OPTIMAL INFLATION FOR ZIMBABWE

BY

N. Masiyandima[1], T. Ngundu[2], K. Kupeta[3], P. S. Moyo[4] and S. Ngwenya[5]

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[1] Principal Economist, Economic Research
[2] Senior Economist, Economic Research
[3] Senior Economist, Economic Research
[4] Senior Economist, Economic Research
[5] Economist, Economic Research

ABSTRACT

This paper examines the inflation and economic growth nexus in Zimbabwe. Specifically, the study attempts to estimate a threshold level of inflation above which inflation is inimical to growth. The paper estimated threshold inflation for Zimbabwe during the stable period when Zimbabwe had its own currency, that is 1980 to 1997 and multicurrency system period, 2009 to 2017. The results suggest the threshold level of inflation of 8.7% for the period 1980 to 1997. As expected the optimal level of inflation falls to 4.6% for the multicurrency system period, 2009 to 2017. In a multicurrency system, the country's inflation should be in line with anchor countries in order to avoid overvaluation, which impacts negatively on competitiveness and growth. The results are broadly in line with the SADC macroeconomic convergence framework inflation targets of 3 to 7 percent. This implies that Authorities should ensure that Zimbabwe's inflation remains within the regional targets to ensure optimization of growth.

Keywords: Inflation, Economic growth, Optimal inflation

JEL Classification: C32, E51, E52, E58

Disclaimer: The views and conclusions expressed in this paper are those of the authors and do not necessarily reflect the official position of the Reserve Bank of Zimbabwe. For more information concerning the paper, please contact the Director, Economic Research, Mr. Simon. Nyarota, email address: snyarota@rbz.co.zw

1. INTRODUCTION

The debate on the relationship between inflation and economic growth gained momentum recently, following the work of Fischer (1993), who found a non-linear negative relationship between inflation and growth. This implies that inflation has a negative effect on growth only when it is above a certain threshold. Ascertaining the threshold level of inflation is important in monetary policy formulation. As a result, recent studies have been pre-occupied in determining the optimal level of inflation for different countries or group of countries.

The empirical results on the threshold level of inflation have, however, been mixed for both developed and developing countries. Most studies suggest a lower threshold for developed countries compared to developing countries (Moshiri and Sepehri, 2004, Khan and Senhadji, 2001 and Schiavo and Vaona, 2007). For developing countries, empirical findings for the threshold level of inflation are mixed. Specifically, Bruno and Easterly (1998) find a threshold of 40%, while Tarawalie et al. (2012) find a threshold of 10% for the West African Monetary Zone (WAMZ). Yabu and Kessy (2015) suggest a threshold of 8.46% for three EAC member states namely Kenya, Tanzania and Uganda. For SADC, Bittencourt et al (2015), without examining the threshold level show that inflation has had a detrimental effect on growth. Based on individual country studies of optimal levels of inflation, Frimpong and Oteng-Abaye (2010) find 11% for Ghana, (Sindano, 2014) suggests 12% for Namibia, and Leshoro (2012) finds 4% for South Africa. Setlhare and Feger (2013) and Phetwe and Molefhe (2016) found 11.4% and 6.9% for Botswana, respectively. Thus, except for Bruno and Easterly (1998), most studies suggest optimal inflation rates of not more than 15% for the SSA countries.

Zimbabwe experienced high inflation levels since 2000, which culminated into hyperinflation in March 2007. Annual inflation peaked at 231 million percent in July 2008. During the high inflation period the country posted huge negative growth rates, which bottomed out at -14.7% in 2008. Resultantly, there is general consensus that very high inflation has distortional effects on economic growth in Zimbabwe. Gokal & Hanif (2004) suggest that high inflation has negative effects on the economy through loss of competitiveness, thus adversely impacting on a country's balance of payments. In addition, high inflation also affects investment decisions as it brings about uncertainty on the future value of investment projects and also erodes the real value of tax revenues.

Zimbabwe experienced an outright reversal of high inflation when it realised deflation for 28 consecutive months from October 2014 to January 2017. Annual inflation reached its lowest level of -3.29% in October 2015. Under a deflationary spiral, falling prices raise the real value of debt, which undermines borrowers' balance sheets. In addition, anticipation of further decreases in prices, results in consumers delaying spending, thus negatively impacting on economic growth. Outright deflation is thus harmful to economic recovery and growth.

Real GDP growth which averaged 10% from 2009 to 2012, fell to 3% in 2014 and declined further to 0.6% in 2016. Zimbabwe's deflation was mainly driven by external factors such as appreciating US dollar, falling international oil and food prices, Nyarota et al. (2016). The negative inflation generated a lot of debate on whether it was good or harmful to the economy. It is likely that negative inflation rate could have imposed opportunity costs in terms of forgone growth since 2014. With seemingly high inflation and huge negative inflation both being detrimental to growth in Zimbabwe, the main question is what level of inflation optimises growth in the country.

To the best of our knowledge there are no studies if any that have focussed on the threshold inflation on growth in Zimbabwe. It is against this background that this paper attempts to empirically examine the optimal level of inflation that maximises growth in Zimbabwe. This paper examines optimal level of inflation for the relative stable period from 1980 to 1997 when Zimbabwe had its own currency and optimal inflation level during the multicurrency period from 2009 to 2017. Assessing the optimal level of inflation is critical for central banks as it guides monetary policy formulation and implementation. The optimal level of inflation has been particularly useful for those countries which are pursuing inflation targeting or are moving towards inflation targeting. It is also important to countries in their endeavour to meet regional macroeconomic convergence targets. SADC macroeconomic convergence targets for annual inflation lies between 3% and 7%, while COMESA target annual inflation below 5%.

The rest of the paper is organized as follows: Section II discusses the stylized facts on the relationship between inflation and GDP growth in Zimbabwe. Section III focuses on a review of literature. The methodology is covered under Section IV. Section V analyses the results. Section VI concludes and discusses policy recommendations.

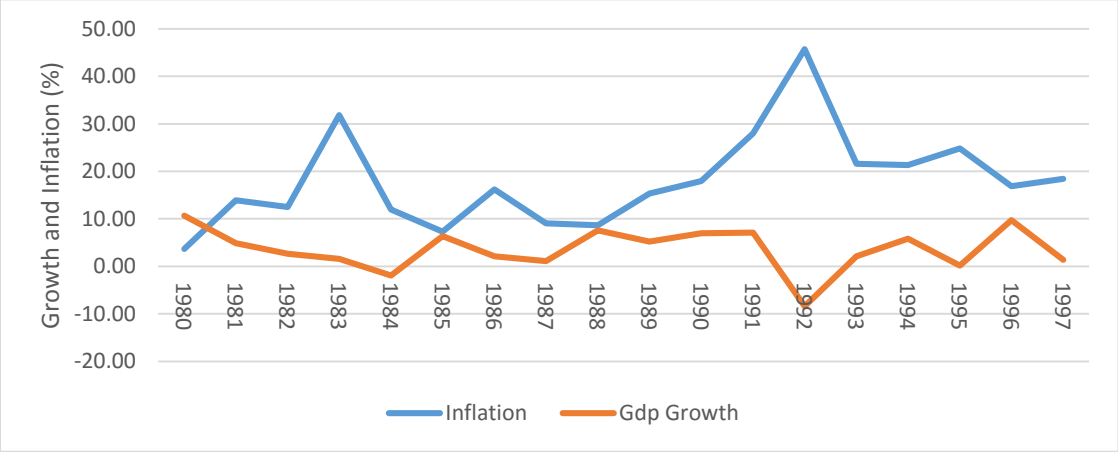
SECTION II: STYLISED FACTS: INFLATION AND ECONOMIC GROWTH RATES IN ZIMBABWE

This section reviews the developments in inflation and economic growth for Zimbabwe for the period from 1980 to 1997, a period of relative stability when the country had its own currency and the multicurrency system period (2009 to 2017).

Period of Relative Price Stability (1980 to 1997)

A historical analysis of inflation in Zimbabwe shows that the country experienced an annual average inflation rate of 18%, like most developing countries that experienced high annual inflation rates in the 1980s and 1990s. As shown in Figure 1, annual inflation rose from 3.6% in 1980 to peak at 31.85% in 1983. The rise in inflation mainly reflected the impact of drought induced food inflation of 1982 and 1983. Annual inflation, however, receded to 7.3% in 1985 and averaged 12% during the period 1985 to 1990.

Figure 1: Annual Economic Growth and Inflation: 1980 to 1997



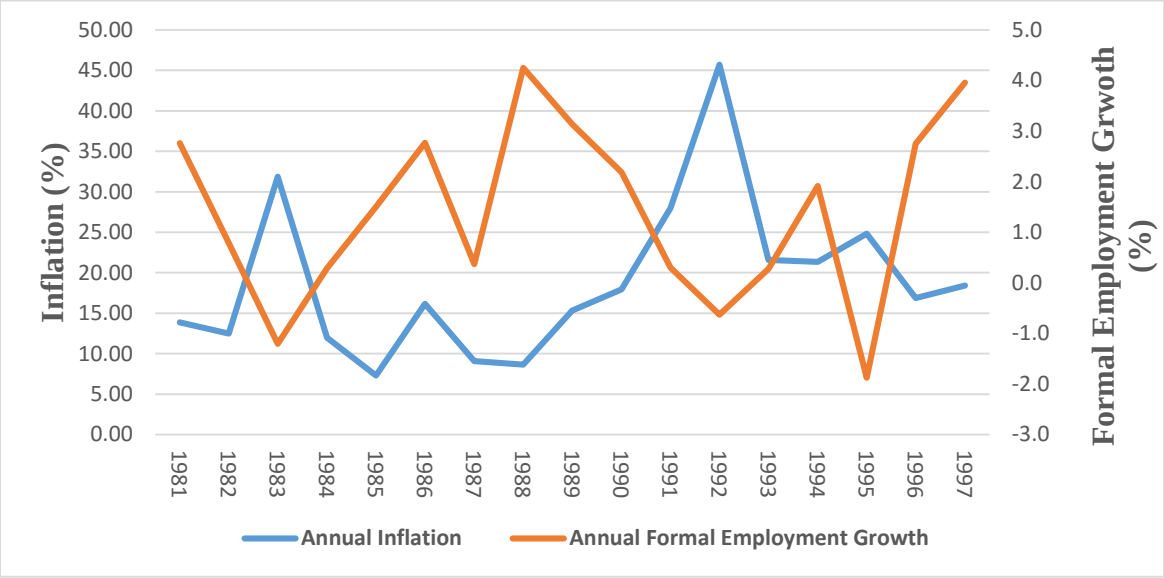
Source: ZIMSTAT

Annual headline inflation rose sharply to 45.72% in 1992, on account of the severe drought during that year. Inflation subsided to average 20%, during the period 1993 to 1997. Figure 1 shows that relatively low periods of inflation were associated with high growth rates. Very high inflation periods such as 1983 and 1992, were associated with low and even negative economic growth rates.

Figure 1 shows that high levels of inflation are associated with lower levels of economic growth. Furthermore, it is clear that when inflation reaches significantly high levels, economic growth tends to be highly negative.

The results are also discernible when looking at the relationship between inflation and growth in formal employment. Figure 2 shows that growth in formal employment tends to be lower when the economy experiences high inflation levels.

Figure 2: Annual Inflation versus Growth in Formal Employment (%)



Sources: ZIMSTAT

Crisis Period (1998 -2008)

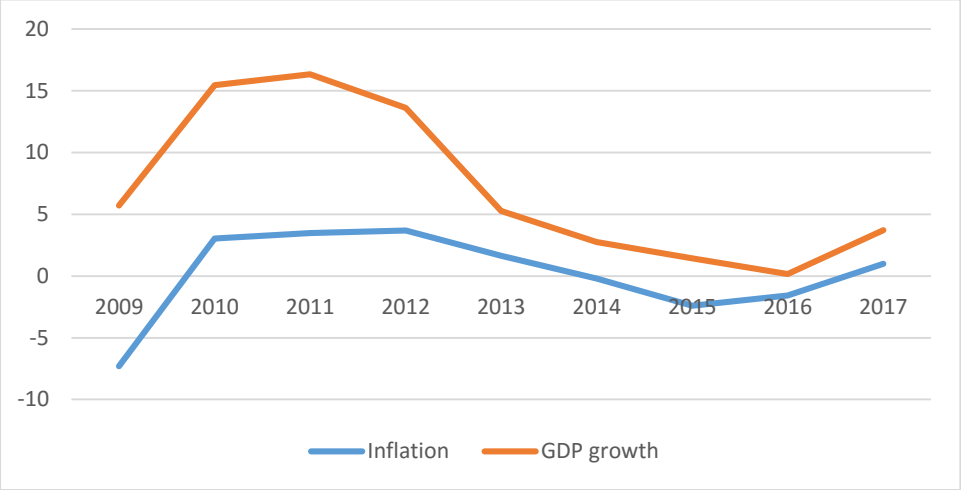
The Zimbabwe economy slipped into an economic crisis in 1998, despite having achieved an all-time high GDP growth rate of 9.2% in 1996. The economic crisis emanated from a combination of entrenched economic structural rigidities which were not successfully addressed during the Economic Structural Adjustment Program and Zimbabwe Program for Economic and Social Transformation. The crisis also reflected inherent inconsistencies in macroeconomic policies, particularly in fiscal issues, thereby, undermining economic performance and investor confidence. Since 1998 when annual inflation went beyond 40%, the economy experienced huge negative growth rates up to 2008. The economy lost on a cumulative 50% of GDP between 1998 and 2008 when the economy suffered high inflation levels of above 50% on an annual basis (ZIMSTAT, 2016).

Multicurrency System Era (2009 to 2017)

This section explores the relationship between inflation and growth during the multicurrency system period from 2009 to 2017, where the US dollar was used mainly as the principal currency. In a multicurrency environment, a country does not have an active monetary policy and its level of inflation tends to be related to US inflation. Zimbabwe uses a basket of currencies but the US dollar emerged as the principal currency. Given that the US inflation is normally targeted at around 2%, Zimbabwe's inflation is expected not to deviate significantly from 2% so that there is no substantial over and undervaluation of the real exchange rate for the country.

Figure 3 shows the relationship between inflation and economic growth during the period from 2009 to 2017.

Figure 3: Annual Inflation Versus Economic Growth: 2009 to 2017



Source: ZIMSTAT, 2017

Figure 3 shows that there may be a threshold level of inflation that may be conducive for growth. As seen above, very low inflation or negative inflation also impacts negatively on growth. Against, this background it is clear that both very high inflation and very low inflation, negatively impact on growth. What is required is a low and stable inflation to support optimal growth in the economy. The question is therefore what level of inflation optimises growth in Zimbabwe. Does the currency regime matter for optimal inflation in the country? Put

differently, do we have different threshold inflation levels for the period when the country had its own currency and for the period under multicurrency regime?

SECTION III: LITERATURE REVIEW

This section focuses on both theoretical and empirical review on the relationship between inflation and economic growth. Given the large body of empirical literature on the optimal level of inflation, the paper reviews few empirical studies that focus on developing countries and the Sub-Saharan Africa (SSA) region.

Theoretical Literature Review

Research studies that attempted to review theoretical literature have focused mainly on anchoring the debate of inflation and growth nexus in the main growth theories (Gillman et al. (2001), Thanh (2015), and Akinsola and Adhiambo (2017). This study gives a brief theoretical review by also focusing on growth theories.

The classical growth theory which has its origins traced to Adam Smith, is anchored on three factors of production, namely land, labour, and capital. The central theme from the classical growth theory is that saving is the most important factor affecting economic growth (Thanh, 2005). As argued by Gokal and Harfi (2004), the relationship between growth and inflation is indirect in the classical set-up. Inflation only affects growth through depressing savings and increasing wage costs, impacting on firm profit level.

According to the Keynesian framework, government intervention is necessary to achieve full employment. The Keynesian long held view is that government can stimulate the economy through expansionary policies. Using an Aggregate demand and Aggregate supply (AD-AS) framework, Keynesians provide for a positive relationship between inflation and output growth in the economy in the short run. There is, however, no permanent trade-off between inflation and growth in the long run. Relatedly, the relationship between growth and inflation is also given by the Phillips curve. The Phillips curve depicts a trade-off between inflation and growth in unemployment rate in the short run. In the long run, expected inflation converges to actual inflation, with no impact on unemployment and output.

Monetarism school attributes inflation to changes in money supply. In this scenario, inflation becomes undesirable if it increases faster than the level of economic growth. Gokal and Hanif (2004) argue that in the long-run there is money neutrality. Money neutrality means that equilibrium values of real variables hold independent of the level of money supply

Under the neo – classical growth model proposed by Solow, (1956) and Swan, (1956) show that economic growth is mainly driven by scientific innovation or technological change. Thus, growth determined exogenously, that is independent of all other factors including inflation. On the other hand, under the endogenous growth theory Solow (1956) states that inflation affects growth through lowering the rate of return on capital, both human capital and physical. Thus, inflation lowers the return on capital and the growth rate.

Empirical literature review

Several empirical studies have been done to examine the threshold effects of inflation on growth and varying results have been highlighted.

Fischer (1993) presents pioneering work on the existence of threshold effects of inflation on growth. The study uses panel data for a set of developed and developing countries and applies a non-linear function to study the relationship between inflation and growth. The author breaks the inflation into three categories; below 15%, 15% to 40% and above 40%. The study concludes that the effects of inflation on growth are non-linear. The main criticisms to Fischer (1993) are that the inflation bands categorisation was arbitrarily chosen.

The major improvement in methodology with regards to modelling the existence of threshold effects in the relationship between inflation and growth was made by Khan and Senhadji (2001). Khan and Senhadji (2001) examine the relationship between growth and inflation utilising a panel data framework for 140 countries which included both developed and developing countries for the period from 1960 to 1998. The authors find 1 to 3 percent and 7 to 11 percent as threshold inflation levels for developed and developing countries, respectively.

Leshoro (2012), investigates the level of inflation that is detrimental to economic growth in South Africa, using quarterly data from 1980: Q2 to 2010: Q3. The study employed threshold regression model developed Khan and Senhadji (2001) and used the Ordinary Least Squares (OLS) technique to estimate results of the study. The results obtained using the OLS method were tested for robustness using the two-stage least squares instrumental variable (2SLS-IV)

technique. Results from both the OLS and 2SLS-IV estimation techniques indicated an inflation threshold level of 4 percent for South Africa. Leshoro, (2012) concluded that inflation above the threshold level had a negative effect on economic growth.

Seleteng (2005) estimated an inflation-growth threshold model for Lesotho using quarterly time series data for the period 1981 to 2004. The study established that the optimal level of inflation above which inflation is detrimental to economic growth in Lesotho is 10 percent.

Ndoricimpa (2017) used a dynamic panel threshold regression model to analyse the impact of inflation thresholds on growth in Africa. The study used unbalanced panel data drawn from 47 African countries based on data availability. The study sample included low income and middle income countries in Africa. Estimation results indicate inflation threshold levels of 6.7% for all the countries under study, 9% for a sub sample low income countries and 6.5% for middle income countries. The study concluded that low inflation encourages economic growth for middle income countries in Africa.

Phetwe & Molefhe (2016) examined the threshold effect of inflation on growth in Botswana for the period from 1994 to 2014. Results confirmed the existence of a non-linear relationship between inflation and growth. The study uses GDP statistics that excludes agriculture, mining and general government sectors which were deemed not to be determined by monetary factors. The study found the threshold level of inflation to be 6.9%, beyond which the impact of inflation on growth becomes negative.

Doguwa (2012) also examined the relationship between inflation and growth with an aim to determine the threshold level of inflation for Nigeria. The study employed three different threshold models using quarterly GDP and inflation data for the period from 2005 to 2012. The different estimation methods produced different but closely related threshold levels of 9.9%, 10.5% and a threshold of between 11.2% and 12 %.

A study by Nkume & Ngalawa (2014), for Malawi for the period from 1980-2013, concluded that the optimal level of inflation was 17%. The study utilized annual time series data and employed the conditional least squares method for the empirical analysis.

Tarawalie et al. (2012), investigated threshold inflation for West African Monetary Zone countries and found the following thresholds: Gambia (7-11%), Ghana (6- 11%), Guinea (3-9 %), Liberia (3-9%), Nigeria (9-14%) and Sierra Leone (7-12%).

The empirical studies for SSA revealed that countries have different optimal levels of inflation, reflecting individual country characteristics. It is therefore, important to estimate the optimal inflation for Zimbabwe.

SECTION IV: METHODOLOGY

The study uses the quadratic threshold model following Yonus (2012) and Phetwe & Molefhe (2016) to model optimal inflation for Zimbabwe. Annual data is used for the pre-dollarisation period while monthly data is used for the multicurrency system. Inflation is modelled as a non-linear quadratic function. The solution to the 1st derivative of the growth model, provides the optimal value of inflation that maximises economic growth. Following Yonus (2012), the model usually include other determinants of growth to remove problems associated with the omission of some variables. The quadratic growth model is therefore specified as follows:

The Quadratic model specification is as follows:

$$gdp_t = \beta_0 + \beta_1 \pi_{t-1} + \beta_2 \pi_t^2 + \beta_3 X_t + u_t \quad \text{---------- (1)}$$

Where

gdp_t represents the GDP growth rate

π_t is the inflation rate

π_t^2 is the squared inflation rate

X_t is vector of control variables which affect economic growth

Model 1 may be re-written as shown below and this is the model which shall be employed in this study.

$$gdp_{gt} = \alpha_0 + \alpha_1 gdp_{t-1} + \alpha_2 \pi_{t-1} + \alpha_3 {\pi^2}_t + \varepsilon_t \quad \text{.....(2)}$$

Where

gdp_t represents the GDP growth in period t;

π_t denotes inflation in period t;

GDP_{t-1}, the lag of the log of GDP in period t; and

ε_t is a random error term.

The advantage of model specification (2) is that it allows for non-linear relationship between economic growth and inflation predicted by theory. A priori, the coefficient on inflation is expected to be positive while that on the square of inflation is expected to be negative. Controlling for the initial income condition in the model can be statistically interpreted as controlling for initial GDP in the conventional income convergence models. In our case, it also amounts to controlling for all the other determinants of growth outside inflation. Hence, it assists in mitigating against model misspecification bias. In estimating (2), the lag of GDP has been instrumented by its second lag to avoid the estimation bias it causes when estimating the model with a finite or small time period.

For the period 1980 to 1997, a dummy variable was introduced to cater for structural shift from 1991 as a result of the opening up of the economy following the adoption on economic reforms under the Economic Structural Adjustment Programme (ESAP). The ESAP programme mainly involved the removal of price controls on goods and foreign exchange market.

Data Sources

The data on GDP and inflation for the period from 1980 to 1997 is obtained from the World Bank's World Development Indicators (WDI) and ZIMSTAT formerly Central Statistical Office (CSO). For the period 2009 to 2017, inflation statistics was obtained from ZIMSTAT while GDP data which was obtained from ZIMSTAT was interpolated into monthly data using Value Added Tax statistics from the Ministry of Finance and Economic Development.

SECTION V: RESULTS AND ANALYSIS

This section discusses the empirical results of the estimation of the optimal inflation for both the relatively stable period when the country had its own currency and the period under multicurrency.

Results of optimal inflation of the Quadratic Model for the period 1980 to 1997

Table 1 summarizes the regression results from the quadratic model for the period 1980 to 1997.

Table 1: Results of Quadratic Estimation Model 2 for the period 1980 to 1997

Dependent Variable: GDP				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Lagged GDP	-0.432914	0.156491	-2.766385	0.0160**
Inflation	0.125272	0.145757	0.859455	0.4057
Inflation^2	-0.007189	0.003561	-2.018516	0.0647**
Dum	-2.610962	3.101879	-0.841736	0.4152
C	3.094220	1.089652	2.839641	0.0139**
R-squared	0.125272			
Adjusted R-squared	-0.007189			
F-statistic	3.942608			
Prob(F-statistic)	0.001327			

Source: Authors' calculations

*significant at 10%, ** significant at 5% and *** significant at 1%.

The results show that the coefficient of inflation is positive while that of inflation squared is negative as expected, apriori. This shows that the relationship between inflation and growth is concave and therefore there is a threshold level of inflation. Resultantly, the results of threshold level of inflation are obtained from the optimisation results as follows:

Optimization results for the period, 1980 to 1997

Substituting the estimated coefficients in equation (1) and taking the first derivative with respect to inflation we obtain the following:

$$\frac{dgdp_t}{d\pi_t} = 0.125272 - 2 * (-0.007189\,\pi_t) = 0$$

$$\frac{dgdp_t}{d\pi_t} = 8.71\%$$

The above analysis shows a growth maximising inflation of 8.71% for the period 1980 to 1997 when the country had its own currency. The figure compares favourably with results from other countries with own currencies. For instance, Tarawalie et al. (2012) found the following optimal inflation levels for different African countries: Gambia (7-11 percent), Ghana (6- 11 percent), Guinea (3-9 percent), Liberia (3-9 percent), Nigeria (9-14 percent) and Sierra Leone (7-12 percent).

The results of the quadratic model for the period under multicurrency system, from 2009 to 2017 are shown in Table 2.

Table 2: Results of Quadratic Estimation Model 2 for the period 2009 to 2017

Dependent Variable: GDP				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-1.007971	0.499661	-2.017311	0.0467**
Lagged GDP	-0.000156	0.000113	-1.386411	0.1691
Inflation	0.441446	0.218692	2.018579	0.0466**
Inflation^2	-0.048329	0.023928	-2.019718	0.0465**
R-squared	0.983105			
Adjusted R-squared	0.982529			
F-statistic	1706.874			
Prob(F-statistic)	0.000000			

Source: Authors' Calculations
*significant at 10%, ** significant at 5% and *** significant at 1%.

Optimization results for the period, 2009 to 2017

For the period 2009 to 2017, substituting the estimated coefficients in equation (2) and taking the first derivative with respect to inflation we obtain the following:

$$\frac{dgdp_t}{d\pi_t} = 0.441446 - 2 * (0.0483296\pi_t) = 0$$

$$\frac{dgdp_t}{d\pi_t} = 4.57\%$$

From the first order growth optimization condition on the estimated model with respect to inflation, the estimated optimum inflation for Zimbabwe under the multicurrency regime is around 4.6%. The optimal level of inflation is lower as expected since the country's monetary policy is influenced by the monetary and inflation conditions obtaining in the countries, which constitute the multicurrency basket, particularly the US.

Critical to note in the estimated results, is the fact that the growth maximizing level of inflation after 2009 is lower than what obtains before the 1998/2008 crisis period. In fact, before the crisis the country's optimum inflation is about double what it is after the crisis. This is in line with our *apriori* expectations. After the hyperinflation period which occurred during the crisis, people still have the hyperinflation memories and money demand is likely to be more sensitive to inflation, even at low levels. Their quicker response in adjusting consumption and investment decisions is, therefore, relayed to growth earlier and at lower inflation rates after the crisis than before.

SECTION VI: CONLUSION AND POLICY RECOMMENDATIONS

The study estimated the growth optimizing inflation rate for Zimbabwe and provides critical answers into the long outstanding question of growth maximizing inflation, essential for policy making purposes. An empirical question relevant for policy pertains to the optimum inflation for a country in light of the fact that low or excessively high inflation discourages growth while moderate inflation is pro-growth.

The study shows that using data for the period 1980 to 1997, an optimal inflation of 8.7% was ideal for Zimbabwe, when the country had its own currency. As expected when the country is in a multicurrency system, where the US dollar is the main currency, the optimal inflation is lower at 4.6%. Under multicurrency, the inflation profile for Zimbabwe should not differ significantly from the inflation rates of countries of anchor currencies. In Zimbabwe these include mainly the US and South Africa inflation rates.

The main policy conclusion from the optimal inflation analysis is that to ensure optimal growth, there is a certain level of inflation which is required in the economy. Under multicurrency, Zimbabwe's inflation can rise to 4.6% without necessarily hurting economic growth. Beyond 4.6%, however, inflation will contribute negatively to growth.

Overally, the results for both own currency and multi-currency regimes showed that the country's optimal inflation is broadly consistent with the regional inflation targets of 3 to 7% for SADC. In this regard, it is important to ensure that the country's inflation remains within the regional target to ensure maximum growth.

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