THE EFFECT OF INFLATION ON ECONOMIC GROWTH IN TANZANIA

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Abstract: The question of the effect of inflation on economic growth is one of the issues that have been hotly debated in macroeconomics. While some scholars, particularly those leaning towards the Keynesian and Structural perspectives tend to believe that inflation is not harmful to economic growth, other scholars, particularly those in the monetarist tradition, argue that inflation is harmful to economic growth. In this study, use is made of the Least Trimmed Squares (LTS) method, as introduced by Rousseeuw and Leroy (1987), which detects regression outliers and produces robust regression, to examine the ijpact of inflation on economic growth in Tanzania. The empirical results obtained suggest that inflation has been harmful to economic growth in Tanzania.

INTRODUCTION

Is inflation harmful to economic growth? This question is increasingly drawing the attention of macro economists and policy makers. The basic theme in the current debate is not new. Its origin can be traced back to the early debate in industrialized countries on the possible trade-off between inflation and unemployment within the Phillip's curve framework. By then, the debate and research addressed the short-term policy agenda of economic stabilization more relevant to industrialized countries, and less relevant to developing countries. The current debate on inflation and economic growth is different from the early debate only in terms of the time perspective, in the sense that it addresses the long-term policy agenda of economic growth (development), more relevant to developing countries.

This study is motivated by the importance of the topic to policymaking in Tanzania. The rest of this paper is organised as follows. Section One outlines the main trends of economic growth and inflation in Tanzania. While Section Two reviews the relevant literature, Section Three presents the methodology. Section Four presents empirical results, and Section Five gives concluding remarks.

Economic Growth and Inflation in Tanzania: 1952-1998

Tanzania's economic performance in terms of the rate of economic growth and trend of inflation over the last five decades deserves serious attention from policy-makers. In 1950s and 1960s, the economic performance was impressive. The annual average growth rate over the period was 5.6 per cent. In 1950s and 1960s annual average growth rates were 4.5 percent and 5.8 percent respectively. The rate decreased to 2.5 per cent in mid 1970s. The economy almost stagnated in the early 1980s, before it started to recover in the late 1980s.

Regarding inflation, there was almost price stability in the 1950s and 1960s. The annual average rates of inflation were low, in single digit, at about 4.5 per cent and 9.3 percent during 1950s and 1960s respectively. The rate rose to 10.5 percent in 1973, before it reached 26.5 percent in 1975. The official rate reached its record high of 36.1 percent in 1984. A casual observation of inflation and economic growth trends in Table I tends to suggest that over the period, there has been an inverse relationship between inflation and economic growth in Tanzania.

For example, during 1952-70, economic growth rate of 5.2 percent, the highest for the entire period, is associated with single digit rates of official infflation, with the exception of the period of 1966-70 when the rate of inflation was 1 1.7 percent. From 1965 to 1985 the rate of economic growth continuously declines as the rate of inflation continuously increases.

Table 1: *Economic Growth Rates and Inflation Rates in Tanzania: 1952-1998*

Year	GDP Growth Rate	Inflation Rate
1952-55	4.8%	4.8%
1956-60	4.6%	4.5%
1961-65	5.7%	6.5%
1966-70	5.2%	11.7%
1971-75	4.1%	14.4%
1976-80	2.1%	14.9%
1981-85	0.9%	27.3%
1986-90	3.7%	23.9%
1991-95	2.0%	25.0%
1996-98	3.7%	13.5%

Source: International Financial Statistics (1998), Bank of Tanzania (1998) Economic Bulletin, and Tanzania Economic Trend (1990).

The table also reveals that, the lowest rate of economic growth, 0.9 percent, during 1980-1985, was associated with the highest rate of inflation, 27.3 percent. Furthermore, the table shows that as the economy recoverd during 19861990, registering an average growth rate of 3.7 percent, the rate of inflation decreased to 23.9 percent. Given the fact that both low rates of economic growth and price instability are not desirable, inflation and economic growth trends in Tanzania over the past five decades provide sufficient ground for serious research interest.

LITERATURE REVIEW: THEORY AND EMPIRICAL EVIDENCE

The effect of inflation on economic growth has been one of the major controversies in macroeconomics over the past four decades. Other scholars, especially those leaning towards the Keynesian and Structural perspectives, have tended to believe that inflation is not harmful to economic growth. In fact a few years ago, some scholars, such as Watchter (1976), Aghevil (1977) and Taylor (I 979) even believed that, if inflation has any effect at all, then, it is conducive to economic growth. It was argued that, since inflation facilitates the transfer of resources, from wage earners and consumers who have high propensity to consume, to the government and capitalists who have a higher propensity to save, it enhances capital accumulation, which ultimately promotes growth.

In contrast other scholars, such as McKinnon (1973), Friedman (1979) and Villanueva (1991), argue that inflation is harmful to economic growth. At a theoretical level, a number of channels through which inflation retards economic growth have been identified. McKinnon (1964) and Findlay (1984) for example, argue that under a fixed exchange rate regime, a high rate of domestic inflation relative to that of the trading partners worsens the balance of trade and create a shortage of foreign exchange, which constrains the import capacity of intermediate and capital goods that are necessary for economic growth.

Friedman argues that uncertainty, generated by inflation volatility, causes inefficiency in resource allocation, which reduces the rate of economic activity. McKinnon (1973) maintains that high inflation volatility shifts investors' preferences from long-term investments that are necessary for economic growth, to quick yielding financial assets, which do not contribute to long-term economic growth.

Several empirical studies carried out to investigate the relationship between inflation and growth in developing countries, seem to propose that; there is a certain range of inflation that is conducive to growth. Dorrance (1966), Thirwall (1974) and EWF (1982) suggest that low rate of inflation promotes growth. Thirwall's study, specifically, suggests that the "optimal" rate of inflation is below 10 per cent. Dorrance's study reveals that high rates of inflation retard growth.

Hanson distinguishes between expected and unanticipated inflation, and observes that, it is only the later that is growth promoting. Glezakos (1978) however, discovers a negative relationship between unanticipated inflation and growth. Daffat's study finds a significant direct relationship even between anticipated inflation and growth. Accordingly, he concludes that his findings are "systematically consistent with the structuralist view" that inflation promotes growth. This conclusion, however, seems to be too strong bearing in mind the fact that; his study covers three Asian economies (Malaysia, Philippines and Thailand) that had relatively low rates of inflation, below 10 per cent, which Thirwall considers to be conducive to growth.

This study, like the other empirical studies that it has reviewed, uses time series data from Tanzania, to investigate the effect of inflation on growth. Unlike the other studies however, it also examines the influence of outliers on empirical results.

In Tanzania, quite a good number of studies, for example, Kilindo (1982), Kilindo (1992), Rwegasira (1972) and Hyuha and Osoro (1984) have examined the causes of inflation. Expansionary monetary and fiscal policies and structural factors, such as the foreign exchange constraint have been identified as the major causes of inflation. In terms of empirical studies, so far very little has been done to examine the effects of inflation on other macroeconomic variables, and more specifically, on economic growth. This study, thus, attempts to fill this gap.

MODEL SPECIFICATION AND ESTIMATION METHOD

Conventionally, the growth model is derived from the aggregate production function; and thus, it usually includes, changes in the labour force and capital stock, and technical progress as be basic explanatory variables. Other explanatory variables that are also included are the rate of growth of the money stock, terms of trade, human capital and the rate of inflation.[1]

In this study, however, a simple national income (GDP) growth model, in which economic growth is specified as a function of only the growth rate of money stock, the rate of inflation and investment, is used. For some reasons other variables have been excluded from the model. First, a simple model is reasonably sufficient because the main objective of this study is to investigate the effect of inflation on economic growth, rather than to investigate factors that influence economic growth in Tanzania.

Second, for some variables, such as the labour force and human capital, it is difficult to get the "appropriate" data. It is particularly very difficult to get time series data for labour force in Tanzania. Regarding human capital, it is very difficult to measure the variable. Hence, by excluding these two variables, it is thought, there is much to gain, in terms of increased degrees of freedom and avoiding measurement errors, than there is to loose. Third, the terms of trade is omitted because the preliminary regression results of the model that included the variable were poor (See Appendix 1). The model to be estimated is thus, specified as follows:

$$y_{gt} = a_0 + a_1 m_{gt} + a_2 \pi_t + a_3 i_t + a_4 d + u_t \quad ....1$$

Where y_{gt}, m_{gt}, p_t, i_t and d is the growth rate of real GDP (at 1992 prices), growth rate of money stock (M2), the rate of inflation (the rate of change of the consumer price index, CPI), investment and a dummy variable respectively. u_t is a random error term, assumed to be normally distributed with zero mean and a constant variance.

[1] For detailed discussion of growth models see Barro and Salai-I-Martin

The growth rate of money stock and investment are presumed to be positively related to economic growth. The relationship between the rate of inflation and economic growth, which is not determined *a priori*, is the phenomenon that this study seeks to investigate. The dummy variable, d, is included to take into account the effect on inflation and economic growth of the first oil shock (1973/74) and the second oil shock during 1979-1981. The dummy assumes the value of 1 during 1973-1975 and 1979-1983, taking into account the extended effect of the shocks. Otherwise, it assumes the value of zero.

Regression outliers (thereafter simply referred to as outliers)[2], in regression, defined as 'extreme' data points, 'which have large residuals relative to most of the other residuals in the regression' (Mukherjee *et. al*, 1998) do influence estimates of regression parameters. Even a single regression outlier, if it is sufficiently large, can have a substantial influence on regression results to the extent of distorting the actual 'normal' behaviour of the phenomenon being investigated. This study, intends to detect the presence of regression outliers, remove them, and produce estimates of parameters that are free from the influence of few extreme data points.

The study uses the Least Trimmed Squares (LTS) method, as introduced by Rousseeuw and Leroy (1987), to detect regression outliers and produce robust regression. Blankmeyer (1999) has written a RATS procedure, which has been used in this study, to run LTS[3]. This procedure, according to Blankmeyer, uses a resampling algorithm to locate 'observations in the uncontaminated half of the sample and uses these good data to identify the outliers, i.e. observations whose LTS-standardized residuals exceed 2.5 in magnitude'. The outliers are then dropped, and OLS is applied on the remaining data to produce final regression estimates.

EMPIRICAL RESULTS

Test for Stationarity of Variables

At present, there is almost consensus that regression involving time series variables containing a stochastic trend may produce results that appear to be statistically significant even though the actual relationship is spurious.[4] Preliminary regression results involving levels of the variables (GDP, money stock (M2), price level, and investment) indicated the possibility of the variables in levels being I(I). In the preliminary results, the coefficient of determination (0.96) was higher than the Durbin-Watson statistic (0.43) (See regression results in Appendix 111).

According to the rule of thumb, when the coefficient of determination is greater than the Durbin-Watson statistic, it is possible that, due to non-stationarily of variables, the actual relationship between variables is spurious, although the relationship from regression results may appear to be statistically significant. The variables, therefore, were tested for the presence of unit roots, and the results are presented in Table 2.

The Table shows that for all the variables, we cannot reject the unit root hypothesis at the 5 percent level. For the first differences of the variables, however, the hypothesis can be rejected. Thus, the first differences of the variables: - growth rate of GDP, growth rate of money stock, the rate of inflation and the change

2 Outlier is a broad term referring to both a regression outlier and an outlier in univariate analysis. While a regression outlier refers to the actual value of the endogenous variable far removed from its fitted value (i.e. its *conditional* mean); an outlier in univariate analysis refers to the actual value of the variable far removed from its own mean (i.e. its *unconditional* mean). See Murkhejee *et al* (1998: 138)

3 At present the LTS proedure is not included in the installation disks of RATS (Regression Analysis of Time Series) software, even for the currrent version of the software - RATS Version 4.31. The file can be freely downloaded at - www.estima.com

4 When dependent and independent variables have unit roots (i.e. their series are not stationary), their regression can indicate statistically significant relationship even if the actual relationship is spurious (Granger and Newbold, 1974; Phillips, 1986)

Table 2: *ADF Unit Root Test for Variables*

Variable	1 (0)	Lags	1 (1)	Lags	Order of Integration
GDP_t	-0.1403	0	-6.0347*	0	1
Money stock (M2)	-2.7514+	0	-3.8157*	0	1
Price Level (CPI)	-2.7101+	0	-4.0693*	0	1
Investment (i_t)	-3.3492**	3	-4.0693***	0	1

Note

For 1(0): -* at level 0.05 (no lag), the tabulated critical value = -2.9527, **at level 0.05 (3 lags), the tabulated critical value = -3.5 867.

For 1(0): - + at level 0.5 (no lag, with deterministic trend), the tabulated critical value = -3.5468.
For I(l) :- *** at level 0.05 (no lag) the tabulated Critical value = -2.9665.

in investment are used in regression. However, it is important to note that we are fully aware of the limitation of using first differences of the variables in regression, particularly if the non-stationary variables are cointegrated. The main limitation of using first differences in such circumstances is to run the risk of throwing away important information regarding the long-run (equilibrium) relationship between the variables.

Regression Results

In order to capture the dynamic behaviour, in terms of delayed response of GDP to variations in the growth rate of money stock, the rate of inflation and investment lags were to be introduced in the model. There exist several criteria for selecting the 'optimal' lag length. The main idea behind the 'optimal' lag length is to include 'in the model a sufficient number of lags, which strikes a balance between fully capturing the dynamics of the model and thus, producing white noise residuals; and at the same time avoiding over-parameterisation of the model.

This study uses the Akalke Information Criterion (AIC), the Bayesian- Schwarz Information Criterion, the Ljung-Box and Lagrange Multiplier (L-M) tests for residual serial correlation, and the general-to-simple lag specification method to determine the optimal lag length. According to the tests results presented in Appendix UL the AIC, BIC, Ljung-Box and the general to simple picks tests one lag, while the L-M picks zero lags. To capture the dynamics, the study uses one lag. Since the model that included both the current and lagged values of exogenous variables produced poor results, possibly due to multicollinearity, the current variables were dropped, leaving only the lagged variables.

Regression results are presented by equations (2) through (4) below. OLS results (equation 2) are very poor. It can be observed that, both the individual coefficients of the explanatory variables and the overall regression equation are not statistically significant.

Ordinary Least Squares

$$y_{gt} = \underset{(4.731)}{0.031} + \underset{(0.134)}{0.005 m_{gt-1}} - \underset{(-0.360)}{0.006 p_{t-1}} + \underset{(0.50)}{0.01 D_{t-1}} - \underset{(-0.45)}{-0.006 d} \quad \ldots (2)$$

$\bar{R}^2 = -0.114, DW = 1.74, F(4,25) = 0.26$, Significance of F = 0.9

Least Trimmed Squares

$$y_{gt} = \underset{(6.822)}{0.044} - \underset{(-0.254)}{0.006 m_{gt-1}} - \underset{(-2.94)}{0.062 \pi_{t-1}} + \underset{(2.32)}{0.031 \Delta i_{t-1}} + \underset{(0.738)}{0.008 d} \ldots (3)$$

$\bar{R}^2 = 0.23$, $DW = 1.53$, $F(4,23) = 2.722$, Significance of F = 0.06

$$y_{gt} = \underset{(10.496)}{0.043} - \underset{(-3.001)}{0.062\pi_{t-1}} + \underset{(2.36)}{0.003i_{t-1}} + \underset{(0.77)}{0.008d} \quad .... \quad (4)$$

$\bar{R}^2 = 0.27$, $DW = 1.48$, $F(4,24) = 3.785$, Significance of F = 0.02

The LTS results (equation (3)) are an improvement over the OLS results, suggesting that outliers have a significant influence in OLS. Some coefficients, particularly those of inflation and investment are statistically significant at 5 percent level. The coefficient of determination is now positive, although it is pitifully low. Taking into account the fact that the trend in the variables has been removed, that level of the coefficient of determination can still be considered to be reasonable. The coefficient of the growth rate of money stock and the overall regression equation are not significant at 5 percent level.

Dropping the growth rate of money stock, improves the LTS results (equation (4)). The overall regression is now significant at 5 percent level and the adjusted coefficient of determination has increased, suggesting that the growth rate of money stock is not important in explaining the variations in economic growth. The coefficients for the rate of inflation and change in investment are still significant. The coefficient for the rate of inflation is negative, suggesting that inflation in Tanzania has been harmful to economic growth. Economic growth appears to respond positively to the acceleration of investment.

The LTS method has identified outliers to belong to 1973-74 and 1979-82. These were years of economic crisis resulting mainly from the oil shocks, incidentally represented in the model by a dummy variable taking on a value of 1. It is most likely that due to the official price controls that existed then, the actual relationship between the actual inflation and economic growth is marred in OLS regression by the recorded official inflation data, which usually underestimates the actual inflation.

Another noteworthy (methodological) issue is the difference in sign of the coefficient of the dummy variable in OLS and LTS. Although the coefficient of the dummy is not statistically significant, it has the expected negative sign in the OLS, suggesting that it only weakly captures the effect of outliers in the OLS. The implication of this is that, the dummy variable can be used to capture the effect of outliers, but it *may* not always work.

Conclusion

The main objective of this study was to examine the effect of inflation on economic growth in Tanzania, using the LTS method that produces regression results, which are free from the influence of extreme data points. Two main points can be raised from the findings of the study. First, the OLS has produced poor results due to outliers belonging to the years in which there was economic crisis resulting mainly from the oil shocks. Second, the LTS results suggest that inflation has been harmful to economic growth in Tanzania. The policy implication of this is that, controlling inflation is at least a necessary condition for promoting growth.

Another point that can be raised basing on the findings of this study is related to the areas for future research. At least three main areas can be identified. First, a research on the effect of inflation on economic growth can be pursued even farther by investigating for example the effect of inflation on variables, such as investment, efficiency in resource allocation and competitiveness in the world market, that directly influence growth. Second, more focused studies could be carried out to examine whether monetary policy in Tanzania has significant influence on output. The third research area at which future efforts could be directed is the effect of inflation on the efficacy of the monetary policy in Tanzania.

APPENDIX I

OLS and LTS Equations including terms of trade as one of the explanatory variables.

OLS Equation:

$$y_{gt} = \underset{(0.6)}{0.09} + \underset{(0.122)}{0.005m_{gt-1}} + \underset{(0.3)}{0.004p_{t-1}} + \underset{(0.5)}{0.01i_{t-1}} - \underset{(-0.39)}{0.013tot_{t-1}} - \underset{(-0.52)}{0.00078d}$$

$\bar{R}^2 = -0.15, DW = 1.76, F(4.24) = 0.223$, Significance of F = 0.9

LTS Equation:

$$y_{gt} = \underset{(1.41)}{0.17} + \underset{(0.003)}{0.00009m_{gt-1}} + \underset{(0.35)}{0.005\pi_{t-1}} - \underset{(-01.14)}{0.031tot_{t-1}} - \underset{(-1.1)}{0.013d}$$

$\bar{R}^2 = -0.07, DW = 1.86, F(4,24) = 0.61$, Significance of F = 0.69

APPENDIX II

Regression of Equation based on levels of the variables:

$$gdp_t = \underset{(60.32)}{9.86} + \underset{(6.16)}{0.17m_{t-1}} - \underset{(-1.53)}{0.68p_{t-1}} + \underset{(1.42)}{0.05i_{t-1}} + \underset{(0.24)}{0.01d}$$

Adjusted R^2 = 0.96, D.W = 0.43, F (4.26) = 182.81, Significance of F= 0.0

Where gdp, m, p, i and d are real GDP, nominal money stock, investment and the dummy variable, respectively.

APPENDIX III

i) AIC and BIC Criteria

Lag	AIC	BIC
0	16.97	17.26
1	15.34	15.68
2	15.41	15.80
3	15.49	15.92
4	15.55	16.03

ii) Ljung-Box and Lagrange Multiplier (LM) test for residual serial correlation

	Ljung-Box		Lagrange Multiplier	
Adding lag	Statistic	Significance level	Statistic	Significance level
0	83.3	0.0	6.0	0.99
1	21.7	0.5	-	-

iii) General-to-simple lag specification

Lag	Significance
4	0.68
3	0.89
2	0.87
1	0.00

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