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An Econometric Assessment of the Impact of Inflation on Economic Growth: A Case Study of Zimbabwe Economy

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Abstract: This study sought to determine the impact of inflation on Economic growth in Zimbabwe. The time series yearly data for Inflation and Economic Growth (GDP) from 1990 to 2017 were used for the study. Ordinary Least Squares (OLS) was used to determine the impact of inflation on Economic growth. 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 Gross Domestic Product in 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 so forth, should be kept on check, with the appropriate policies so as to foster economic growth.

Keywords: Inflation, Economic Growth, Terms of Trade, Cointegration and Stationarity

1. 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 has to face a lot of challenges. As the scenario is made complicated by unstable socio-political background internally, an increasingly globalize international economic environment, giving a meaning of greater amount of exposure to external shocks. Inflation, which is often perceived by many economists as 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 examines empirically the relationship between inflation and economic growth (GDP) in Zimbabwe.

2. Background of the Problem to the Study

For many years, the subject that has preoccupied the government of Zimbabwe is the economic growth and inflation rate reduction. 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 [1]. An increase in inflation means that prices would have beenrisen. Thus, with an increase in inflation, there tend 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 further. 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 [2].

Zimbabwe is one of the African economy that has experienced hyperinflation, with the highest rate of 156.9 % recorded in 2008 [3], against a Gross Domestic Product of 4.4 [3]. 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. Also, the Zimbabwean dollar in the period 2006 to 2008 continued to be under severe pressure on both the official and parallel market exacerbating the inflation rate [4].

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 [3]. 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 [3]. Policy makers came up with different market policies that sought to stabilise prices of goods and services. From 2009 to 2017, the country recorded an inflation average of 2.8% against an average GDP of 3.5%, acceptable by all standards [5]. 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.

3. Problem Statement

Although the causes of inflation in Zimbabwe dates back from pre-colonial era, they were so severe during the period extending from 2004 to 2009 [3]. 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. This, henceforth, manifested in the general rise in the price of goods and services, thereby affecting the general welfare of economy's citizens. This study, therefore, seeks to determine empirically the impact of inflation on economic growth for the Zimbabwe economy.

4. Research Objectives and Hypothesis

The objective of this study is to determine the impact of inflation on economic growth for the Zimbabwe economy. It also seeks to make recommendations that would assist policy makers in managing inflation at the same time growing the economy. The hypothesis that pinned this study is that inflation is negatively related to economic growth.

5. Review of Related Literature

There is a huge survey of literature, which investigated theoretical and empirical aspects of relationship between inflation and economic growth. This section presents literature on the impact of inflation on economic growth. Fischer [6], 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 [7] 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 [8] examined the relationship between inflation and economic growth and they found that this relationship exists only if there are high inflation rates. To determine the high rates of inflation, they set a threshold of 40 per cent. 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 [9] 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 two to three per cent). 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 percent larger than that related to an increase in inflation of from 40 to 50 percent.

Quartey [10] using the Johansen co-integration methodology, investigated whether the revenue maximising rate of inflation is growth maximising in Ghana. He found that there is a negative impact of inflation on economy growth. Furthermore, the study found a revenue maximising rate of inflation at 9.14 percent 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 [11] 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. 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 percent. Inflation rate lower than 13 percent reflected statistically significant positive effect on GDP growth but this positive relationship became negative when inflation exceeded 13 percent. He added that, economic growth was expected to decline by about 3 percent when inflation increased above the 13 percent threshold.

Umaru and Zubairu, [12] 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 also revealed that inflation possessed a positive impact on economic growth through encouraging productivity and output level and on evolution of total factor productivity. Frimpong and Oteng-Abayie, [13] found a threshold effect of inflation on economic growth of 11 percent for Ghana over the period 1960-2008 though failing the test of significance at that level. They also estimated a robust 11 percent 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 is 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 a 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.

On the other hand, Bick, Kremer, and Nautz [14] empirically expanded the scope of Khan and Senhadji, [15] 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 percent for industrialized countries and 17 percent for developing economies. Below the 17 percent 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, [16] examined the issue 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 his 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, [17] 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 percent tend to slow down economic growth while below 8 percent promotes economic growth. Espinoza, Leon and Prasad, [18], 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 all country groups' threshold level of inflation for economic growth was about 10 percent (with the exclusion of industrialized countries where threshold level was much lower). Estimated results suggested that inflation from higher than 13 percent decreases real non-oil GDP by 207 percent per year.

Lastly, review of literature on money supply and exchange rate influence on economic growth and inflation. Mehari and Wondafrash, [19] revealed that money supply had a direct impact on inflation. Mwase, [20] 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.

6. Materials and Method

This section explores 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 use ordinary least squares (OLS) to estimate the equation. The estimation of the equation was such that unit root test is 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 of different orders, the second step is 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. Lastly, the OLS is considered after normality tests using the Jacque-Bera Test.

The theoretical basis of the model is 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 is then undertaken because most of the economic time series data are non-stationary.

$$GDP_t = a_0 + a_1 INFLAT_t + a_2 UNEMP_t + a_3 CAPINVEST_t + a_4 GVSPE_t + a_5 TOT + U_t \qquad (2)$$

The expected signs from the regression equation to be estimated are as follows:
1. a1<0; a2< 0; a3 > 0;a4 > 0; a5 >0

7. Data Analysis and Interpretation of Results

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.

Preliminary Tests

Table 1. *Descriptive Statistics.*

	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 dependant and explanatory variables used in the study for the period 1990 to 2017. Maximum and minimum statistics rule out the possibility of outliers in the data used. Classical linear regression requires that the residuals be normally distributed and judging by the probability values of the Jarque-Bera, four variables 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. *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 is weak multi-collinearity among variables as 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	Critical1%	Critical5%	Critical10%	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 unemploymentbecame stationary at levels.Before conducting cointegration test, the statistical properties of the model were assessed. Diagnostic tests were carried out to test for serial-correlation, heteroscedasticity, normality and specification. The results are presented in Table 4 below:

Table 4. *Diagnostic 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

As shown in table 4 above, the diagnostic tests carried out show that the model is reasonably well specified and that the residuals are homoscedastic and serially uncorrelated. The next stage involves testing for the existence of cointegration relationship among the variables.

Cointegration Test

Table 5. *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 is 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 6 below.

Ordinary Least Squares Estimation

Table 6. *Ordinary Least Squares (OLS) Results.*

Dependent Variable: GDP

Variable	Co-Efficient	Std. Error	t-Statistic	Prob
Inflat	-0.012502	0.039778	-0.314289	0.0728
CapInvest	0.543996	0.274881	1.979022	0.0611
GvtExp	-0.107687	0.306219	-0.535291	0.7286
ToT	0.595069	0.316538	-1.624236	0.0741
Unemp	-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

Table 6 shows the estimated results exhibiting 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 suggests 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 is 47%, suggesting that 47% variation in gross domestic product is explained by the variation in the independent variables. The DW of 1.51 means that there is no serial correlation in the variables.

8. Conclusion

This study found out that an increase in the general price level (inflation) has 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.

9. Policy Recommendations

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 gas as an alternative to hydro-electricity.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. Similarly, agricultural produce may be increased 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 their products should be undertaken. The elasticity coefficient of GDP to inflation rate is rather inelastic in Zimbabwe. To policy makers, this could imply that even if there are other factors which influence economic growth such as positive

terms of trade, capital investment and capital expenditure, inflation remain a significant macro-economic variable requires constant check. Thus, to attain and sustain high economic growth (GDP) policy makers in Zimbabwe should strive to keep inflation rate at a possible minimum rate.

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