Estimating the Threshold Level of Inflation for Thailand

Jiranyakul, Komain

National Institute of Development Administration

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Komain Jiranyakul
School of Development Economics
National Institute of Development Administration
Bangkok, Thailand
Email: komain_j@hotmail.com

Abstract:

This paper analyzes the relationship between inflation and economic growth in Thailand using annual dataset during 1990 and 2015. The threshold model is estimated for different levels of threshold inflation rate. The results suggest that the threshold level of inflation above which inflation significantly slow growth is estimated at 3 percent. The negative relationship between inflation and growth is apparent above this threshold level of inflation. In other words, the inflation rate that is higher than this threshold level can jeopardize the growth rate of the country.

Keywords: Inflation, growth, threshold model
JEL Classification: C13, E31

1. Introduction

Previous empirical studies document the nonlinear relationship between inflation and economic growth. The relationship between inflation and growth is positive when the inflation rate is low and negative when the inflation rate is higher than the threshold level. Due to the existence of this phenomenon, many economies set inflation target such that inflation rates should not harm or slow output growth. Ghosh and Phillips (1998) find that the threshold level of inflation at only 2.2 percent can jeopardize output growth in industrialized countries. Khan and Senhadji (2001) estimate the threshold level of inflation for both developed and developing countries. Their results suggest that the threshold level of inflation for developing countries is higher than that of developed countries. Mubarik (2005) employs this type of threshold model to estimate the threshold level of inflation for Pakistan and finds that this level is at 9 percent. Burdeken et al. (2004) find that the effects of inflation on growth change substantially as inflation rises. Furthermore, the nonlinearities in the relationship are quite different for industrialized countries than for developing countries. Lopez-Villavicencio and Mignon (2011) examines the growth effect of inflation on a wide sample of industrialized and emerging economies. They find that there exists a threshold beyond which inflation exerts a negative effect. Seletang et al. (2013) examine the inflation-growth nexus in the Southern African Development Community region by employing a panel smooth transition regression (PSTR) approach. They find that the threshold level of inflation of 18.9 percent can jeopardize output growth in this region. Employing the PSTR approach to estimate the threshold level for the ASEAN-5 economies, Than (2015) finds that the threshold level of inflation for this economies is at 7.8 percent.

Thailand experienced moderate inflation with the average rate of inflation of 3.19 percent per annum during 1990 and 2015. The country's average annual growth rate was 4.14 percent. The historical nature of the relationship between inflation and output growth is illustrated in Figure 1.

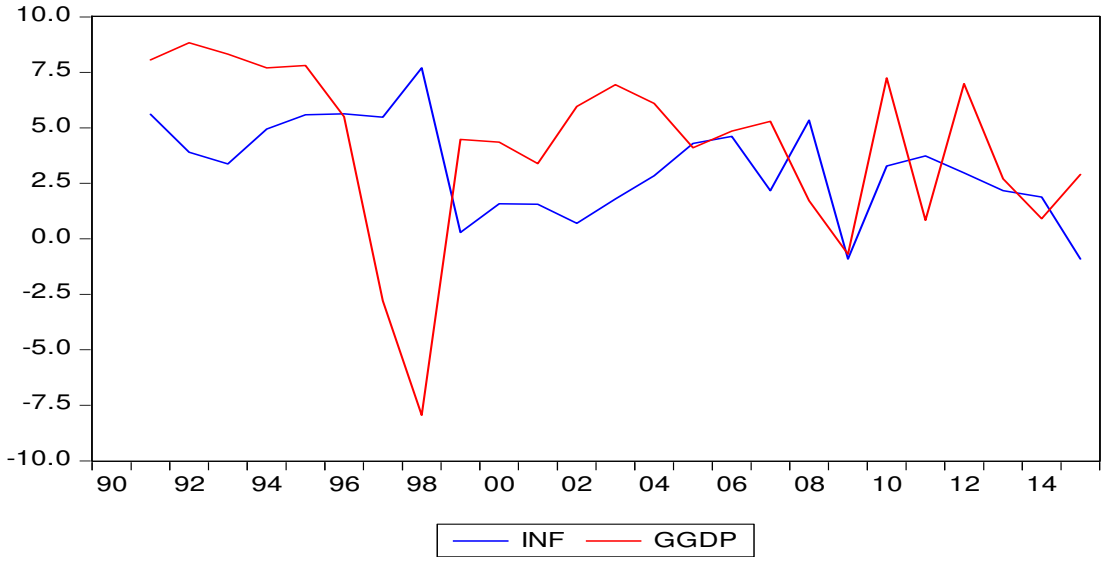

Figure 1. Annual Inflation and Growth Rates (1990-2015)

The figure shows somewhat negative relationship between inflation and output growth. However, this figure does not show a precise picture of the relationship. Since the literature suggests a negative relationship between the two variables, a sound econometric method should be employed to confirm the relationship.

The present paper uses annual data for the period 1990 to 2015 for the estimation of the threshold level of inflation for Thailand. The main finding is that there exists a negative relationship between inflation and economic growth when inflation rate is above the threshold level. The estimated threshold level of inflation is 3 percent. The inflation rate above this threshold level can harm output growth. The finding can give a clue for policymakers. The paper is organized as follows. Section 2 explains the data and estimation methods used in this study. Section 3 presents empirical results with some discussion, and the last section gives concluding remarks.

2. Data and Methodology

2.1 Data

This study uses annual dataset comprising consumer price index (CPI), real GDP, population, and the ratio of investment to nominal GDP. The selection of sample is based on the availability of the data. The dataset is obtained from the Bank of Thailand website, except for the series of investment ratio, which is obtained from Economy Watch com's Econ Stats database. The inflation rate, economic growth rate and the rate of population growth are computed by using log transformation as used by Khan and Senhadji (2001). The main advantage of using log transformation is that this method should provide best fit in the class of non-linear model (see Mubarik, 2005).

The unit root test statistics show that the four variables that will be used contain no unit root. Therefore, it will be suitable for applying Granger causality test and estimating the non-linear model.

2.2 Estimation Methods

To test for the existence of linear causation between inflation and economic growth, the standard Granger causality test can be applied. The test equations are specified by the following equations:

$$gGDP_t = a_{01} + \sum_{i=1}^{p} b_{11} gGDP_{t-1} + \sum_{i=1}^{p} b_{21} INF_{t-i} + \varepsilon_{1t} \quad (1)$$

and

$$INF_t = a_{02} + \sum_{i=1}^{p} b_{12} INF_{t-1} + \sum_{i=1}^{p} b_{22} gGDP_{t-i} + \varepsilon_{2t} \quad (2)$$

where *gGDP* is the growth rate (= d(logGDP)*100), *INF* is inflation rate (= d(logCPI)*100), and *p* is the optimal order of lags in the test equations. Equation (1) is used to test for causality running from inflation to economic growth while equation (2) is used to test for causality running from economic growth to inflation. The test results might help in determining the choice of dependent and independent variables in threshold estimation. In addition, the test results can show whether there exists linear relationship.

The threshold model developed by Khan and Senhadji (2001) and used by Mubarik (2005) is used in the analysis of threshold level of inflation. The model comprises four variables, which are the growth rate, inflation rate, population growth and investment ratio. Population growth and investment are believed to enhance economic growth in the growth model (see Mankiw et al., 1992, among others). The threshold model is specified by the following equation:

$$gGDP_t = \beta_0 + \beta_1 INF_t + \beta_2 D_t * (INF_t - k) + \beta_3 gPOP + \beta_4 INVratio + e_t \quad (3)$$

where *gPOP* is the growth rate of population (= d(logPopulation)*100), *INVratio* is the ratio between private investment spending and nominal GDP as a percentage) and *k* is threshold level of inflation. The dummy variable, *D*, is defined as:

$$D_t = 1 : INF_t > k, = 0 : INF_t \leq k$$

The parameter *k* possesses the property that the relationship between inflation and growth is given by low inflation rate: β_1; and high inflation rate: $\beta_1 + \beta_2$. If β_2 is statistically significant, the impact of inflation on economic growth will be added even though β_1 is statistically significant or not. Since the value of k is arbitrary, the optimal *k* can be obtained from estimates of equation (3) by selecting the value from estimated equation that gives the lowest fraction of residual sum of squares (RSS).

3. Empirical Results

In order to measure the linear causation between economic growth and inflation, standard Granger causality test is performed. Test statistics in Table 1 show that the null hypothesis is rejected at the 10 percent level of significance, which implies that output growth positively causes inflation. For the feedback, the null hypothesis cannot be rejected, which implies that inflation does not negatively cause output growth. Even though the test results might help in the choice of dependent and independent variables for the specification of the threshold model, the finding that output growth Granger causes inflation is marginally significant. It can be concluded that the results are not robust enough. The inflation-growth nexus can be far from being linear (Lopez-Villavicencio and Mignon, 2011). Thus the choice of dependent and independent variables in equation (3) is used in the threshold estimation.

Table 1. Pairwise Granger Causality Tests, 1990-2015.

Null hypothesis	Observations	F-Statistics	Prob.
gGDP does not cause INF	24	3.199 (+)	0.088
INF does not cause gGDP	24	0.724 (-)	0.404

Note: + indicates positive causation while – indicates negative causation. The optimal lag of one is determined by Akaike Information Criterion (AIC).

The estimates of equation (3) with the threshold values ranging from 2 to 6 percent are reported in Table 2.

Table 2. Estimation of Threshold Model at k = 2 to 5.
(Dependent Variable: GDP growth)

k	Variable	Coefficient	S.D	t-Statistic	Prob.	RSS
	INF	0.795	0.740	1.074	0.296	
	(INF>2)*(INF-2)	-2.636	0.968	-2.725	0.013	
2%	Population growth	-0.218	0.889	-0.245	0.809	0.362
	Investment ratio	0.426	0.088	4.828	0.000	
	Constant	-6.480	2.188	-2.962	0.008	
	INF	0.151	0.565	0.991	0.373	
	(INF>3)*(INF-3)	-2.889	0.903	-3.198	0.005	
3%	Population growth	0.121	0.875	0.138	0.892	0.328
	Investment ratio	0.374	0.087	4.279	0.000	
	Constant	-5.620	2.032	-2.766	0.012	
	INF	0.082	0.500	0.165	0.871	
	(INF>4)*(INF-4)	-2.963	1.007	-2.803	0.011	
4%	Population growth	-0.145	0.889	-0.164	0.872	0.356
	Investment ratio	0.339	0.096	3.524	0.002	
	Constant	-4.337	2.126	-2.040	0.055	
	INF	-0.213	0.475	-0.448	0.659	
5%	(INF>5)*(INF-5)	-3.607	1.555	-2.319	0.031	
	Population growth	-0.307	0.925	-0.332	0.744	0.391
	Investment ratio	0.299	0.113	2.635	0.016	
	Constant	-2.899	2.401	-1.207	0.241	

Note: The dummy variable is (INF>k), k is the threshold value, and INF is inflation rate.

The results in Table 2 reveal that the estimated coefficient of population growth is not statistically significant for all levels of threshold inflation rate. On the contrary, the estimated coefficient of investment ratio is statistically significant for all levels of threshold inflation, which means that investment significantly stimulates output growth. Furthermore, the estimated coefficient β_1 is statistically insignificant for all specified threshold levels of inflation. This result implies that there is no relationship between inflation and output growth at low level of inflation. However, the estimated coefficient of the threshold level inflation is statistically significant at least at the 5 percent level for all *k*s. The threshold level of inflation is at 3 percent, which is obtained by finding the minimum value of the fraction of residual sum of squares (RSS).

It should be noted that there exists a significant negative relationship between inflation and output growth for inflation rates above the threshold level of inflation. This finding is in line with the finding for individual country study by Mubarik (2005) for Pakistan. However, the threshold level of inflation found in this study is much lower than the level found by Than (2015) for the ASEAN-5 economies (Indonesia, Malaysia, Philippines, Singapore, and Thailand). It is possible that individual country study will give different results from a group of countries study. Furthermore, different time periods of investigation might matter.

4. Concluding Remarks

This study employs causality test and estimates the specified threshold model using Thailand's annual dataset of inflation and output growth along with other two variables during the 1990-2005 period. The results from standard causality tests show the absence of linear causations between output growth and inflation. The threshold model estimation suggests that the threshold level of inflation is at 3 percent. Inflation rates above this threshold level can harm output growth of the country. The finding can be useful for policymakers in that it provides a clue in setting an inflation target.

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