Modelling the Zimbabwe Inflation and Economic Development for Policy Reform

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Abstract

This study sought to determine the implication of inflation on economic growth in Zimbabwe. The time series yearly data for inflation and economic growth from 1990 to 2017 were used for the study. A Full Modified Ordinary Least Squares (FMOLS) was used to determine the relationship between the variables. Some Stationarity and Cointegration tests were carried out. Data became stationarity after first and second differencing using Augmented Dickey Fuller Test. There was also evidence of cointegration between the two variables using the Johansen Cointegration Test. The results of the study established no relationship between inflation and economic growth for Zimbabwe. These results have important policy implications, implying that controlling inflation is a necessary but not a pre-condition for promoting economic growth in Zimbabwe. Thus, the Zimbabwean government should focus on maintaining inflation at a low rate (single digit). In this regard the study concluded that all factors which cause an increase in the general price levels such as energy (petrol, diesel, gasoline, paraffin), exchange rates volatility, increase in money supply, poor agricultural production and others, should be kept on check, with the appropriate policies to foster economic growth.

Key words: Full Modified Ordinary Least Squares; Inflation, Economic Growth

Introduction

Attaining sustainable economic growth, coupled with price stability, continues to be the central objective of macroeconomic policies for most countries in the world today. In fact, for the achievement of the targets of economic and social development, the government of Zimbabwe faces several challenges. The scenario is made complicated by an unstable socio-politic background, and an increasingly globalized international economic environment that give meaning and a great amount of exposure to external shocks. Inflation, often perceived by many economists as an enemy of society, due to its field of activity of increasing pricing of goods and services, is one of the macro-economic indicators affecting the country. This paper examined empirically the relationship between inflation and economic growth (GDP) in Zimbabwe.

Background of the problem to the study

For many years, the subject that has preoccupied the government of Zimbabwe is how to achieve economic growth and inflation rate reduction at the same time. Inflation is defined as the increase in the level of prices and economic growth, usually referred to as the gross domestic product (GDP), measuring the market values of a country's final goods in a specified period, with economic growth being defined as the total output of goods and service of a country (Ahmed, 2010). An increase in inflation means that prices would have risen. Thus, with an increase in inflation, there tends to be a decline in the purchasing power of money, which reduces consumption. This, therefore, would result

in the GDP decrease. In fact, high inflation makes investments less desirable, since it creates uncertainty for the future and also affect the balance of payments as exports become less competitive. As a result, GDP decreases. It, therefore, appears that GDP is negatively related to inflation. However, there are studies indicating that there may also be a positive relationship. The Phillips curve, for example, shows that high inflation is consistent with low rates of unemployment, implying that there is a positive impact on economic growth (Chimobi, 2010).

Zimbabwe is one of the African economies that has experienced hyperinflation, with the highest rate of 156.9 % recorded in 2008, against a Gross Domestic Product of 4.4% (IMF, 2009). This disposition is reminiscent of the high inflation which the economy experienced from 2000 to 2008 and this constrained much of the industrial production capacity in the country. Most of the commodities in the market have been export products mainly from South Africa which would normally have higher prices than the prices in Zimbabwe. The Zimbabwean dollar continued to be under severe pressure on both the official and parallel market exacerbating the inflation rate in the period 2006 to 2008 (Makuyana, Munongo & Zivanomoyo, 2011). Zimbabwe recorded high levels of inflation, with 113.5% in 2004, followed by 32.9%, 72%, and 156.9% during the period 2006 to 2008 (IMF, 2009). On the other hand, the country's GDP stood at 6.1% in 2004 followed by 5.6%, 5.4% and 4.4% during the period extending from 2006 to 2008 (IMF, 2009). Policy makers came up with different market policies that sought to stabilise the price of goods and services. From 2009 to 2017, the country recorded an average inflation of 2.8% against an average GDP of 3.5%, acceptable by all standards (Economic Outlook, 2018). This study is a contribution to the growing literature aimed at understanding the impact of inflation on economic growth using Zimbabwe data with a more extended and updated period of study 1990 to 2017.

Statement of the problem

Although the causes of inflation in Zimbabwe date back from pre-colonial era, they were so severe during the period extending from 2004 to 2009 (IMF, 2009). Some other macro-economic indicators such as unemployment, soared to unacceptable high levels. As if not enough, the introduction of multicurrency in 2009, brought along with some challenges which companies failed to cope with. This manifested in the general rise in the price of goods and services, thereby affecting the general welfare of economy's citizens. This study, therefore, sought to determine empirically the relationship between inflation and economic growth for Zimbabwe, for the purposes of coming up with informed policy recommendations that would propel the economy in the face of inflation.

Review of related literature

A survey of literature investigated theoretical and empirical aspects of the relationship between inflation and economic growth. This section presented literature on the impact of inflation on economic growth. Fischer (1993) showed that inflation and growth are negatively related. More specifically, he argues that growth, investments and productivity are negatively related to inflation and that capital accumulation and productivity growth are also negatively affected by budget deficits. Moreover, he states that some exceptional cases show that even though high growth is not necessarily associated with low inflation and small budget deficits, high rates of inflation are not consistent with permanent growth.

Barro (1995) examined data for almost 100 countries for the period between 1960 and 1990 and found that the impact of inflation on growth and investment is significantly negative, given that a number of countries characteristics are constant. An average increase in inflation of ten per cent leads to a

decrease of GDP and investment by 0.2 to 0.3 and 0.4 to 0.6 respectively. He also showed that even if inflation has a small impact on growth, this appears to be significant in the long run.

Bruno and Easterly (1996) examined the relationship between inflation and economic growth and they found that this relationship existed where there were high inflation rates. They set a threshold of 40 per cent to determine the high rates of inflation. Above this threshold, inflation has a temporally negative impact on growth, whereas below this threshold, they found no robust relationship. The decrease in growth is temporary because after a high inflation crisis, the economy quickly recovers to its previous level. During this recovery, the economy can regain most, if not all of the loss of the economy's output. Their results are robust after controlling for other factors such as external shocks.

Ghosh and Phillips (1998) studied the relationship between inflation and GDP for a large set of IMF countries for the period from 1960 to 1996. They found that, generally, the coefficient, with respect to inflation, was negative. The findings were statistically significant. More specifically, they found two nonlinearities in the inflation-growth relationship. The relationship between these appeared to be negative for very low inflation rates (around 2 to 3%). They also found a negative correlation for higher values, but the relationship was convex, meaning that a decline in growth related to an increase of inflation from 10 to 20% larger than that related to an increase in inflation of from 40 to 50%.

Quartey (2010), using the Johansen co-integration methodology, investigated whether the revenue maximising rate of inflation was growth maximising in Ghana. He found that there was a negative impact of inflation on economy growth. Furthermore, the study found a revenue maximising rate of inflation at 9.14% over the period 1970-2006 using the Laffer curve. He further established that the rate of inflation that is growth maximising is not a single digit one.

Hasanov (2010) employed annual data set on growth rate of real GDP, Consumer Price Index Inflation and growth rate of real Gross Fixed Capital Formation to investigate whether there was any threshold effect of inflation on economic growth over the period of 2001-2009. An estimated threshold model indicated that there was non-linear relationship between inflation and economic growth in the Azerbaijani economy and threshold level of inflation for GDP growth was 13%. An inflation rate lower than 13% reflected statistically significant positive effect on GDP growth but this positive relationship became negative when inflation exceeded 13%. He added that, economic growth was expected to decline by about 3% when inflation increased above the 13% threshold.

Umaru and Zubairu (2012) suggested that all the variables in the unit root model were stationary, and the results of causality revealed that GDP caused inflation and not inflation causing GDP. The results revealed that inflation had a positive impact on economic growth through encouraging productivity and output level and on evolution of total factor productivity. Frimpong and Oteng-Abayie (2010) found a threshold effect of inflation on economic growth of 11% for Ghana over the period 1960-2008 though failing the test of significance at that level. They also estimated a robust 11% threshold inflation level with close coefficients after dropping growth rate of aggregate labour force and money supply growth which were found to be insignificant in the OLS models. They further revealed that even at relatively lower threshold levels, inflation was still significant. But their study however, failed to check for sensitivity of the estimated coefficients across sub-samples of the full sample period to establish new evidence of the threshold effect. The study thus concluded by highlighting the need to extend the context of analysis to deal with lower threshold levels in search of that evidence.

Kremer, and Nautz (2009) empirically expanded the scope of Khan and Senhadji (2001) by modelling a large panel-dataset of 124 industrialized and developing countries over the period from 1950 to 2004. Using a dynamic panel threshold model to shed light on the impact of inflation on economic growth,

they found an inflation target of about 2% for industrialized countries and 17% for developing economies. Below the 17% threshold, the impact of inflation on economic growth remained insignificant, thus failing to support the growth-enhancing effects of inflation on economic growth in non-industrialized economies. Nell (2000) examined if inflation was detrimental to economic growth or not by using Vector Auto Regressive (VAR) technique. Data for the period from 1960-1999 was used and the empirical results suggested that inflation within the single-digit zone may be beneficial to economic growth, while inflation in the double-digit zone tends to limit economic growth.

Sergii (2009) found that growth-inflation interaction was strictly concave with some threshold level of inflation. Inflation threshold level is estimated using a non-linear least squares technique, and inference made by applying a bootstrap approach. The main findings were that inflation rate above 8% tended to slow down economic growth while inflation below 8% promoted economic growth. Espinoza, Leon and Prasad (2010) examined threshold effect of inflation on economic growth by using a panel data of 165 countries including Oil Exporting Countries and Azerbaijan over the period of 1960-2007. Their study found that for a country groups' threshold level of inflation for economic growth was about 10% (with the exclusion of industrialized countries where threshold level was much lower). Estimated results suggested that inflation from higher than 13% decreases real non-oil GDP by 207% per year.

Lastly, a review of literature was undertaken on money supply and exchange rate influence on economic growth and inflation. Mehari and Wondafrash, (2008) revealed that money supply had a direct impact on inflation. Mwase (2006) indicated that currency appreciation is associated with a decrease in inflation rate, with one quarter lag. The impact of inflation on economic growth is, therefore, not a universal phenomenon which can be adopted in any country; thus, it is still a moot point in countries where the two variables were not empirically tested. Therefore, this study undertakes this study in the Zimbabwe Context, so that the two macro-economic variables can be examined for informed policies.

Research methodology

This section explored econometric methodology applied in the study to establish the impact of inflation on economic growth in Zimbabwe. The study employs secondary annual time series data set to examine the relationship between inflation and economic growth in Zimbabwe from 1990 to 2017. In this study, we used the fully modified ordinary least squares (FMOLS) to estimate the equation. The estimation of the equation was such that a unit root test was undertaken to determine the order of integration of the variables and that would be done using the Augmented Dickey Fuller (ADF) test. Given that all the variables are integrated from different orders, the second step was cointegration analysis which is applied for the estimation and determination of long-run equilibrium relationship among the variables and to check the integration of linear combination through the Johansen cointegration technique. The FMOLS was considered after lag length determination tests were undertaken. Lastly, the stability test was done to find out the extent of model specification. The theoretical basis of the model was a linear relationship between economic growth (GDP) as the dependent variable and the explanatory variables which include Inflation (INFLAT), unemployment (UNEMP), capital investment (CAPINVEST), government spending (GVSPE) and (TOT) terms of trade.

GDPCP = F(INFLAT, UNEMP, CAPINVEST, GVSPE, TOT) (1)

Where,

GDP-is gross domestic product INFLAT-is Inflation Rate.
UNEMP-is Unemployment Rate.

CAPINVEST- is Capital Investment; TOT-is Terms of Trade.
GVTSPE-is the Government Spending.

Logarithms of the variables were undertaken because most of the economic time series data are non-stationary.

$$GDP_t = a^0 + a^1 INFLAT_t + a^2 UNEMP_t + a^3 CAPINVEST_t + a^4 GVSPE_t + a^5 TOT_t + U_t \quad (2)$$

The expected signs from the regression equation to be estimated are as follows:
$a^1 < 0$; $a^2 < 0$; $a^3 > 0$; $a^4 > 0$; $a^5 > 0$

Results and discussion

This section focuses on the empirical estimation, presentation and economic interpretation of the regression results carried out using the methodology highlighted in the previous section.

- **Descriptive Tests**

Table 1. Jacque-Bera Normality Test

	CAPINVEST	GDP	GVTSPE	INFLAT	TOT	UNEMP
Mean	13.79864	1.208214	17.72250	3.200000	99.92536	5.457143
Median	14.44000	1.565000	17.92000	-0.600000	98.15500	5.400000
Maximum	23.73000	15.45000	24.90000	157.0000	110.3100	6.900000
Std. Dev	6.551561	8.425782	6.139732	42.51694	5.496630	0.615497
Skewness	-0.338555	-0.382418	-1.105332	2.145071	0.414851	0.270341
Kurtosis	2.046517	2.917295	3.789235	8.807419	2.734340	2.932562
Jacque-Bera	1.595544	0.690449	6.428245	60.82001	0.885478	0.346367
Probability	0.450331	0.708061	0.040191	0.000000	0.642275	0.840983
Observations	28	28	28	28	28	28

Table 1 shows descriptive statistics of the dependent and explanatory variables used in the study for the period 1990 to2017. Maximum and minimum statistics rule out the possibility of outliers in the data used. Classical linear regression required that the residuals be normally distributed and judging by the probability values of the Jarque-Bera, fourvariables except for GVTSPE and INFLAT residuals do not follow a normal distributed therefore, the test for correlation among the variables can be conducted.

- **Correlation Test**

Table 2. Pearson Correlation Matrix

	CAPINVEST	GDP	GVTSPE	INFLAT	TOT	UNEMP
CAPINVEST	1.000000	0.586886	0.325385	-0.221040	0.339253	0.477344
GDP	0.586886	1.000000	0.299542	0.291043	0.498662	0.281781
GVTSPE	0.325385	0.299542	1.000000	0.1717625	0.551832	-0.225624
INFLAT	-0.221040	-0.291043	0.1717625	1.000000	-0.211606	-0.263218
TOT	0.339253	0.498662	0.551832	-0.211606	1.000000	-0.044738
UNEMP	0.477344	0.281781	-0.225624	-0.263218	-0.044738	1.000000

In this study there was weak multi-collinearity among variablesas reflected by the coefficient of less than 0.8. The correlation tests show a negative relationship between the two macro-economic variables under study namely GDP and inflation.

- **Stationarity Tests**

The stationarity or unit root test of the data used in this study were conducted using Augmented Dickey Fuller Test and the results are shown below.

Table 3. Augmented Dickey Fuller (ADF) Test Results after differencing

Variable	t-ADF Statistic	Critical 1%	Critical 5%	Critical 10%	Conclusion
CAPINVEST	-4.324251	-3.711457*	-3.981038	-2.629906**	I(2)
GDP	-3.204882	-3.699871*	-2.976263	-2.627420**	I(0)
GVTSPE	-4.945784	-3.711457*	-2.981038	-2.629906**	I(2)
INFLAT	-7.196901	-3.699871	-2.976263	-2.627420**	I(0)
TOT	-7.034203	-3.724070	-2.986225	-2.632604**	I(2)
UNEMP	-3.204241	-3.669871*	-2.976263	-2.627420**	I(0)

**, ** indicate significance at 1% and 10% respectively*

The results from the ADF test became stationary after differencing. GDP, inflation and unemployment became stationary at levels. Before conducting a cointegration test, the statistical properties of the model were assessed. The next stage involves testing for the existence of cointegration relationship among the variables.

- **Cointegration Test**

Table 4. Johansen Technique Results (Trace)

Hypothesize No. of CEs	Eigenvalue	Trace Statistic	5% Critical Value	Prob.**
None*	0.748448	100.5170	95.75366	0.0226
At most 1	0.646170	64.63424	69.81889	0.1209
At most 2	0.551474	37.62182	47.85613	0.3188
At most 3	0.297990	16.77532	29.79707	0.6566
At most 4	0.226643	7.576310	15.49471	0.5118
At most 5	0.033798	0.893929	3.841466	0.3444

**Denotes rejection of the hypothesis at the 5% significance level.*

Using the Johansen cointegration, there was evidence of cointegration between GDP and its explanatory variables. With these results, the study proceeded to estimate the OLS equation. The results are shown in table 5 below.

- **Lag Length Criteria**

Table 5. VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-41.64346	NA	0.000246	3.042897	3.229724	3.102665
1	20.14025	102.9729*	1.18e-05*	-0.009350*	0.924781*	0.289487*
2	35.26005	21.16771	1.33e-05	0.049330	1.730767	0.587236
3	43.70920	9.575703	2.61e-05	0.552720	2.981462	1.329696

** Indicates lag order selected by the criterion*

The VAR lag length criteria result in Table 5 showed that the maximum lag length selected by all the information criteria depicts optimal lag length of one (1). Therefore, lag length one (1)

as informed by the Akaike Information Criterion (AIC) was used for the purpose of our estimation.

- **Fully Modified Ordinary Least Squares Estimation (FMOLS)**

Table 6. Fully Modified Ordinary Least Squares (FMOLS) Results.
Dependent Variable: GDP

Variable	Co-Efficient	Std. Error	t-Statistic	Prob
LInflat	-0.012502	0.039778	-0.314289	0.0728
LCapInvest	0.543996	0.274881	1.979022	0.0611
LGvtExp	-0.107687	0.306219	-0.535291	0.7286
LToT	0.595069	0.316538	-1.624236	0.0741
LUnemp	-0.839845	2.907191	1.381263	0.7755
C	-67.72614	33.70253	0.824444	0.0575

**R-Squared= 0.470871; Adjusted R-Squared= 0.319691;F-Statistic= 3.114643; Durbin Watson Statistic (DW) = 1.514931; Mean dependent var = 1.119436; S.D. dependent var = 0.714057; Sum squared resid= 5.039168; Long-run variance= 0.265939*

A Fully Modified Ordinary Least Squares (FMOLS) estimation results presented in Table 6 provide crucial insights into the relationship between inflation and economic growth. The estimated results exhibit the coefficient values of the explanatory variables as well as indicating through the probability value whether each respective variable is significant. According to the estimated model above, the relationship between economic growth (GDP) and inflation (INFLAT) exhibits a negative co- efficient of 0.012502, against a P-value of 0.0728. This suggested that a unit increase in inflation would result in 0.01 decrease in economic growth, hence a statistically insignificant P-value. The value of the adjusted R-squared was 47%, suggesting that 47% variation in gross domestic product is explained by the variation in the independent variables. The DW of 1.51 meant that there was no serial correlation in the variables. Stability tests were carried out to test for serial-correlation, heteroscedasticity, normality and specification. This was done in order to determine if the model was well specified. The results are presented in Table 7 below.

- **Stability Tests**

Table 7. Stability Tests

F. Statistic		Probability
Specification Error: Ramsey Reset Test	3.114643	0.024190
Serial Correlation: Breusch-Godfrey Serial Correlation LM Test	0.278333	0.955163
AR Conditional Heteroscedasticity (ARCH): Breusch -Pagan-Godfrey	0.200163	0.958978
Normality: Jacque-Bera	0.163005	0.921730

The diagnostic tests carried out show that the model is reasonably well specified and that the residuals are homoscedastic and serially uncorrelated, given that all the p-values were greater than 0.05%, as shown in table 7 above

Conclusion and recommendations

This study found that an increase in the general price level (inflation) had an insignificant impact on economic growth in Zimbabwe. These results have important policy implications for both domestic policy makers and development partners, implying that controlling inflation

is a necessary but not a pre-condition for promoting economic growth in Zimbabwe. Thus, as a standing policy, the Zimbabwean government should focus on:

- Maintaining inflation at a low rate (single digit). In this regard the study concluded that all factors which cause an increase in the general price levels such as energy (petrol, diesel, gasoline, paraffin), exchange rates volatility, increase in money supply, poor agricultural production and so forth should be kept on check, with the appropriate policies so as to foster economic growth.
- Since the double-digit inflation rate in Zimbabwe was mainly due to energy crisis and poor agricultural produce, the government should use other sources of power such as solar and gas as an alternative to hydroelectricity. Constant availability of power is of great important for production since the more the country produces the less the prices of goods and services hence higher economic growth.
- Increasing agricultural produce by improving infrastructure, provision of labour force, training to farmers as well as strategies like loan provision schemes with affordable interest rates, and establishment of permanent markets for products characterised by competitive prices.

In conclusion, the elasticity coefficient of GDP to inflation rate was rather inelastic in Zimbabwe. This could imply that even if there were other factors which influenced economic growth such as positive terms of trade, capital investment and capital expenditure, inflation remain a significant macro-economic variable required constant check to Zimbabwe policy makers. Policy makers should strive to keep the inflation rate at a possible minimum rate to attain and sustain high economic growth (GDP).

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