Inflation and Economic Growth:

An estimate of an optimal level of inflation in Lesotho

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Abstract:

This study seeks to estimate the optimal level of inflation, which is conducive for economic growth in Lesotho, using quarterly time-series dataset for the period 1981 to 2004. The data was converted from annual to quarterly time-series by applying cubic interpolation technique embedded in Eviews econometric software. The estimated model suggests a 10 per cent optimal level of inflation above which, inflation is detrimental for economic growth.

Keywords: **Economic growth, Inflation rate, Monetary policy, Optimality**

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1. INTRODUCTION

1.1 Background

There appears to be a consensus that macroeconomics stability, specifically defined as low inflation, is negatively related to economic growth. Hence rapid output growth and low inflation are the most common objectives of macroeconomic policy. Over the years, the existence and the link between these two variables has become the subject of considerable interest and debate. Economic theories reach a variety of conclusions about the responsiveness of output growth to inflation. Theories are deemed useful as they account for some observed phenomenon.

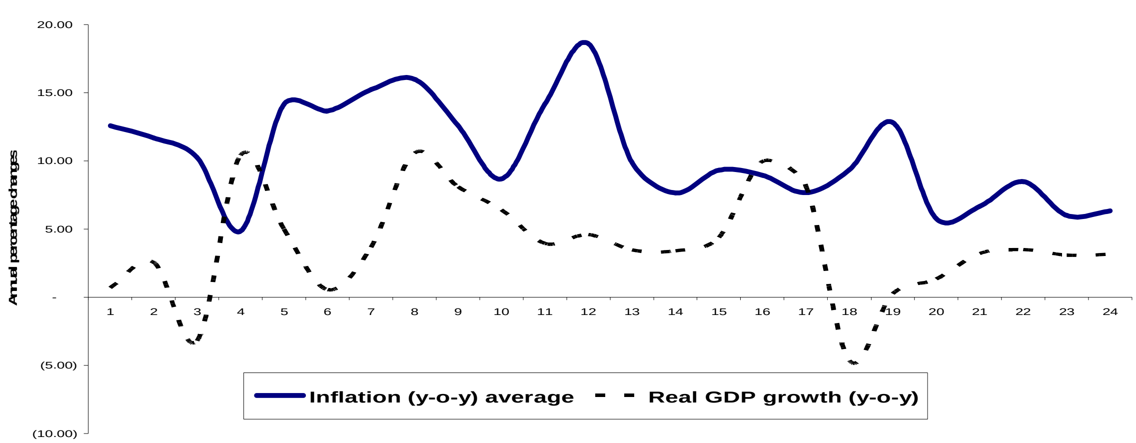
Some researchers advocated that, inflation can lead to uncertainty about the future profitability of investment projects. Hence this leads to more conservative investment strategies than would otherwise be the case, ultimately leading to lower levels of investment and economic growth. Khan (2002) concurs that inflation may also reduce a country's international competitiveness, by making its exports relatively more expensive, thus impacting negatively on the balance of payments. In addition, budget deficits also reduce both capital accumulation and productivity growth. On the contrary, some theorists advocated that there is a positive relationship between inflation and economic growth.

1.2 Historical overview of inflation and economic growth in Lesotho

The history of Lesotho's inflation dates back to 1980, where April 1989 was initially used as a reference period (i.e. April 1989 = 100) for consumer price index. The reference period was later changed to April 1997[1]. Inflation movements in Lesotho have been following those in South Africa (SA) because of the trade linkages between the two countries.

Figure 1 below depicts the relationship between inflation and real economic growth in Lesotho. The real GDP growth rate is measured on the left axis and inflation on the right axis.

Figure 1: Inflation versus real GDP growth rate



[1] Bureau of Statistics (various publications)

Figure 1 above illustrates the fact that in Lesotho over the years, the relationship between inflation and real economic growth rate has been negative. Thus, in years when inflation rate was high, real GDP growth rate was low, and vice versa. However, it should be taken into account that the impact is not instantaneous. Inflation affects economic growth with a significant lapse of time. As depicted in figure 1 above, from 1980 to 1992, inflation rate oscillated between around 5 per cent and 12 per cent. However, in the long-run, the average percentage change in the inflation rate seems to be at around 10 per cent. At these highest peaks, economic growth rate seemed to be rather very low.

1.3 Statement of the problem

The question is; how low should inflation be? Or put in different words; is there a level of inflation at which the relationship between inflation and economic growth becomes positive? The hypothesis is that; at some low rate of inflation, the relationship between the two variables is non-existent, or perhaps even positive, but at higher rates it becomes negative. As Khan (2001) puts it, if a relationship between inflation and economic growth exists, then it should be possible in principle to estimate the inflexion point, or threshold, at which the sign of the relationship between the two variables would switch. The answer to this question obviously depends on the nature and structure of the economy and hence varies from country to country.

There have been a number of formal empirical attempts to identify threshold level in the inflation-growth relationship. These include, for instance, paper by Ghosh and Phillips (1998), Sarel (1996), and Khan and Senhadji (2001). These studies generally found that for economies with initially low rates of inflation, modest increases in the rate of inflation do not affect long-run rates of real economic growth. But for economies with initially high rates of inflation, further increases in the inflation rate have adverse effects on real economic growth. Khan and Senhadji (2001) found that the threshold rate of inflation is fairly low – around 1-3 per cent for industrialized countries and 7-11 per cent for developing countries.

1.4 Objectives

This paper attempts to estimate the optimal level of inflation for Lesotho. The consensus that moderate inflation helps in economic growth, led to interesting policy issue of how much of inflation is too much; that is, how much inflation impedes economic growth?

1.5 Structure

Section two of this paper looks at both the theoretical and empirical evidence of the relationship between inflation and economic growth. In this chapter, theory of the relationship between inflation and economic growth is looked at. Furthermore, several similar studies investigating this relationship are also looked at. In addition, historical overview of inflation and economic growth in Lesotho is also looked at. Empirical analysis is presented in Section three. This deals with the data, methodology and techniques adopted in carrying out the research of this nature. Estimation results of the model are presented in section 4. Section five concludes the paper and gives policy recommendations.

2. INFLATION AND ECONOMIC GROWTH: Theory and evidence

2.1 Theoretical framework

2.1.1 Classical Growth Theory

This was propounded by Adam Smith and he postulated a supply side-driven model of growth and his production function was as follows:

$$Y = f(L, K, T)$$

Where Y is output, L is labour, K is capital and T is land, so output was related to labour, capital and land inputs. As a consequence, output growth function is as follows:

$$g_y = \phi(g_f, g_k, g_l, g_t)$$

Where output growth (g_y) was driven by population growth (g_l), investment (g_k), land growth (g_t) and increases in overall productivity (g_f).

Smith viewed savings as a creator of investment and hence growth, therefore, he saw income distribution as being one of the most important determinants of how fast (or slow) a nation should grow. The link between inflation and its tax effects on profits levels and output were not specifically articulated in classical theories. However, the relationship between the two variables is implicitly suggested to be negative, as indicated by the reduction in firms' profit levels through higher wage costs.

2.1.2 Keynesian Theory

The Keynesian model comprises of Aggregate Demand (AD) and Aggregate Supply (AS) curves. According to this model, in the short-run, the AS curve is upward sloping rather than vertical. The implication is that changes in the demand side of the economy affect both prices and output. This holds because many factors[2] drive inflation rate and level of output in the short-run. Therefore, the Keynesians advocate that there exist a positive relationship between inflation and output. Blanchard and Kiyotaki (1987) concur that the positive relationship can be due to agreement by some firms to supply goods at a later date at an agreed price. Therefore, even if the prices of goods in the economy have increased, output would not decline, as the producer has to fulfil the demand of the consumer with whom the agreement was made.

2.1.3 Monetarism

This was propounded by Milton Friedman, and it basically emphasized several key long-run properties of the economy. The Quantity Theory of Money linked inflation and economic growth by simply equating the total amount of spending in the economy to the total amount of money in existence. He proposed that inflation was a result of an increase in supply or velocity of money at a rate greater than the rate of growth in the economy. In summary, Monetarism suggests that in the long-run, prices are mainly affected by growth rate in money, while having no real effect on growth. Inflation occurs if the growth in the money supply is higher than the economic growth rate.

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[2] These includes changes in; expectations, labour force, prices of other factors of production, fiscal and/or monetary policy

2.1.4 Endogenous Growth Theory

This theory describe economic theory as being generated by factors within the production process, for instance, economies of scale, increasing returns or induced technological change. According to this theory, the economic growth rate depends on one variable: the rate of return on capital. Variables like inflation decreases the rate of return and this in turn reduces capital accumulation and hence reduces the growth rate. Other models of endogenous growth explain growth further with human capital. The implication is that growth depends on the rate of return to human capital, as well as physical capital. The inflation acts as a tax and hence reduces the return on all capital and the growth rate.

2.2 Empirical framework

Several studies have estimated a negative relationship between inflation and economic growth. However, some studies have accounted for the opposite.

Khan and Senhadji (2001) examined the issue of the existence of 'threshold' effects in the relationship between inflation and growth, using econometric techniques. Their paper focused on whether there is a statistically significant threshold level of inflation above which inflation affects growth differently than at a lower rate. It also examined whether the threshold effect is similar across developing and industrial countries. The authors used data set from 140 countries[3] and used growth rate in GDP recorded in local currencies and inflation measured by percentage change in CPI index. In order to test for the existence of a threshold effect, a log model of inflation was estimated. With the threshold level of inflation unknown, the authors estimated it using conditional least squares (CLS) along with the other regression parameters. Empirical results suggested that inflation levels below the threshold levels of inflation have no effect on growth, while inflation rates above the threshold have a significant negative effect on growth. The authors' results were that the threshold is lower for industrialized countries (1-3 per cent) than it is for developing countries (7-11 per cent). The thresholds were statistically significant at 1 per cent or less, implying that the threshold estimates were very robust.

Ghosh and Phillips (1998) used a data set of 3,603 annual observations on real per capita GDP growth, and period average consumer price inflation, corresponding to 145 countries, over the period of 1960-1996. The objective of the authors was to determine whether inflation-growth correlation is robust. Furthermore, they also checked for non-linearity of the relationship. Their results revealed that there is a negative relationship between inflation and growth. They found that, at very low rates of inflation (2-3 per cent a year or lower), inflation and growth are positively correlated. Otherwise, inflation and growth are negatively correlated, but the relationship is convex. The authors also found a threshold at 2.5 per cent and a significant negative effect above this level. Similarly, the empirical results by Nell (2000) suggest that inflation within the single-digit zone may be beneficial, while inflation in the double-digit zone appears to impose slower growth.

Sarel (1995) used panel data set of 248 observations from 87 countries so as to test whether inflation had a negative effect on growth. In addition, the paper also examined the level of inflation at which the structural break occurs. The finding was that there is evidence of a structural break. The break was estimated to occur when the inflation rate is 8 per cent. It was found that below this rate, inflation does not have any influence on growth or at least there may be a slight positive effect. Furthermore, the author found out that when the inflation rate is above 8 per cent, the estimated effect of inflation of economic growth is negative, significant and robust.

[3] Comprising both industrial and developing countries

Gillman et al. (2002), using the panel data of Organisation for Economic Cooperation and Development (OECD) and Asia-Pacific Economic Cooperation (APEC) countries, found out that the reduction of high and medium inflation (double-digits) to moderate (single-digit) figures has a significant positive effect on economic growth both for the OECD and APEC countries.

Bruno and Easterly (1996) found no evidence of any relationship between inflation and growth at annual inflation rates of less than 40 per cent. However, they found a negative, shorter to medium term relationship between high inflation (more that 40 per cent) and growth.

Empirical findings by Fischer (1993) indicate that inflation reduces growth by reducing investment and productivity growth. He further observed that, low inflation and small fiscal deficits are not necessary for high growth even over long periods; likewise, high inflation is not consistent with sustained economic growth.

3. EMPIRICAL ANALYSIS

3.1 Model specification

The model is adopted from the model developed by Khan and Senhadji (2001) for the analysis of the threshold level of inflation for industrialized and developing countries. The theoretical and empirical framework as articulated in section two suggests a four-variable model consisting of economic growth, inflation rate, population growth and investment growth rates.

The Augmented Dickey Fuller (ADF) tests were done to test for stationarity of all the variables. All variables were found to be integrated of order one I(1), meaning that they had to be differenced once in order to be rendered stationary (see computability of variables below equation 1).

The model for Lesotho is therefore arithmetically specified in the following manner:

$$Growth_t = \beta_0 + \beta_1(Inf_t) + \beta_2 * D_t(Inf_t - \kappa) + \beta_3(Pop_t) + \beta_4(Inv_t) + \varepsilon_t \ \ldots\ldots\ldots\ldots\ldots \rightarrow [1]$$

Where $\varepsilon_t \approx NID(0, \delta^2)$

Whereby the variables are computed as:

$$Growth_t = 100 * DLog(Y_t)$$
$$Inf_t = 100 * DLog(P_t)$$
$$Pop_t = 100 * DLog(Pn_t)$$
$$Inv_t = 100 * DLog(I_t)$$

The dummy variables are defines as follows:

$D_t =$ 1: $100*DlogP_t > k$

0: $100*DlogP_t \leq k$

Table 1: Definition of variables

Variables	Definition
Growth	Growth rate of real gross domestic product
Inf	Inflation
Inv	Growth rate of real investment
Pop	Population growth rate
P	Consumer price index
K	Optimal level of inflation
Pn	Population (in millions)
I	Real investment
ε	Stochastic error term

The **value of *k*** is given arbitrarily for estimation purposes; the **optimal *k*** is obtained by finding the value that minimises the residual sum of squares (RSS). Thus, the optimal level of inflation is the one that minimises the sequence of RSS.

3.2 Model Estimation

The study uses the quarterly time-series data for the period 1981 to 2004, on Consumer Price Index (base year = 1995), real GDP (at constant 1995 prices), population and real gross fixed capital formation (real investment; also based on the 1995 constant prices). Data unavailability is the main concern in carrying out the research of this nature in most developing countries. Lesotho is therefore not an exception. The annual time-series in Lesotho is not long enough to carry out a robust and sensible econometric analysis. The data for most of the variables listed above is on annual basis. Only inflation is available on quarterly basis. As a consequence, in order to have a longer time-series data, Eviews software was used in order to carry out a cubic interpolation of the quarterly time-series. However, the methodological technicalities and underpinnings behind the interpolation technique adopted is beyond the scope of this paper.

After the interpolation procedure, the data covering 1981 QI to 2004 QIV was used and this yielded 93 observations. The variables were further transformed into logarithm form due to the following advantages as suggested by Sarel (1996) and, Ghosh and Phillips (1998):

- The log transformation provides the best fit. That is to say, the log transformation also, to some extent, smoothes time trend in the dataset.
- The log transformation can be justified by the fact that its implications are more plausible than those of a linear model.

The dataset is further smoothed using Hodrick-Prescott filter. This is a smoothing method that is widely used among macroeconomists to obtain a smooth estimate of the long-term trend component of a series. Before estimating the model, Granger-Causality test is applied to measure the linear causation between inflation and economic growth.

4. ESTIMATION RESULTS

Table 2 depicts the results of the Granger-Causality between inflation and economic growth.

Table 2: Pair wise Granger Causality Tests

Sample: 1981:1 2004:4
Lags: 7

Null Hypothesis:	Obs	F-Statistic	Probability
INF does not Granger Cause Y	86	3.93980	0.00570
Y does not Granger Cause INF		2.85779	0.02871

Test statistics in Table 2 show that the null hypothesis is rejected, which means that inflation rate Granger-Causes real GDP growth. The causality between the two variables is two-directional. The second null hypothesis of economic growth Granger-Causes inflation is also rejected, which implies that there is a two-way causality between economic growth and inflation. Granger-causality test also implies that there is a long-run relationship between the above-mentioned variables and hence the variables are co-integrated. *However, one has to be very careful in implementing the Granger-Causality test because it is very sensitive to the number of lags used in the analysis*. Thus the Akaike Information Criterion (AIC) and Schwarz Information Criterion (SIC) were used to determine the lag length with the minimum preferred.

Table 3: Estimation of log-linear model at k = 1 to 12 %
(Dependent variable: Real GDP growth)

k	**Variable**	**Coefficient**	**Std. Error**	**t-stats**	**Prob.**	**RSS**
1%	*Inflation*	3.0848	0.9999	3.0851	0.0028	0.4117
	(Inf>1)(Inf-1)*	-1.8066	1.4498	-1.2461	0.2163	
	Population growth	-0.1162	0.06617	-1.7555	0.0829	
	Investment growth	0.1922	0.0251	7.6479	0.0000	
	C	0.4349	0.2049	2.1231	2.1231	
3%	*Inflation*	3.0848	0.9999	3.0851	0.0028	0.4117
	(Inf>3)(Inf-3)*	-1.8066	1.4498	-1.2461	0.2163	
	Population growth	-0.1162	0.06617	-1.7555	0.0829	
	Investment growth	0.1922	0.0251	7.6479	0.0000	
	C	0.3989	0.1838	2.1708	0.0329	
5%	*Inflation*	-3.0848	0.9999	-3.0851	0.0028	0.4117
	(Inf>5)(Inf-5)*	-1.8066	1.4498	-1.2461	0.2163	
	Population growth	-0.1162	0.0662	1.7555	0.0830	
	Investment growth	0.1922	0.0251	7.6479	0.0000	
	C	0.3627	0.1651	-2.1971	0.0309	
7%	*Inflation*	-2.5634	0.9555	-2.6829	0.0088	0.4184
	(Inf>7)(Inf-7)*	-0.8072	1.6598	-2.6829	0.0088	
	Population growth	-0.0789	0.0297	-1.1273	0.2629	
	Investment growth	0.1830	0.0297	6.1704	0.0000	
	C	0.2847	0.1617	1.7606	0.0821	
9%	*Inflation*	-2.1725	0.7373	-2.9466	0.0042	0.3734
	(Inf>9)(Inf-9)*	-7.2811	2.2992	-3.1668	0.0022	
	Population growth	-0.2167	0.0652	3.3257	0.0013	
	Investment growth	0.3218	0.0507	6.3454	0.0000	
	C	0.6088	0.1718	3.5429	0.0007	

10%	*Inflation* *(Inf>10)*(Inf-10)* *Population growth* *Investment growth* *C*	-1.5208 -6.9758 -0.1425 0.3102 0.5014	0.7664 2.0732 0.0473 0.0449 0.1476	-1.9844 -3.3648 -3.0155 6.9056 3.3963	0.0506 0.0012 0.0034 0.0000 0.0011	0.3682
11%	*Inflation* *(Inf>11)*(Inf-11)* *Population growth* *Investment growth* *C*	-1.8538 -3.7165 -0.0640 0.2333 0.3045	0.8116 2.2275 0.0413 0.0414 0.1373	-2.2841 -1.6684 -1.5479 5.6358 2.2169	0.0250 0.0991 0.1255 0.0000 0.0294	0.4057
12%	*Inflation* *(Inf>12)*(Inf-12)* *Population growth* *Investment growth* *C*	-2.1154 -2.1577 -0.0523 0.1944 0.2574	0.8103 2.7458 0.0412 0.0344 0.1353	-2.6106 -0.7858 -1.2703 5.6585 1.9021	0.0108 0.4343 0.2076 0.0000 0.0607	0.4164
• *(Inf>k)*(Inf-k) denotes the dummy variable*						

The estimation of equation 1 gives a precise value of the optimal level and also quantifies the impact of that level on economic growth (Table 3). Therefore, equation 1 is estimated and the RSS for optimal level of inflation ranging from 1 per cent to 12 per cent was computed. In the Granger-Causality test depicted in table 2, inflation rate was found to be Granger-Causing economic growth and vice versa, at a lag of seven (lag = 7) for the given period of 1981 QI to 2004 QIV; therefore inflation is kept at lag seven in the estimate. The optimal level is therefore identified as the one that minimises the sequence of RSS as depicted in table 3 and figure 2.

Figure 2: The value of k versus the residual sum of squares

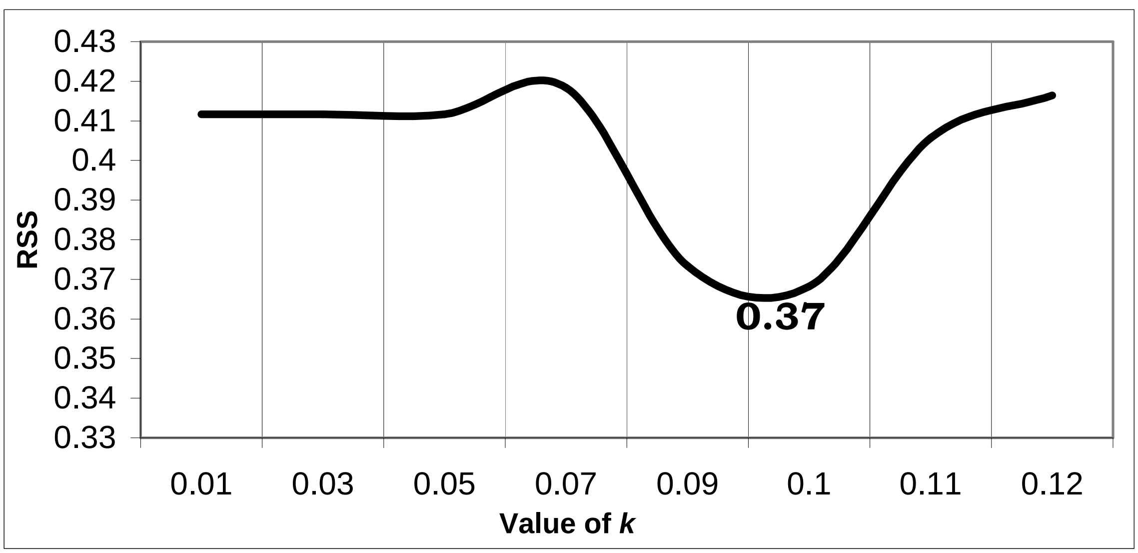

Table 3 and figure 2 illustrates the level of inflation, which is conducive for economic growth, and this is found to be 10 per cent and this is in line with the findings by Khan and Senhadji (2001). These authors found out that for developing countries, the optimal level of inflation ranges between 7 and 11 per cent.

5. DIAGNOSTIC TESTS

Diagnostic tests were done for all twelve estimated equations as depicted in table 3, however, only diagnostic results for the optimal level of inflation are depicted in table 4 below.

Table 4: Diagnostic tests for optimal level of inflation

Equation	Test for	Test Statistic	Conclusion
$K = 10$	**1. Normality** (JB test)	P = 0.196	Residuals Normally distributed
	2. Serial Correlation (LM test)	P = 0.65	No serial correlation
	3. Heteroscedasticity White (cross terms) White (No cross terms)	P = 0.15 P = 0.09	No heteroscedasticity
	4. Stability Cusum Cusum square	Within the bands	stable

The diagnostic tests carried out for all twelve equations were all satisfied. The residuals for all the estimated equations were found to be normally distributed and stable. No serial correlation and heteroscedasticity were observed in all the equations, implying that the estimates are reliable and therefore, can be relied upon.

6. CONCLUSION AND POLICY RECOMMENDATIONS

The estimates of causality test and an application of optimisation model suggests the following major findings. The Granger-Causality test identified a feedback or bilateral causality between inflation and economic growth. This helped to some extend, in the model specification. The results of the model recommend a 10 per cent optimal level of inflation, which is conducive for economic growth. The implication is that any inflation rate above this optimal level seems to affect economic growth negatively.

The finding of the study provides the CBL, whose primary objective is the achievement and maintenance of price stability, with an ideal (optimal) rate of inflation, which is conducive for economic growth. Within the Common Monetary Area (CMA) Agreement, the South African Reserve Bank (SARB) pursues the inflation targeting framework and the target range for CPI, excluding interest on mortgage bonds (CPI-X) is defined as 3 per cent to 6 per cent, hence the upper band of 6 per cent seems to be rather low for the case of Lesotho since the optimal level of inflation conducive for economic growth is found to be 10 per cent. This is bearing in mind that the CBL does not conduct an independent monetary policy implying that the monetary policy within the country is closely linked to the South African monetary policy.

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APPENDIX

(Estimation of non-linear models at K= 1% to 12%)

k =1 %

Dependent Variable: Y
Method: Least Squares
Date: 07/18/06 Time: 13:08
Sample(adjusted): 1983:3 2004:4
Included observations: 86 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-7)	3.084842	0.999909	3.085124	0.0028
POP	-0.116176	0.066179	-1.755482	0.0830
INV	0.192154	0.025125	7.647963	0.0000
Dummy variable	-1.806648	1.449797	-1.246139	0.2163
C	0.434974	0.204878	2.123085	0.0368

R-squared	0.867132	Mean dependent var	0.505051
Adjusted R-squared	0.860570	S.D. dependent var	0.190932
S.E. of regression	0.071295	Akaike info criterion	-2.387612
Sum squared resid	0.411716	Schwarz criterion	-2.244917
Log likelihood	107.6673	F-statistic	132.1566
Durbin-Watson stat	1.878343	Prob(F-statistic)	0.000000

K= 3 %

Dependent Variable: Y
Method: Least Squares
Date: 07/18/06 Time: 13:11
Sample(adjusted): 1983:3 2004:4
Included observations: 86 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF(-7)	3.084842	0.999909	3.085124	0.0028
POP	-0.116176	0.066179	-1.755482	0.0830
INV	0.192154	0.025125	7.647963	0.0000
Dummy variable	-1.806648	1.449797	-1.246139	0.2163
C	0.398841	0.183774	2.170281	0.0329

R-squared	0.867132	Mean dependent var	0.505051
Adjusted R-squared	0.860570	S.D. dependent var	0.190932
S.E. of regression	0.071295	Akaike info criterion	-2.387612
Sum squared resid	0.411716	Schwarz criterion	-2.244917
Log likelihood	107.6673	F-statistic	132.1566
Durbin-Watson stat	1.878343	Prob(F-statistic)	0.000000

K=5 %

Dependent Variable: Y
Method: Least Squares
Date: 07/18/06 Time: 10:12
Sample(adjusted): 1983:3 2004:4
Included observations: 86 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POP	-0.116176	0.066179	-1.755482	0.0830
Dummy varibale1	-1.806648	1.449797	-1.246139	0.2163
INF(-7)	-3.084842	0.999909	-3.085124	0.0028
INV	0.192154	0.025125	7.647963	0.0000
C	0.362708	0.165082	2.197139	0.0309

R-squared	0.867132	Mean dependent var	0.505051
Adjusted R-squared	0.860570	S.D. dependent var	0.190932
S.E. of regression	0.071295	Akaike info criterion	-2.387612
Sum squared resid	0.411716	Schwarz criterion	-2.244917
Log likelihood	107.6673	F-statistic	132.1566
Durbin-Watson stat	1.876444	Prob(F-statistic)	0.000000

K=7 %

Dependent Variable: Y
Method: Least Squares
Sample(adjusted): 1983:3 2004:4
Included observations: 86 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POP	-0.078851	0.069945	-1.127338	0.2629
INV	0.183001	0.029658	6.170424	0.0000
INF (-7)	-2.563439	0.955485	-2.682868	0.0088
Dummy variable2	-0.807165	1.659897	-0.486274	0.6281
C	0.284694	0.161699	1.760638	0.0821

R-squared	0.864979	Mean dependent var	0.505051
Adjusted R-squared	0.858311	S.D. dependent var	0.190932
S.E. of regression	0.071870	Akaike info criterion	-2.371537
Sum squared resid	0.418388	Schwarz criterion	-2.228843
Log likelihood	106.9761	F-statistic	129.7263
Durbin-Watson stat	1.667239	Prob(F-statistic)	0.000000

K=9 %

Dependent Variable: Y
Method: Least Squares
Sample(adjusted): 1983:3 2004:4
Included observations: 86 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POP	-0.216685	0.065156	-3.325650	0.0013
Dummy variable3	-7.281068	2.299165	-3.166832	0.0022
INF(-7)	-2.172463	0.737254	-2.946696	0.0042
INV	0.321786	0.050711	6.345440	0.0000
C	0.608844	0.171849	3.542907	0.0007

R-squared	0.879503	Mean dependent var	0.505051
Adjusted R-squared	0.873553	S.D. dependent var	0.190932
S.E. of regression	0.067894	Akaike info criterion	-2.485349
Sum squared resid	0.373380	Schwarz criterion	-2.342655
Log likelihood	111.8700	F-statistic	147.8046
Durbin-Watson stat	1.837464	Prob(F-statistic)	0.000000

K=10 %

Dependent Variable: Y
Method: Least Squares
Date: 07/18/06 Time: 10:21
Sample(adjusted): 1983:3 2004:4
Included observations: 86 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POP	-0.142483	0.047250	-3.015501	0.0034
Dummy variable4	-6.975788	2.073166	-3.364799	0.0012
INV	0.310240	0.044926	6.905602	0.0000
INF(-7)	-1.520847	0.766386	-1.984440	0.0506
C	0.501400	0.147633	3.396274	0.0011

R-squared	0.881191	Mean dependent var	0.505051
Adjusted R-squared	0.875324	S.D. dependent var	0.190932
S.E. of regression	0.067417	Akaike info criterion	-2.499454
Sum squared resid	0.368151	Schwarz criterion	-2.356760
Log likelihood	112.4765	F-statistic	150.1918
Durbin-Watson stat	1.778434	Prob(F-statistic)	0.000000

K=11 %

Dependent Variable: Y
Method: Least Squares
Sample(adjusted): 1983:3 2004:4
Included observations: 86 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
POP	-0.064005	0.041349	-1.547933	0.1255
Dummy variable5	-3.716481	2.227514	-1.668443	0.0991
INF(-7)	-1.853833	0.811623	-2.284107	0.0250
INV	0.233357	0.041406	5.635826	0.0000
C	0.304477	0.137342	2.216931	0.0294

R-squared	0.869084	Mean dependent var	0.505051
Adjusted R-squared	0.862619	S.D. dependent var	0.190932
S.E. of regression	0.070769	Akaike info criterion	-2.402412
Sum squared resid	0.405668	Schwarz criterion	-2.259717
Log likelihood	108.3037	F-statistic	134.4289
Durbin-Watson stat	1.877743	Prob(F-statistic)	0.000000

K= 12 %

Dependent Variable: Y
Method: Least Squares
Date: 07/18/06 Time: 10:31
Sample(adjusted): 1983:3 2004:4
Included observations: 86 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INV	0.194388	0.034353	5.658527	0.0000
INF(-7)	-2.115378	0.810309	-2.610581	0.0108
Dummy variable6	-2.157680	2.745832	-0.785802	0.4343
POP	-0.052345	0.041206	-1.270332	0.2076
C	0.257424	0.135339	1.902064	0.0607

R-squared	0.865609	Mean dependent var	0.505051
Adjusted R-squared	0.858972	S.D. dependent var	0.190932
S.E. of regression	0.071702	Akaike info criterion	-2.376217
Sum squared resid	0.416435	Schwarz criterion	-2.233522
Log likelihood	107.1773	F-statistic	130.4297
Durbin-Watson stat	1.794328	Prob(F-statistic)	0.000000