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Do Budget deficits cause inflation in Pacific Island Countries? An empirical study of Fiji

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Do Budget deficits cause inflation in Pacific Island Countries? An empirical study of Fiji

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ABSTRACT

The Pacific island countries (PICs), with the exception of the resource-rich Papua New Guinea, have been experiencing budget deficits now for more than two decades. There has been a widespread criticism that budget deficits are responsible for inflation. This paper seeks to test the hypothesis that budget deficits cause inflation in PICs by undertaking an empirical study of Fiji during a thirty year period: 1981-2011. The methodology employed for estimating long-run relationship is cointegration analysis, by undertaking Granger causality tests within the error correction model. The findings of the study are that budget deficits, nominal exchange rate and poor governance have indeed been responsible for inflation.

I. Introduction

In the past two decades, budget deficits have become an annual occurrence in Pacific island countries (PICs). The reasons are well documented (Jayaraman 2006). Since the end of the Cold War era with the fall of Berlin Wall in 1986, the priorities of the advanced countries in the West had changed. As a result, the donors phased out direct annual budgetary aid to PICs, most of which went earlier towards supporting the recurrent expenditures in terms of wages and salaries and other housekeeping components. Donors have since then been directing their assistance towards supporting specific programs such as education and health, and capital projects such as roads, bridges and ports construction.

Governments in PICs, being the largest employers, are keen to keep their civil servants happy and contented. Bonuses and pay revisions have been the usual occurrences whenever revenues from export taxes and levies are high, especially in boom years. Because of their failure to build up fiscal space during good years, resulting either in small or no surpluses, governments find it to difficult finance budget deficits during lean years when revenues are insufficient to cover expenditures (Jayaraman 2011). Since the revenue position in most PICs continues to be stagnant due to slack tax administration as well as frequent exercise of discretionary powers of tax exemption by ministers, the gap between revenues and rising expenditures has been widening. Based on experiences in the past, especially in Solomon Islands during the 1990s and in other

PICs as well in the recent past, academics and international funding institutions have been unanimous in their criticism of fiscal policies of PICs (ADB 2012, UN ESCAP 2012, IMF 2012a, 2102b, 2012c, 2012d, 2012e).

The critics have been holding budget deficits funded by public borrowing responsible for inflation. External shocks including sudden hikes in oil prices and staples including rice and wheat, which influence price levels in the import dependent PICs, are beyond the control of PICs. This paper seeks to test the hypothesis that budget deficits cause inflation in PICs by undertaking an empirical study of Fiji during a thirty year period: 1981-2011. Specifically, the paper examines the long-run relationship through cointegration analysis and by undertaking Granger causality tests within the error correction model. The paper is organized along the following lines: the second section presents a review of theoretical and empirical studies; the third section outlines the modeling procedure adopted in the study; and the fourth section presents the results of the empirical investigation; and the last section presents set of conclusions with policy implications.

II. A Review of Empirical Studies

Much of the theoretical literature on the subject of budget deficits causing inflation is traced to the well-known classical quantity theory of money. Since budget deficits tend to be funded by money creation through central bank financing, it is held that addition to money supply creates excess demand and results in rise in price level. As a conclusion drawn from the monetarist framework, the proposition that budget deficits are inflationary has been tested time and again. However, the empirical evidence on the relationship between budget deficits and inflation is not consistent.

Some of the earliest studies on the subject were in the United States. Niskanen (1978), Hamburger and Zwick (1981) and Dhakal *et al*. (1994) established the hypothesis that budget deficits caused inflation. The results of studies by Dwyer (1982), Karras (1994), Abizadeh and Yousefi (1998) were however to the contrary.

In regard to the developing world, studies by Aghevli and Khan (1978) on selected countries, Chang (1994) on Taiwan and Metin (1998) on Turkey showed that budget deficits led to inflation. While Hondroyiannis and Papapetrou (1997) did not find any direct impact of the budget deficit on inflation in Greece, Darrat (2000) concluded in his study that higher budget deficits had a significant hand in the Greece inflationary process. In a succinct summary, Habibullah, Cheah and Baharom (2011) note that the results of the studies undertaken during the last three-decades are mixed. The highlights of their summary are given here.

Rahman *et al*. (1996) present indirect empirical evidence by giving conclusion to long run and short run unidirectional Granger causality from budget deficits to real exchange rates, and from real exchange rates to inflation rates. However, Dwyer (1982), Brown and Yousefi (1996), Abizadeh and Yousefi (1998) provide the results that there is no connection between budget deficits and inflation. Utilising annual data of Greece for a thirty-three year period (1960-1992), Hondroyiannis and Papapetrou (1994) concluded that there was a long run relationship between government budget and price level and supported the hypothesis of a bi-directional causality between the two variables. In his study on Turkey, Metin (1995) analyzed inflation using a general framework of sectoral relationships and found that fiscal expansion was a determining factor for Turkey's inflation.

Recent studies including (Cukierman *et al.* 1992) have stressed the importance of relationship between inflation and central bank autonomy (CBA). Empirical findings lend support to the view that a high degree of CBA helps mitigate the inflationary bias of policy. Based on the concept of central banks' independence, budget deficit should Granger cause inflation in developing countries since the central banks are not autonomous in most of the developing countries (Brown and Yousefi, 1996). They began with a monetarist's premise that excessive injection of money into the income stream, in which the rate of growth of money supply exceeds the economy's rate of growth of output, is inflationary in the long run. The absence of political independence of central banks, particularly in developing countries, implies that monetary policy and price stability are undermined in these countries.

These studies imply that political independence of central banks would mean that a central bank can refuse to finance government deficits and thus, provide more financial stability than would otherwise be possible. Brown and Yousefi (1996) chose ten developing countries from a list of countries given in Cukierman *et al.* (1992) study. The countries that were studied were India, Indonesia, Israel, Mexico, Pakistan, Philippines, South Africa, Thailand, Turkey and Venezuela and the study rejected a causal relationship between inflation and deficits in these countries. Brown and Yousefi (1996) explained the results by suggesting the possibility that inflation in these countries is largely attributed to external shocks and inflation may be structural.

In a most recent study on thirteen Asian developing economies, namely; Bangladesh, India, Indonesia, Malaysia, Myanmar, Nepal, Pakistan, the Philippines, Singapore, South Korea, Sri Lanka, Taiwan and Thailand, Habibullah, Cheah and Baharoom (2011) analyzed the relationship between budget deficit and inflation. In their analysis, they took into consideration the role of money supply by examining its impact on inflation. By identifying the causal direction among the three variables, the study provided an additional piece of evidence on the growing body of literature on the budget deficits-money- inflation nexus. In the next section, we proceed to examine the long term relationship between budget deficits and inflation in Fiji.

III. Data, Modeling and Methodology

Data

The empirical analysis on Fiji employs annual data series on consumer price index and budget deficit in nominal terms for a thirty-one year period: 1981-2011. As budget deficits tend to result in rise in money supply as well as to depreciate the exchange rate, which further contribute to inflation, especially in a highly import dependent island economy, a multivariate model would be more appropriate. In order to minimize any bias due to omission of relevant variable, it was accordingly decided to strengthen the bivariate analysis.

We considered adding two more variables, namely exchange rate (units of Fiji dollar per unit of US dollar) and a governance index, which would reflect interaction of a large number of forces such as openness, competitiveness and accountability as well as central bank autonomy. While the data series on exchange rate is available, there is no consistent time series on governance index. The available data series on governance index begins only from 1996. As we need a longer time series, we use *Polity2*, an index obtained from the Polity IV project[1]. The *Polity2* index is on an increasing scale: better the degree of governance, higher is the number.

Time series data on consumer price index and nominal exchange rate were obtained from *International Financial Statistics CD Rom* (2012) and budget deficit in nominal prices data series from *Asia Pacific Developing Countries Key Indicators* (Asian Development 2012). All variables were transformed into natural logarithm for the analysis throughout the study. Table 1 presents summary statistics of data used in the study.

Table 1. Data for study

	Price Index[1]	Budget Deficit (FJ$MILL)	Exchange Rate (FJ$/US$)	Polity2 Index[2]
1981-1985	40.40	71.66	1.02	9.00
1986-1990	53.26	86.34	1.35	1.00
1991-1995	71.07	72.58	1.48	5.00
1996-2000	82.72	124.20	1.79	5.20
2001-2005	94.88	216.73	1.96	5.40
2006-2011	118.28	166.10	1.77	-3.83
Mean (1981-2011)	78.11	124.33	1.57	3.39
Standard deviation (1981-	27.61	69.94	0.37	4.76

[1] The Polity2 index, which is cited widely in the literature, is the most popular measure of a country's political regime (Plümper and Neumayer, 2010). The data is available from the Center for International Development and Conflict Management at the University of Maryland, and can be found on http://www.systemicpeace.org/polity/polity4.htm. The Polity2 index and the Governance index developed by World Bank have been compared by a recent study (Shepherd 2012) and it was found that they were highly correlated, the correlation coefficient being 0.8425. For this reason as well as for the reason that Polity2 index is available for a longer period, we choose Polity2 index as a proxy variable for governance index. Maximum of *Polity2* index is 10. Index varies from 10 (excellence) to -10 (poorest)

2011)				
Maximum (1981-2011)	137.42	289.54	2.28	9.00
Minimum (1981-2011)	35.62	7.50	0.88	-4.00

Source: As stated in the text

Notes:

1. Base year for Consumer Price index is 2000=100
2. Maximum is 10. Index varies from 10 (excellence) to -10 (poorest)

Model

The model employed for the study is written as follows:

$$(1)\ \ln(P_t) = \beta_0 + \beta_1 \ln(bd_t) + \beta_2 \ln(er_t) + \beta_2 Polity2_t + \beta_4 StrBr_t + \varepsilon_t$$

where,

P is consumer price index (2005 = 100);

bd is budget deficit (in FJ$ million);

er is exchange rate (in FJ$/US$);

Polity2 is a proxy for governance index;

StrBr is an artificial variable to capture the effects of structural breaks (mainly major disasters), which are observed from estimated errors and based on Wald tests on parameter restrictions.

StrBr = 1 for years when structural breaks are observed, and *StrBr* = 0 for the other years.

The hypotheses to be tested are: (i) ln(*bd*) and ln(*P*) are directly associated; hence sign of the estimated coefficient ln(*bd*) should be positive; (ii*)* ln(er) and ln(*P*) are directly associated; hence sign of *er* should be positive; (iii) *Polity2* and ln(*P*) are indirectly related; hence sign of *Polity2* should be negative; and (iv) *StrBr* and ln(*P*) are positively related; hence sign of *StrBr* should be positive.

Unit Root Test and Engle-Granger Cointegration Test

Before undertaking the econometric analysis with a view to determining the long-run relationships between the variables, the first critical step is to verify the order of integration of each of the time series of the variables concerned. We resort to augmented Dickey-Fuller (ADF) tests for checking the presence of unit root of each variable using the following equation:

$$(2)\ \Delta V_t = \alpha + \delta T + \rho V_{t-1} + \sum_{i=1}^{m} \vartheta_i \Delta V_{t-i} + u_t$$

where Δ is the first difference operator, *V* is individual series, and *T* is time trend. Inclusion of intercept and/or time trend is based on the observation that whether the series has a drift or time trend. The number of lagged difference terms to be included should be enough to make the error term uncorrected. Evidence of unit root for each variable is found if the null hypothesis of $\rho = 0$

is not rejected, otherwise we have evidence that V is stationary, i.e. I(0). If V is non-stationary, we test for unit root of first difference of V, and V is said to be integrated of order one, i.e. I(1) if ΔV becomes stationary.

If all variables are found integrated of order one, the next step is to investigate whether the residual from the OLS estimation of Equation (1) is stationary or not. If the estimated residual $\hat{\varepsilon}_t$ is stationary, we can conclude that there is cointegration relationship between $\ln(P_t)$ and explanatory variables stated in the above. This process is called Engle-Granger cointegration test.

Error Correction Model

The cointegrating relationship indicates the existence of a long-run relationship while short-run effects can be obtained from an error correction model (ECM):

$$(3)\ \Delta \ln(P)_t = \phi + \sum_{j=1}^{P} \varsigma_j \Delta \ln(P_{t-j}) + \sum_{i=1}^{K} \sum_{j=0}^{P} \xi_{ij} \Delta X_{j,t-i} + \eta \hat{\varepsilon}_{t-1} + e_t$$

where X_j is the vector of explanatory variables in Equation (1), and $\hat{\varepsilon}_{t-1}$ is one lag of the cointegrating error estimated from Equation (1). The maximum number of lags p can be determined by using Akaike information criterion, Schwarz critierion or Hannan-Quinn criterion. Long-run equilibrium between $\ln(P_t)$ and Xs will be evidenced by a negative coefficient of the error correction term (ECT), η which captures the rate of adjustment at which a short-run disequilibrium is corrected.

IV. Results

Results of Unit Root Test and Cointegration Test

For ascertaining the order of integration of the variables in our model, we applied the augmented Dickey-Fuller test for unit root, testing the null hypothesis of non-stationarity. Before we proceed to calculating the τ statistic, an important step is to establish the optimal lag length to be use in the unit root analysis. Using the Schwarz Bayesian Criterion, we find that 2 lags would be optimal for this exercise. The ADF test statistics for log-levels of variables under consideration are found smaller than the 5 per cent critical value. However, when we subject the first difference of these variables to the ADF test, we find the test statistics exceed the 5 per cent level critical value, leading us to conclude that all variables described in the above are each integrated of order one, i.e. $\mathrm{I}(1)$.

Our next aim is to investigate whether or not price index (P) and budget deficit (bd) share a long-run relationship. To achieve this, as noted earlier, we proceed to test for the presence of long-run relationship in Equation (1). As shown in Table 3, the estimated residuals are stationary, which leads us to the conclusion of a long-run relationship between the dependent variable ln$P$ and all the explanatory variables including ln(bd).

Table 2 Results of Augmented Dickey-Fuller Tests

	Level			First difference		
	τ-stat	5% critical	*p*-value	*τ-stat*	5% critical	*p*-
$\ln(PI_t)$	-0.380	-2.992	0.9135	-3.342	-2.989	0.0131
$\ln(bd_t)$	-0.823	-2.992	0.8124	-7.305	-2.989	0.0000
$\ln(er_t)$	-2.064	-2.992	0.2594	-4.410	-2.989	0.0003
$\hat{\varepsilon}_t$	-4.964	-2.986	0.0000			

Long-run elasticities and short-run disequilibrium

Given the cointegrating relationship identified by the Engle-Granger cointegration test, the OLS estimation of Equation (1) yields non-spurious long-run effects of explanatory variables on price level in Fiji as follows:

$$\ln(\hat{P}_t) = -1.52 + 0.26\ln(bd_t) + 0.79\ln(er_t) - 0.01Polity2_t + 0.26StrBr_t$$
$$t = (-2.39)\ (5.48) \qquad (6.04) \qquad (-2.09) \qquad (4.57)$$
$$\hat{R}^2 = 0.9384$$

Diagnostic tests are summarized in Table 3. The test results confirm that the OLS estimates are free from heteroskedasticity, autocorrelation, incorrect functional form or multicollinearity problem.

Table 3: Diagnostic Test Results

Test	The Null Hypothesis	Test statistic	*p*-value
Breusch-Pagan test	Constant variance of error	$chi^2(1) = 0.16$	0.6914
Breusch-Godfrey LM test	No serial correlation in the error	$chi^2(1) = 0.130$	0.7187
Ramsey RESET test	Model has no omitted variables	$F(3, 23) = 0.22$	0.8823
Mean Variance Inflation Factor	No multicollinearity if VIF is less than 5	Mean VIF = 1.98	

With reference to the research questions posed in the study, the study results reveal there is strong evidence that budget deficit has a positive effect on price level in Fiji. Specifically, a one percent increase in budget deficit increases price index by 0.26 percent, given the other factors remain unchanged. We also find that the nominal exchange rate measured by Fijian dollars per US dollar has a positive effect on price, confirming depreciation of the Fiji dollar rate adversely affects price level. The coefficient on ln(*er*) of 0.79 suggests that a one percent increase in exchange rate leads to 0.79 percent increase in price index.

The proxy index for governance, namely *Polity*2 and price level are negatively associated. Better governance indicated by a rise in the index reduces the price level. The coefficient of – 0.01 on

*Polity*2 indicates that a unit increase in the index will reduce price index by 1 percent. The artificial variable *StrBr*, representing years when major structural breaks occurred, has a positive effect on price. The coefficient of 0.26 suggests that, keeping other factors unchanged, major structural break on average is associated with 26 percent increase in price index. All explanatory variables are found to be statistically significant at least at the 5% level.

Short-run disequilibrium is further assessed from the error correction model in Equation (3), and the OLS estimation yields results as follows:

$$\begin{aligned}
\Delta \ln(\hat{P}_t) &= 0.03 + 0.30\Delta \ln(P_{t-1}) + 0.33\Delta \ln(P_{t-3}) \\
t &= (3.09)\ (1.98) \qquad\qquad (2.17) \\
&\quad + 0.01\Delta \ln(bd_t) - 0.02\Delta \ln(bd_{t-3}) - 0.01\Delta \ln(bd_{t-4}) - 0.02\Delta \ln(bd_{t-5}) \\
t &= (1.84) \qquad (-3.89) \qquad (-2.85) \qquad (-3.67) \\
&\quad - 0.08\Delta \ln(er_{t-1}) + 0.09\Delta \ln(er_{t-3}) - 0.003Polity2_t - 0.14\hat{\varepsilon}_{t-1} \\
t &= (-1.89) \qquad (1.75) \qquad (-3.99) \qquad (-2.97) \\
\overline{R}^2 &= 0.6294
\end{aligned}$$

The OLS estimation of the ECM shows that the impact of changes in explanatory factors is felt up to 5 periods after changes occurred. Not much interpretation could be attached to the short-run coefficients. Yet, the error correction term is highly significant and has a negative coefficient – 0.14, suggesting that on an average 14 percent of disequilibrium will be corrected within one year. In the other words, it takes more than 7 years for the disequilibrium to be corrected, which is a slow adjustment. In addition, the ECM explains 62.9 percent of fluctuation in prices.

V. Conclusions

The paper undertook an empirical study on the impact of budget deficits on inflation in Fiji during 1981-2011. The study utilized time series of data on price index, budget deficits and nominal exchange rate as well as a proxy index for governance, for reflecting a favourable influence of better governance on inflation and an artificial variable for capturing the adverse effects of structural breaks on inflation. The study findings confirm that budget deficits were responsible for rise in price level, just as poor governance gave rise to inflation. Both structural breaks and depreciation of domestic currency also emerged to be significant factors influencing rise in price index.

The policy recommendations are straightforward. Authorities have to be aware of the grave implications of budget deficits and adverse influence of poor governance on inflation. Aside from cutting non-essential expenditures to trim the budget making process, Fiji's policy makers have to pay greater attention to step up revenue collection and discontinuing the needless incentive schemes for investment and concessions offered by way of subsidies and discretionary measures by ministers.

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