflation growth rates continued in years that followed dollarisation dropping even to negative territories. According to the RBZ, under the multicurrency system, yearly inflation reclined to below 5% in 2011, 3.7% in 2012, 1.6% in 2013 and -0.2% in 2014. The negative annual headline inflation trend persisted up until 2016 though at a decelerating rate to around -0.9% by December 2016 (RBZ, 2016).

This article set out to provide empirical evidence on whether growth in money supply causes inflation in Zimbabwe. This is an interesting question to provide answers to in light of the fact that, in 2010, the then RBZ Chief, once argued that much more fundamental factors other than money supply explain inflationary expectations in the Zimbabwean context. As such, the proposition that, whether directly or indirectly, inflation is always and everywhere a monetary phenomenon as stated by Friedman

(1945), is yet to be established in the Zimbabwean context. The findings of this article thus provide an opportunity for government and other stake holders to reflect on historical monetary positions and their outcomes. As arguments were put forward to the notion that, pockets of inflationary pressures persisted during the years of multicurrency regime. This is a very essential ingredient for policy implementation now that Zimbabwe has moved from the multi-currency system in favour of its own currency. Furthermore, this study is a great addition to scant literature on the economic developments in Zimbabwe, a case setting that is often at the periphery of academic research due to international isolation and challenges associated with accessing reliable economic data. Figures 1 and 2 below track inflation, money supply, fiscal deficit and exchange rates developments in Zimbabwe from 1980 to 2018.

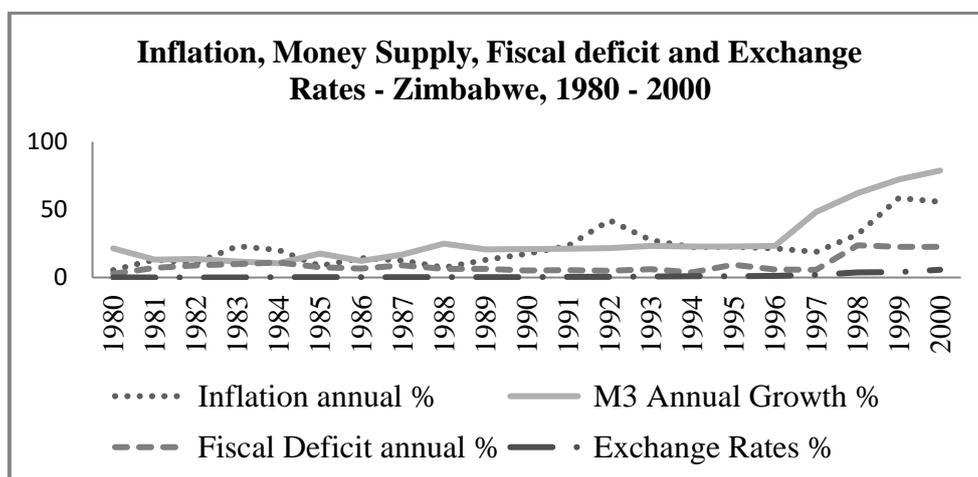


Figure 1. Trends in Inflation, M3, Fiscal Deficit and Exchange rates in Zimbabwe (1980-2000)

Source: World Bank, IMF – International Financial Statistics

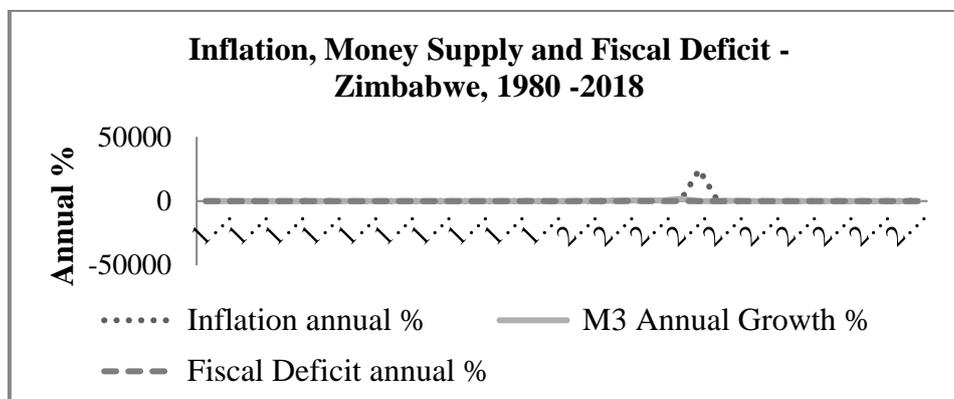


Figure 2. Trends in Inflation, M3 and Fiscal Deficit in Zimbabwe (1980-2018)

Source: World Bank, IMF – International Financial Statistics

2. Literature Review

From the theoretical front, the relationship between money supply and inflation can be better understood from the Monetarist and Austrian theories point of views. Many economists, however, complain repeatedly about fiat money and increases in money supply. Characteristically, they argue that any increase in money supply must always lead to a rise in the price level or the inflation rate. Many complain about central banks' creation of money as the cause of inflation. In view of that, the Austrian theory defines inflation specifically as an increase in money supply, contrary to the popular definition of an average increase in the price level as given by the Monetarist theory (based on the quantity theory of money). In the Austrian theory, inflation is not a general increase in prices, but an increase in the money supply. The quantity theory of money is, however, the basis of Milton Friedman's monetarism, a macroeconomic theory that became popular in the late 1970s and early 1980s. The quantity theory is also used frequently by pro-free market writers to decry expansion of money supply under a fiat monetary system.

According to Rothbard (2009), "the Austrian theory under Ludwig von Mises, for instance, agreed with the classical 'quantity theory' that an increase in the supply of dollars or gold ounces will lead to a fall in its value or 'price' (that is, a rise in the prices of other goods and services). Furthermore, Mises showed that the 'quantity of money' does not increase in a lump sum: the increase is injected at one point in the economic system and prices will only rise as the new money spreads in ripples throughout the economy. So that an increase in the supply of money changes relative to prices at least temporarily, and may result in a permanent change in relative incomes as well." Mises' argument was that a given increase in the supply of money would not lead to a direct, proportional and mechanistic rise in the general price

levels as what monetarists believe was the case. To Mises, inflation, means increasing the quantity of money and bank notes in circulation and the quantity of bank deposits subject to check. However, people today use the term “inflation” to refer to the phenomenon that is an inevitable consequence of inflation, that is, the tendency of all prices and wage rates to rise. The result of this deplorable confusion is that there is no term left to signify the cause of this rise in prices and wages. There is no longer any word available to signify the phenomenon that has been, up to now, called inflation. It follows that nobody cares about inflation in the traditional sense of the term. Mises further argues that if one cannot talk about something that has no name, one cannot fight it. To him, those who pretend to fight inflation are in fact only fighting what is the inevitable consequence of inflation, rising prices. Their ventures are doomed to failure because they do not attack the root of the evil. They try to keep prices low while firmly committed to a policy of increasing the quantity of money that must necessarily make them soar. Moreover, Mises argues that as long as this terminological confusion is not entirely wiped out, there cannot be any question of stopping inflation. In this regard, Garrison (2007) argues that Austrians, for example, “Friedrich August von Hayek criticized Milton Friedman for concentrating too much on statistical relationships (between the quantity of money and the price level), claiming that matters are not quite that simple.”

Shostak (2002) gives a balanced argument on the Austrian theory of inflation when he argues that, “the essence of inflation is not a general rise in prices but an increase in the supply of money, which in turn sets in motion a general increase in the prices of goods and services. While increases in money supply (that is, inflation) are likely to be revealed in general price increases, this need not always be the case. Prices are, however, determined by real and monetary factors. Consequently, it can occur that if the real factors are pulling things in an opposite direction to monetary factors, no visible change in prices might take place. In other words, while money growth is buoyant, that is, inflation is high, prices might display low increases.” Shostak (2002) provides an important argument that inflation rate is affected by real as well as monetary factors which tend to decrease the level of prices and some of these include: (i) the falling prices of specific goods through increasing productivity or output, (ii) an appreciating exchange rate, (iii) a rise in cheaper imports into a country, (iv) falls in the prices of imported basic commodities that are factor inputs, (v) changes in the velocity of circulation of money, (vi) higher unemployment (= less demand for goods and services), and (vii) a fall in extension of bank credit. In reality, all or some of these factors listed above could operate to cause either a zero inflation rate (which Japan actually had in 1996 and 2004) or a fall in average prices (deflation), even when the supply of money is still actually increasing.

Cachanosky (2009) argues that fundamentally, Ludwig von Mises in *The Theory of Money and Credit in 1912*, did not define an increase in the money supply accompanied by a corresponding demand for money as inflation, however, “Mises

suggests inflation as ‘an increase in the quantity of money above the market demand of money.’ Under this definition, Mises argued that, not every increase in the quantity of money is inflation, only increases that exceed market demand saved the term inflation for cases where the quantity of money is increasing above the market demand for money (Cachanosky, 2009).

Empirically, the nexus between money supply and inflation has received a great deal of attention from researchers the world over. The monetarist places a strong weight on the growth rate of money supply in explaining inflation dynamics. Although widespread empirical evidence exists validating this rationale, there is an ongoing criticism arguing that, the monetarist might have exaggerated the role played by money supply in fueling inflation.

Amassoma, Sunday & Onyedikachi (2018) empirically investigated the impact of money supply on inflation in Nigeria. The study was borne out of the curiosity to reexamine the immediate cause of the alarming rate of inflation in Nigeria which was adversely affecting the general welfare of Nigerian populace. Their study employed co-integration test and error correction approach on annual time series data spanning from 1970 to 2016. The study found that money supply does not considerably influence inflation both in the long and short run possibly because the country was in a recession. The error correction model had the correct sign and was significant meaning that about 21% of the errors are corrected yearly. The Granger causality outcome demonstrates that, there was no causality between money supply and inflation in Nigeria.

Ofori, Danquah & Zhang (2017) in their article entitled, “*The Impact of Money Supply on Inflation: A Case of Ghana*,” examine the impact of money supply on inflation in Ghana. The trio used annual data from 1967-2015 to estimate their model. Their study was limited to money supply as independent variable and inflation as the dependent variable. The findings of their study showed a long-run positive relationship between money supply and inflation based on an Ordinary Least Squares.

In their study entitled, “*Money supply and inflation in Europe: Is there still a connection?*” Diermeier & Goecke (2016) found the following, (i) The formulation of an appropriate monetary policy for the heterogeneous country groups of the euro area remains a challenge, (ii) Controlling the money supply is now the last option remaining out of three monetary policy instruments, (iii) Monetary developments have become disconnected from inflation developments. At present a structural break exists for the various euro area countries, (iv) The ECB’s asset purchase programme and the accompanying shift from long-term to short-term assets on banks’ balance sheets is partly responsible for this development, (v) In the current regime of extremely low interest rates, there is a strong connection between the liabilities and lending of commercial banks and inflation for individual countries and

(vi) Two problems stand in the way of a universally effective monetary policy in the euro area: real economy divergence and the different ways in which financial intermediation works in the different countries.

Obi & Uzodigwe (2015) support the argument by monetarists who argue that inflation is essentially a monetary phenomenon in the sense that a continuous rise in the general price level is due to the rate of expansion in money supply far in excess of the money actually demanded by economic units. In their study, they assessed the dynamic linkage between money supply and inflation in ECOWAS member states; West African Monetary Zone (WAMZ) and West African Economic Monetary Union (WAEMU) from the period 1980 to 2012. They used both the univariate and panel sense, that is, KPSS and ADF; IPS and LLC to assess the stationary properties of the series. The random effect model for ECOWAS member states shows that the impact of money supply on inflation is effective in the current and first period. While the impact is effective in the first period for WAMZ, WAEMU experiences the impact in current period. They also found significant specific-country effects on the variables.

In his study to establish the relationship between inflation and money supply in Kenya, Kiganda (2014) found a significant and positive long run relationship between inflation and money supply and a significantly error correcting inflation rate of 68% per year. Unidirectional causality was also established running from money supply to inflation validating the Monetarist theory. In conclusion it was established that in the long run money supply is a significant determinant of inflation in Kenya. His study was modeled on the Monetarist theory with annual time series data spanning 29 years from 1984 – 2012 used to measure correlation between the variables. The study used Vector Error Correction Mechanism to integrate long run and short run dynamics and Granger causality for directional causality.

Sabade (2014) tests the validity of the quantity theory of money in Indian situation and provides an alternative postulate. The findings showed that the quantity theory of money gives the identity namely $MV = PT$ which is true, but the functional relationship between M and P , that is, $P = f(M)$ does not hold in India since it is based on the constancy of V and T . So, Sabade (2014) argues that when inflation happens it is not attributed to money supply alone. In fact, even if a greater than required money supply has caused it, there is no guarantee that reduced money supply will bring inflation down. On the contrary, it may have other side-effects such as recession. Sabade (2014) further argues that as Friedman said, a counter-revolution never restores the initial situation. It always produces a similar situation, which is strongly influenced by the intervening revolution and this is true of monetarism. The study also found that the strong monetary tightening measures taken did not result in the original levels of inflation of below 5%, leave alone original absolute prices. However, it caused India's GDP growth rate to fall to 5%

and unemployment levels to rise. Moreover, monetary tightening can thus push an economy into inflation, but liberal monetary policy cannot get the economy out of it.

Ayubu (2013) examines the degree to which inflation is a result of monetary phenomena in Tanzania. This was achieved by comparing money supply and other potential determinants of inflation which include output, the exchange rate and international oil price. The analysis was done using impulse response function on SVAR and VECM econometric models with data set ranging between 1993Q4 to 2011Q4. The empirical results showed that inflation in Tanzania is more of an output factor than a monetary phenomenon. The study calls for parallel coordination of monetary policy and deliberate strategy for fostering economic growth.

Simwaka et al. (2012) examine the relative importance of monetary factors in driving inflation in Malawi. A stylized inflation model was used which includes standard monetary variables, the exchange rate and supply-side factors. The study results showed that inflation in Malawi was a result of both monetary and supply-side factors. Monetary supply growth drives inflation with lags of about 3 to 6 months. On the other hand, it was observed that exchange rate adjustments play a relatively more significant role in fuelling cost-push inflation. It was further observed that slumps in production generate inflationary pressures. In summary the researchers argued that at policy level, the Reserve Bank should ensure that broad money supply expands in line with nominal gross domestic product (GDP). Table 1 summarises the empirical studies on the relationship between inflation and money supply.

Table 1. Studies Showing the Nature of Relationship between Inflation and Money Supply

Author(s)	Region/Country	Methodology	Relationship
Akinbobola (2012)	Nigeria	Co-integration & Vector Error Correction Model (VECM)	Negative impact
Olorunfemi & Adeleke (2013)	Nigeria	Vector Autoregressive (VAR) Model	Positive impact
Ajisafe & Folorunso (2002)	Nigeria	Error-Correction Model (ECM)	Positive impact
Odiba, Apeh & Daniel (2013)	Nigeria	Multiple Regression Analysis	Positive impact
Qayyum (2006)	Pakistan		Positive impact
Bozkurt (2014)	Turkey	Co-integration test	Positive impact (money supply & velocity of money)

			are the principal determinants of inflation in the long-run.
Koyuncu (2014)	Turkey	Time-series analysis	Causality runs from money supply to inflation.
Tyrkalo & Adamyk (1990)	Jordan	Investigation	Long-run connection between money growth & inflation.
Thornton (2008)	36 African countries	Panel & cross section analysis	Money strongly determines inflation in countries with more than 10% inflation and money growth rates.
Tang & Lean (2007)	Malaysia	Regression Analysis	Negative impact
Aikaeli (2007)	Tanzania	GARCH Model	Positive impact (It takes 7 months for any fluctuations in money supply to have an impact on inflation).
Lahiri (1991)	Yugoslavia	Investigation	Bi-directional relationship between money stock & inflation.
Chaudhary & Ahmed (1995)	Argentina	Investigation	Bi-directional relationship between money stock & inflation.
Makinen & Woodward (1989)	Taiwan	Investigation	Uni-directional causality between money supply & inflation with causality running from inflation to money supply in the economy.
Waingade (2011)	Nigeria	Examination	Positive impact
Lim & Papi (1997)	Turkey	Multi-sector microeconomic model	Positive impact

Us (2004)	Turkey	VAR, Variance decomposition, Impulse response functions and Granger Causality tests	No impact (Inertial inflation is not a monetary phenomenon but rather an outcome of a political misconduct, which therefore shows the fiscal dominance).
Polan & Grauwe (2005)	160 countries over 30 years	OLS estimation	Positive impact
Gungor & Berk (2006)	Turkey	Multilayer perceptron neural network model	Positive impact
Nhavira (2009)	Zimbabwe	Granger causality test & VAR	No impact (Monetary aggregates are no longer relevant in Zimbabwe and that targeting M3 and reserves should be discontinued in favour of inflation or interest rate target).
Ndanshau (2010)	Tanzania	Autoregressive Distributed Lag (ADL) & ECM	No impact
Ndanshau (2012)	Tanzania	Pair-wise Granger causality test & VECM	Positive impact
Pindiriri (2012)	Zimbabwe	Time series econometric model	Positive impact
Nikolic (2000)	Russia	Time series – OLS method	Weak correlation
Zhang (2013)	China	Multivariate dynamic models	Positive impact
Altimari (2001)	Euro Area	Linear bivariate model & P-Star Model	Positive impact
Morana & Bagliano (2007)	USA	Econometric model – ARFIMA model	Positive impact
Kabundi (2012)	Uganda	Single equation error correction model	Positive impact

Simwaka et al. (2012)	Malawi	Johansen's cointegration model & ECM	Positive impact
Drevall & Ndung'u (2001)	Kenya	Parsimonious and empirically constant model	Positive impact (exist only in the short run).
Darrat (1986)	North Africa	Empirical investigation – inflation model & causality.	Positive impact
Diouf (2007)	Mali	Cointegration techniques and general-to-specific modeling	Long & short run correlation.
Jones & Khilji (1988)	Pakistan	Granger direct test	Positive impact

Source: Author's compilation from empirical studies

3. Research Design and Sources of Data

According to Keller (2017) a research design is a plan, structure or strategy of investigation used to obtain data from respondents needed in coming up with answers to research questions. The study used a quantitative statistical research design to present, analyze and interpret secondary financial data. The data used were drawn from IMF and Zimbabwe purely for comparability of the findings generated from the simple linear regression model used. The study examined the impact fiscal deficit, exchange rates and money supply, particularly M3 on the Zimbabwean inflation rate (%) for the period 1980-2019. The secondary financial data used were analyzed using a simple linear regression model because IMF data sources were assumed to be more credible, realistic, valid and consistent compared to those from emerging economies such as Zimbabwe.

3.1. Specification of the Model

The study's multiple linear regression model (MLRM) was of the form;

$$gr_{IR} = \beta_0 + \beta_1 FD + \beta_2 ER + \beta_3 M3 + e_t,$$

Where:

gr_{IR} = The annual growth rate in Zimbabwe's inflation rate (%) for 1980 – 2019,

FD = fiscal deficit,

ER = exchange rate,

M3 = money supply level,

β_s = regression coefficients and

e_t = the random or error term.

The above financial variables were drawn into the MLRM based on accessibility in the desire to examine their impact on explaining the country's inflation growth rate (%) for the period under investigation. The study used Excel E-Views 8 Package to regress growth rate in Zimbabwe's inflation rate (IR %) in the period under review as a function FD, ER and M3. The independent variables above were pertinent and justified for inclusion in the MLRM because of the possibility of them being manipulated by monetary authorities in emerging economies at the expense of the majority of the citizens. Inflation rates in repressed or administered financial systems were worth investigating because if manipulated, significantly eroded purchasing power of their currencies and inflicted untold suffering, hunger and starvation let alone poverty-strickenness to vulnerable citizens and retarded economic growth and development of such nations.

4. Findings, Analysis and Discussions

The findings of the study are presented and analysed using descriptive statistics, multicollinearity measures, unit root tests and MLRM generated using Excel E-Views 8 Package alluded to in research methodology section above.

4.1. Descriptive Statistics Results

The descriptive statistics (Table 2) were generated from the interaction of growth rates of FD, ER and M3 for the period 1980-2019 in Zimbabwe. The study revealed that exchange rates had the highest mean followed by inflation rates and M3 respectively as compared to that for fiscal deficit. However, in terms of the median, M3 had the highest followed by inflation rates and lastly exchange rates. When kurtosis and dispersion of the data were measured, the study discovered that exchange rates had the highest scores, followed by inflation rates and M3 and lastly fiscal deficit. However, all the model variables had positive measures of skewness to translate into the order, exchange rates, inflation rates, M3 and fiscal deficit in order of their magnitudes of skewness.

Table 2. Descriptive Statistics

	Exchange Rates	Fiscal Deficit	Inflation	M3
Mean	123258.9	7.052564	697.8664	115.7699
Median	0.002542	5.650000	19.44500	23.05000
Maximum	4900000.	23.75000	24411.30	1763.000
Minimum	0.000000	1.200000	-2.409500	-47.95323
Std. Dev.	774649.5	5.539947	3850.833	293.1811
Skewness	6.084511	1.782165	6.059126	4.693074
Kurtosis	38.02280	5.811404	37.81809	26.34237
Jarque-Bera	2291.136	33.48871	2265.253	1054.943
Probability	0.000000	0.000000	0.000000	0.000000
Sum	4930358.	275.0500	27914.66	4630.797
Sum Sq. Dev.	2.34E+13	1166.259	5.78E+08	3352251.
Observations	40	39	40	40

Descriptive statistics obtained from Zimbabwean data were compared with those drawn from IMF for the period 2004-2019. It was realized that the statistics, namely measures of central tendency and dispersion had a significant variance with those from Zimbabwe outweighing all those generated from IMF rates. Most current researches are shunning data drawn from developing countries such as Zimbabwe because of the suspicion of the authenticity of their origins and credibility. However in this respect, the great variance in descriptive statistics noted between the two sets of data could have been influenced by the global economic depression, lack of stability in Zimbabwe over the period under review, particularly 2006-08, let alone influence of perpetual country and political risks on ZIMSTATS to mention just but a few variables. The study went further to discover that the exchange rates had the greatest impact on inflation rates followed by M3 and finally fiscal deficit. One of the explanations given for the above finding could be that the impact and distortions caused by exchange rates and M3 in particular can be attributed to the unparalleled growth rate of the black market in Zimbabwe at the expense of the formal system. The fact that monetary resources were being siphoned out of the formal system into the black market by those in authority implied that control of money supply and exchange rates was now dictated by black market players instead of monetary authority.

4.2. Multicollinearity of Variables

The study discovered that there was no multicollinearity among the variables used in the model as none of them had measures from 0.80 or 80% upwards. All the

variables had collinearity measures below 0.80 which implied absence of multicollinearity among the model input variables. In other words the variables used to explain growth rate in Zimbabwe's inflation rate that is exchange rates, fiscal deficit and were independent of each other. Hence the financial variables analysed satisfied the independence assumption required under multiple linear regression models.

4.3. Unit root Tests

The study discovered that all variables of the model, namely inflation rates, exchange rates, fiscal deficit and M3 achieved stationarity conditions after the first difference integration that is they were all stationary in level I (0) under ADF test. Hence the satisfaction of the above unit root tests by all input variables made the use of MLRM possible in analyzing the impact of exchange rates, fiscal deficit and M3 on Zimbabwe's IR growth over the period under consideration. Unit root tests of variables of models satisfying the theoretical conditions above were also critical in order to avoid coming up with inconsistent and invalid results from the applied MLRM. Table 3 below depicts the unit root test.

Table 3. Unit Root Test and Multicollinearity Measures

	Exchange Rates	Fiscal deficit	Inflation	M3
Exchange Rates	1.000000	-0.141744	-0.016855	-0.091244
Fiscal deficit	-0.141744	1.000000	-0.123887	-0.085346
Inflation	-0.016855	-0.123887	1.000000	0.031625
M3	-0.091244	-0.085346	0.031625	1.000000

4.4. Results From the Multiple Linear Regression Model (MLRM)

The findings of the MLRM connecting IR to ER, FD and M3 are given by: $IR (\%) = 1\,327.2 - 0.00017ER - 89.5FD + 0.233M3$. By comparison the study discovered that IR was inversely related to ER and FD but positively sensitive to M3 in terms of percentage changes over the period under investigation. It was also realized that autonomous growth rate in Zimbabwe's inflation rate was 1 327.5% between 1980 and 2019, and this was attributable to variances attained in 2006 to 2008 which surpassed any levels that the world had ever realized. Secondly, the two variables, ER and FD had an inverse relationship with the dependent variable and contributed 0.0002% and 89.5% respectively to the country's inflation rates in the period under review. A 100% increase in M3 money supply brought about 23.3% increase in the growth rate of Zimbabwe's inflation rate. According to the findings of the study, inflation rate was directly related to the M3 variable and inversely related to ER and FD. For comparability purposes the study proceeded to regress the financial data drawn from IMF for the period 2004 to 2019 on impact of M3 on inflation rate, and

came up with a specific simple linear regression model of the form, $IR = 21.34 + 0.068M3$. The autonomous component of inflation rate fell from 4 digits to two and the sensitivity measure fell by almost by 3.5 times from 23.3% to 6.8%. The major finding, however, was that both sets of data gave a consistent result that M3 in Zimbabwe had a positive relationship with inflation rate, though variances in estimates could also be investigated separately. The study findings are in line with those by Simwaka et al. (2012), Olorunfemi & Adeleke (2013), Odiba, Apeh & Daniel (2013), Kiganda (2014), Zhang (2014), Bozkurt (2014), Koyuncu (2014), Obi & Uzodigwe (2015), Ofori, Danquah & Zhang (2017) among others. Table 4 below provides a summary of the findings of the multiple linear regression model.

Table 4. Multiple Linear Regression Model Connecting Inflation to Fiscal Deficit, Exchange Rate and M3 Variables

Dependent Variable: Inflation				
Method: Least Squares				
Date: 02/24/20 Time: 11:45				
Sample (adjusted): 1980 2018				
Included observations: 39 after adjustments				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1327.198	1134.123	1.170242	0.2498
Fiscal deficit	-89.48978	119.8192	-0.446874	0.0601
Exchange Rates	-0.000165	0.000847	-0.195299	0.0463
M3	0.233131	2.222145	0.104912	0.0170
R-squared	0.24866	Mean dependent var		702.3963
Adjusted R-squared	-0.93403	S.D. dependent var		3901.065
S.E. of regression	4030.392	Akaike info criterion		19.53803
Sum squared resid	5.69E+08	Schwarz criterion		19.70865
Log likelihood	-376.9916	Hannan-Quinn criter.		19.59925
F-statistic	0.200144	Durbin-Watson stat		1.955883
Prob(F-statistic)	0.795577			

5. Conclusions and Recommendations

Based on the above findings translated into the MLRM above, the study concluded that Zimbabwe's inflation rate was inversely related to ER, FD and directly related to M3. By comparison the impact of ER and FD, it was concluded that the country's IR was more inversely sensitive to FD. On the other hand the study concluded that the two financial variables, namely IR and M3 had a positive relationship in the period reviewed. The study concluded that IR had a weak negative correlation with ER and FD, and a weak positive relationship with M3. However when the coefficient of determination was estimated each of the independent variables was found to explain below 25% of the variability in Zimbabwe's inflation rate and all else was accounted for through variables captured in the error term. Although both ER and FD had negative impact on inflation rate ER contributed more to negative effect than that caused by FD. A 1% increase in Zimbabwe's growth rate in inflation rate was caused by 89.5% and 0.0002% fall in ER and FD together with a 0.233% rise in M3 growth. According to financial theory growth rate in inflation rate should be directly related to M3 according to the definition of inflation.

A comparison of the two sets of results for the period 2004-19 concluded that findings from IMF data were more consistent with financial theory at hand that M3 and FD had a positive relationship with inflation rate. However autonomous inflation rates for the two sets of data were positively related to IR though that of IMF data was 85 times lower than that drawn from Zimbabwean data for the same period. It was also concluded that M3's contribution to IR was direct for IMF data and inverse for Zimbabwean data. Under IMF data, an adjustment of M3 by 100% increased IR by 6.8% and decreased that for Zimbabwean data by 54%. M3 variable had very weak positive and negative correlations with growth rate in inflation rate based on financial data drawn from IMF and Zimbabwe respectively. The coefficients of determination for the IMF and Zimbabwean data respectively explained 0.9% and 1.44% of the variability in growth rate in Zimbabwe's inflation rates.

The study recommended that more thorough research studies should be carried out in order to come up with the practical variables that drove the unprecedented growth rate in the Zimbabwe's inflation rate. The Reserve Bank of Zimbabwe should be accorded the independence, rationality and genuine financial roles to assume its role as lender of last resort. The Bank should rise above sovereign and political influences if the economy is to attain stability in regulation, supervision and capitalization so as to attract the much needed foreign currency for financing the Stock Exchange and development process of the country. It was also recommended that the government, through monetary authorities should stop politicizing the financial sector if were to assume its autonomous or independent function of availing capital resources to creditworthy investors in both the public and private sectors. It is important to note that only independent and autonomous central banks are able to be efficient in

allocation, information dissemination, distribution and production in the desire to direct the economy towards self-reliance and sustainable development.

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