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Inflation and Growth in Fiji: A Study on Threshold Inflation Rate

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Abstract: Industrialized countries have been pursuing expansionary monetary policies since the onset of recession in 2008. Farhi (2012) suggests that the only way open to the US policy makers is to encourage inflation for promoting growth. In Fiji, the Reserve Bank keeps the benchmark rate at a historically lowest rate at 0.5 percent since October 2011. This raises the question of finding a threshold inflation rate up to which growth is positively influenced by inflation, and above which rise in inflation would negatively affect growth. This paper undertakes an empirical study of threshold inflation in Fiji.

Keywords: Threshold, Inflation, Fiji

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1. Introduction

Viewed against backdrop of the ongoing world recession, the topic of inflation and economic growth has once again assumed importance. For instance, Farhi (2012) suggests that the only way open to the US policy markers is to encourage inflation for promoting growth, as the US has been in "a liquidity trap" with the interest rate being close to zero during last two years. Expansionary monetary and fiscal policies are not unusual in the midst of a declining aggregate demand. Fiji and other Pacific island countries (PICs), reeling under the impact of world economic downturn since 2008 have been pursuing policies to step up domestic demand for mitigating the adverse effects of falling external demand. While the success of fiscal policies is largely determined by public sector efficiency in the implementation of projects, the efficacy of monetary policy is determined by the degree of financial sector development, which facilitates effectiveness of transmission mechanism Jayaraman (2011). One early warning sign is the build-up of excess liquidity in the banking system, which is reflected the ratio of excess reserves to total deposits. Given the benign inflationary outlook viewed against the background of low investor confidence, Fiji's monetary policy of Reserve Bank of Fiji (RBF) with the historically lowest benchmark interest rate at 0.5 percent rate since October 2011 has been described as appropriate by International Monetary Fund (IMF 2012). However, one

cannot ignore the caution sounded by IMF against the high risk involved in the current accommodative policy stance.

During the first six years of this century, inflation on an average was hovered around 2.5 percent until 2006. In the next year, it rose to 4.8 percent in 2007, which witnessed an unprecedented credit boom in Fiji. Sudden spurt in world food prices and uncertainties in world oil market resulted in a big rise in Fiji's inflation in 2008. World recession since late 2008 dampened the demand for primary commodities all over the world, which helped Fiji's inflation to come down from the 2009 high to 3.7 percent. However, natural disasters, including floods in the northern and the western divisions destroyed farm lands and disrupted communications and resultant shortages and led to rise in price level in 2011.

In these circumstances, it would be of interest to return to the topic of inflation and growth in Fiji. Gokal and Hanif (2004), who studied inflation and growth over a 34-year period (1970-2003), came to the conclusion that there was a less than robust link between inflation and economic growth. Focusing only on the bi-variate relationship, the two authors found that the correlation coefficients displayed only a weak negative link together with causality connection running from economic growth to inflation. Although they indicated the possibility of a threshold rate of inflation, they did not probe it further but attributed their study result to the structure of the economy.

The objective of our investigation in this paper is not only to update the study by Gokal and Hanif (2004) but also extend to the study beyond bi-variate relationship by including some relevant explanatory variables and determine the threshold of inflation for Fiji along the lines of pioneering studies by Sarel (1996) and Khan and Senhadji (2001). The paper is organized on the following lines: Section 2 presents a brief literature review; Section 3 outlines the modeling methodology adopted for the study; Section 4 reports results; and Section 5 is a summary presenting some conclusions with policy implications.

2. Brief literature Review

The relationship between inflation and economic growth has received considerable attention in economic literature right from the classical era to modern times. The neoclassicals, notably Mundell (1963) and Tobin (1965) believed that rise in inflation or inflation expectations reduce wealth. As the rate of return on real balances would fall, economic agents prefer real assets. For accumulating them, they are forced to save and capital accumulation begins; and in the process, inflation causes agents to switch on to real assets, thereby promoting growth. Thus, the neoclassicals firmly believed that inflation and growth are positively related. However, rational expectations theorists laying stress on

inflationary spiral possibilities argued that gradually increasing price level can transform into macroeconomic uncertainty, which is harmful for economic growth.

In a succinct summary, Drukker *et al*. (2005) listed the chief observations made by four schools of economists regarding the impact of inflation on output and growth and categorises them into four: (i) Sidrauski (1967): there is no effect of inflation on growth; (b) Tobin (1965): money is a substitute for capital, causing inflation to have a positive effect on long-run growth; (c) Stockman (1981): money is complementary to capital, causing inflation to have a negative effect on long-run growth; and (d) empirical models: inflation has a negative effect on long-run growth, but only if the inflation rate exceeds certain threshold level (Sarel 1996, Khan and Senhadji 2001)

Just as the theoretical contributions over a century differed, so too was the inconclusive nature of empirical evidence. For instance, Fischer (1991) found a significantly negative relationship between inflation and growth. Kearney and Chowdhury (1997) undertook a study on causal relationship in 70 countries and concluded that there was no causal relationship between inflation and growth. In a study on South Asian countries, Malik and Chaudhury (2001) noted positive association between inflation and growth and sensitivity of inflation to changes in growth rate is larger than that of growth to change in inflation rate. Black *et al.* (2001) in their study on the US economy, found a positive association between inflation and growth during the 1980s accompanied by a downward trend in inflation. Regarding desirability of lower inflation from the point of view on promoting growth, the former US Fed Governor Ferguson referred to the pertinent question: "Is the pace of economic development slower when inflation is at 15 percent than when it is at 5 percent?" (Ferguson 2005). By way of response, he referred to two studies by Sahel (1996) and Khan and Senhadji (2001)[1]. The latter two studies, using nonlinear estimation techniques, explored the existence of thresholds above which inflation significantly slows growth.

While Sarel (1996) identified 8 percent as the rate for selected countries under his examination, Khan and Senhadji (2001) identified the thresholds from 1 percent to 3 percent for industrial economies and 11 percent to 12 percent for developing economies. Ferguson (2005) does not seem to accept such threshold estimates readily, as he refers in all fairness to the rest of the academic literature, which has not found such a clear relationship. Levine and Renelt (1992), for example, found no robust relationship in

[1] Khan and Senhadji (2001) studied 140 developing and industrialized countries for the period of 1960-98 using panel data on population, gross domestic output, consumer price indices, terms of trade, real exchange rates, government expenditures and investment rates.

exhaustive cross-section studies, and many researchers using other techniques have also failed to detect a significant relationship.

The problem may lie in identifying the direction of causation: In the short-to-medium run, causality may run from higher growth to higher inflation, as business-cycle pressures push spending and activity above the economy's capacity. This direction of causality may obscure the negative relationship, running from higher inflation to lower growth, presumed to hold in the longer term. Given these limitations, it would be worthwhile to estimate the inflation threshold in Fiji by employing appropriate explanatory variables and using a non-linear model along the lines of Sarel (1995) and Khan and Senhadji (2001).

3. Model and Data

The model, adopted for the study for testing the existence of a threshold inflation level is based on the studies of Sarel (1996) and Khan and Senhadji (2001), typically explains the relationship between inflation and GDP per labor in Fiji:

$$\ln(y_t) = c + \alpha \ln(k_t) + \sum \theta' X_t + \gamma_1 (1 - d_t^{\inf*}) f(\inf, \inf*) + \gamma_2 d_t^{\inf*} f(\inf, \inf*) + e_t$$

where (1)

$$f(\inf, \inf*) = (\inf_t - 1) I(\inf_t \leq 1) + [\ln(\inf_t) - \ln(\inf*)] I(\inf_t > 1)$$

In Equation (1), ln(y) is natural logarithm of real GDP per labor, ln(k) is natural logarithm of real capital stock per labor, X is a vector of other control variables including government expenditure-to-GDP (*gov*) and imports-to-exports (*imex*), inf is inflation rate, inf* is the threshold level of inflation, $d^{\inf}$ is a dummy variable that takes a value of one for inflation levels greater than inf* percent and zero otherwise, and $I(\inf \leq 1)$ and $I(\inf > 1)$ are indicator functions which take the value of one if the term between parentheses is true and zero otherwise. Parameters γ_1 and γ_2 respectively capture the effects of inflation rate less than and greater than the threshold rate.

The above model has to be estimated along with the other parameters since the threshold rate inf* is unknown. This gives raise to the need of the estimation method of nonlinear least squares (NLLS). The threshold rate is then decided upon the value of inf* which maximizes the R-squares as practiced in Sarel (1996) or minimizes the residual sum of squares (RSS) as in Khan and Senhadji (2001).

The study employs data sourced from World Bank database. The sample covers a 39-year period (1970-2008). The following time series are utilized: nominal gross domestic products, labor force, gross fixed capital formation, government expenditure-to-GDP,

imports, exports, and inflation.[2] The series which are entered into regression analysis are as follows: real GDP per labor at 2005 price, real physical capital stock per labor at 2005 price, ratio of government expenditure to GDP and ratio of imports of to exports and inflation.[3] The two ratios of Government expenditure rate and imports-to-exports are used to eliminate the negative correlation between income level and inflation which is caused by unproductive housekeeping component (which amounts to about 80 to 85 percent) of government expenditure, and unanticipated external environment shocks. Relevant series are summarized in Table 1.

Table 1: Summary of Relevant Series over 1970-2008

Year	Real GDP per labor (US$)	Real capital per labor (US$)	Government expenditure-to-GDP (%)	Imports-to-Exports (%)	Inflation (%)
Average of 1970-1979	15496.2	25443.6	14.2	112.6	10.6
Average of 1980-1989	12195.6	32437.2	17.6	105.2	7.5
Average of 1990-1999	8306.0	24291.8	17.0	102.3	4.2
Average of 2000-2004	6804.8	21301.1	16.6	114.0	2.6
2005	8795.5	21068.1	16.0	123.0	2.4
2006	8725.3	21273.9	18.2	139.6	2.5
2007	8938.3	21299.8	16.9	131.9	4.8
2008	8706.9	21586.4	14.8	140.9	7.7

Data source: World Bank (WDI).

4. Results

As a first step before undertaking the regression analyses, we resort to unit root tests of all data series that are included in the model. According to summary statistics on augmented Dickey-Fuller test results in Table 2, all the data series at their levels are found to be nonstationary, since *τao*-statistics are greater than critical values at 5% significance level and thus the null hypotheses of unit root are not rejected. By taking their first differences,

[2] Published labor force data starts from 1980. In order to obtain stable estimates for the empirical analysis, this series is extended to a longer time period starting from 1970 by multiplying population of age 15-64 by a proportion rate of 0.56. The extension is validated by consistent result from regressions using samples 1970-2008 and 1980-2008 respectively.

[3] Physical capital stock is estimated based on gross fixed capital formation using the perpetual inventory method. The benchmark capital stock in 1970 is estimated by multiplying gross fixed capital formation in 1970 by 8, and depreciation rate is set to 6 percent per year.

the data series become stationary, since *τao*-statistics are less than the critical values at 5% significance level and thus the alternative hypotheses of stationarity are favored. Thus, there is strong evidence that the data series under study series are integrated of order one. Cointegration relationship between ln(*y*) and control variables is evidenced by the stationary estimated residuals series in Equation (1) since the augmented Dickey-Fuller test statistic is less than the 5% critical value and thus the null of unit root is rejected.

Table 2: Unit Root and Cointegration Test

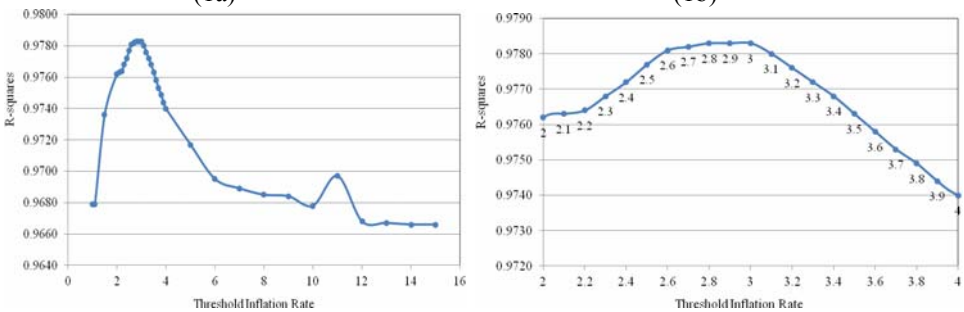
Variable	Test	Data Trend	*τao-stat*	*5% critical*
ln(*y*)	Augmented Dickey-Fuller	Drift	-1.132	-1.688
Δln(*y*)	Augmented Dickey-Fuller	None	-4.930	-2.966
ln(*k*)	Augmented Dickey-Fuller	Trend	-2.918	-3.548
Δln(*k*)	Augmented Dickey-Fuller	Drift	-1.754	-1.692
Imex	Augmented Dickey-Fuller	Intercept	-2.396	-2.964
Δ*imex*	Augmented Dickey-Fuller	None	-6.117	-2.966
Gov	Augmented Dickey-Fuller	Intercept	-1.725	-2.964
Δ*gov*	Augmented Dickey-Fuller	None	-7.784	-2.966
Predicted residual	Augmented Dickey-Fuller	None	-7.131	-2.966

Estimation of the proposed model starts with the NLLS estimator where autocorrelation in the error is found. As a remedy to the autocorrelation problem as well as to obtain a robust dynamic threshold effect in the relationship between inflation and income level in Fiji, an autoregressive distributed lags (ARDL) form is applied to Equation (1). To test for threshold effect, a set of ARDL-NLLS regressions were run each with one assumed threshold inflation rate, which yield a set of R-squares values. The threshold inflation rate is identified from the regression where the R-squares value is the highest among all regressions. In this case a scatter diagram between R-squares values and assumed threshold inflation levels is helpful.

As indicated in Figure (1b) which is part of Figure (1a), the threshold inflation level for Fiji is 3.0 percent per year. This suggests that inflation level less than 3.0 percent would benefit the Fijian economy, while inflation level higher than this rate would be harmful. Our analysis further reveals that inflation rate greater than the identified threshold level and up to 3.6 percent still continues to have positive impact on growth.

Figure 1: Root Mean Squares of Error *vs.* Threshold Rates

(1a) (1b)



The ARDL-NLLS estimation, with threshold inflation level for Fiji as 3.0 percent per year, gives the regression result as follows:

$$\begin{aligned}
\ln(\hat{y}_t) &= 2.79 + 0.46\ln(y_{t-1}) - 0.28\ln(y_{t-2}) + 3.56\ln(k_t) - 3.01\ln(k_{t-1}) \\
t &= (2.22)\ (3.81) \qquad (-2.54) \qquad (4.57) \qquad (-4.10) \\
&\quad - 0.03gov_t + 0.004imex_{t-1} + 0.003imex_{t-2} - 0.015trend \\
&\quad (-3.20) \qquad (3.22) \qquad (2.28) \qquad (-6.14) \qquad (2) \\
&\quad + 0.34(1 - d_t^{\inf*}) f(\inf, \inf*) - 0.35 d_t^{\inf*} f(\inf, \inf*) \\
&\quad (3.92) \qquad (-4.54) \\
R^2 &= 0.9783 \qquad n = 37
\end{aligned}$$

where *trend* is included to capture effect caused by technological progress. It is of interest to note that as indicated by the performance of *trend*, there is no evidence that technological progress had a positive impact on economic growth in Fiji over the time period under study.[4] This finding is consistent with the downward trend in real per capita GDP.

5. Summary and Conclusions

Economists were pre-occupied with inflation in the last three decades of the last century. The ongoing global economic downturn since late 2007, which was compounded by the Eurozone crisis since late 2011, has shown deflation, not inflation, is now the greatest concern for the world economy. There is now a renewed interest in study of relationship between inflation and economic growth.

[4] Here we refer to economic growth rather than income level because the included $\ln(y_{t-1})$ makes the model equivalent to explaining growth of income level.

A zero level of inflation or disinflation negatively impacts economic growth due to decreasing motivations of producers. Quantitative easing measures by the central banks in the US and UK which have lowered the benchmark interest rates close to zero have inspired central banks elsewhere including Fiji to adopt expansionary monetary policies. With nominal interest rate being low and in the context of recession with falling prices it is expected inflation would be more appropriate as it would keep real borrowing cost from rising and encourage investment.

Our study has shown that the threshold level of inflation for Fiji, based on the past trends in growth and inflation, is 3.6 percent. As long as the inflation level is below this threshold level, the effects on growth would be positive and any higher level would adversely affect growth. This points out to the need for constant vigilance over the inflationary pressures.

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