Budget Deficit, Money Supply and Inflation: The Case of Pakistan

RESEARCH PAPER

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Abstract

Conventional notions suggest that persistently high budget deficits give rise to inflation, which monetary policy on its own is powerless to prevent. However, empirical evidence does not provide convincing support for such a hypothesis. This paper reexamines the issue in the case of Pakistan using Johansen cointegration analysis. The empirical results suggest that in the long-run inflation is not related to budget deficit but only to supply of money, and supply of money has no causal connection with budget deficit. Hence, the findings imply that the hard government budget constraint does not find empirical support for Pakistan.

Keywords: budget deficit, inflation, money supply, cointegration, Pakistan
JEL classification: C32, E31, E63

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1 Introduction[1]

Conventional notions suggest that persistently high budget deficits give rise to inflation. However, the results of empirical studies investigating this issue are inconclusive, indicating that the link from budget deficits to monetary expansion and then to inflation might be less crucial in determining the course of inflation. Furthermore, declining or intact seigniorage revenues, i.e., lack of monetization in the face of increasing budget deficits presents an additional argument on that point. Nevertheless, even when a central bank does not monetize the deficit, adjustments in the private sector to higher deficit policies may very well lead to inflation.

In general, there is little disagreement that in the long-run inflation is primarily a monetary phenomenon. Pakistan's experience is not different in that respect as inflation is generally associated with monetary expansion. Therefore, a rise in the general price level can most often be traced to money supply growth. However, the developments in the fiscal sector are also considered to be an important factor in explaining price fluctuations.

During the 1960s, the overall inflation in Pakistan averaged 3.2 percent per annum. In the 1970s, it increased to an average of around 12.5 percent per annum. This acceleration in inflation was attributable to heavy devaluation of the rupee, a sharp rise in oil prices and large monetary expansion (average annual increase of 21 percent as against 4.8 percent GDP growth). During the 1980s, the economy experienced a comparatively moderate rate of inflation averaged at 7.2 percent per annum. But during the decade of the 1990s, inflationary trends witnessed acceleration with an annual average growth of 9.7 percent; monetary assets also witnessed a sharp average annual rise of 21.7 percent as against an average annual increase of 4.6 percent in GDP. That is why during the last decade, a critical task faced by the State Bank of Pakistan was to contain inflation within the targeted level and ensure macroeconomic stability. Despite strong economic growth,

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inflation has been contained around 7 percent during the period 2000-2007 through a combination of tight monetary policy and the resolving of several supply bottlenecks.[2] In Pakistan, it is being asserted that the main causes behind a high rate of inflation could be large monetary expansion, fiscal imbalances, sources of fiscal deficit financing, strong economic growth and exchange rate depreciations.

The purpose of this paper is twofold. Firstly, to examine the long-run relationship among inflation, supply of money and budget deficit in Pakistan and secondly, to detect the direction of causality among these variables.

The rest of the paper is organized as follows. Section 2 provides a brief review of literature. The methodology is introduced in Section 3, while Section 4 contains data description and empirical findings. Section 5 concludes the study.

2 Literature Review

In economic literature, numerous models have been developed to analyze the long-run relationship among inflation, money supply and budget deficit. However, evidence from the empirical literature is mixed. De Haan and Zelhorst (1990) analyze the relationship between government budget deficit and money growth in developing countries. The overall conclusion of this study does not provide much support for the hypothesis that government budget deficit causes monetary expansion and, therefore, leads to inflation. Similarly, Vieira (2000) investigates the relationship between fiscal deficit and inflation in the case of six major European economies. The results provide little support for the proposition that budget deficit has been an important contributing factor to inflation in these economies over the last 45 years. Durevall and Ndung'u (2001), using a dynamic error correction model of inflation for Kenya, find that money supply affects prices only in the short-run. However, the study by Catao and Terrones (2003) shows that there is a strong positive relationship between budget deficits and inflation

[2] *Source for the data in this Section is* Pakistan Economic Survey.

among developing countries as well as countries characterized by high inflation, but not among advanced economies with low-inflation.

In the case of Pakistan, studies conducted to examine the role of fiscal deficit as a major determinant of inflation also provide mixed results. Bilquees (1988) finds no relationship between budget deficit and inflation. Neyapti's (1998) empirical analysis based on the data set for 44 developing and less developed countries indicates that positive association between budget deficits and inflation is not statistically significant for a number of countries including Pakistan. However, in contrast to these studies, Shabbir and Ahmed (1994) find a positive relationship between budget deficits and inflation in Pakistan. According to their findings, a one percent increase in budget deficit leads to a 6 to 7 percent increase in the general price level. The findings of Chaudhary and Ahmad (1995) suggest that domestic financing of the budget deficit, particularly from the banking system, is inflationary in the long-run. The results point to a positive relationship between budget deficit and inflation during acute inflation periods of the 1970s. The authors also find that money supply is not exogenous; rather, it depends on the position of international reserves and fiscal deficit. Khan and Qasim (1996) reveal that the expansionary fiscal policy stance has been reflected in a deteriorating balance of payments position and has induced repeated downward adjustment in the rupee, which has caused the price level to increase. In a more recent study, Agha and Khan (2006) examine the long-run relationship between inflation and fiscal indicators in Pakistan for the period 1973-2003. The empirical results, using Johansen cointegration analysis, indicate that in the long-run inflation is not only related to fiscal imbalances but also to the sources of fiscal deficit financing. The authors conclude that inflation in Pakistan is strongly affected by government's bank borrowing for budgetary support as well as fiscal deficits and, consequently, that fiscal policy is an important factor in explaining price movements.

In all the above mentioned studies the empirical work has been carried out using annual data in order to examine the relationship between inflation and budget deficit in Pakistan; the findings have, however, remained mixed. Therefore, there is a need to reexamine the issue. The availability of

a relatively long quarterly data series might provide more credible evidence with regard to the nature of the relationship among inflation, money supply and budget deficit. The present research exercise is a move in this direction.

3 Analytical Framework

3.1 Unit Root Test

Since most of the macroeconomic time series are non-stationary (Nelson and Plosser, 1982) and thus conducive to spurious regression, we first test for stationarity. For this purpose, we conduct an augmented Dickey-Fuller (ADF) test by carrying out a unit root test based on the following structure:

$$\Delta X_t = \kappa + \phi\, t + \Theta X_{t-1} + \sum_{i=1}^{n} \varphi_i \Delta X_{t-i} + \varepsilon_t, \qquad (1)$$

where X is the variable under consideration, Δ is the first difference operator, t captures time trend, ε_t is a random error, and n is the maximum lag length. The optimal lag length is identified so as to ensure that the error term is white noise. κ, ϕ, Θ *and* φ are the parameters to be estimated. If we cannot reject the null hypothesis $\Theta = 0$, then we conclude that the series under consideration has a unit root and is therefore non-stationary.

3.2 Cointegration Test

The econometric framework used for analysis in this study is the Johansen (1998) and Johansen and Juselius (1990) maximum likelihood cointegration technique, which tests both the existence and the number of cointegrating vectors. This multivariate cointegration test can be expressed as:

$$Z_t = K_1 Z_{t-1} + K_2 Z_{t-2} + ... + K_{k-1} Z_{t-k} + \mu + v_t, \qquad (2)$$

where $Z_t = (CPI, M2, BD)$ is a 3×1 vector of variables. *CPI, M2* and *BD* are consumer price index, money supply and budget deficit, respectively.

The variables are potentially I(1). K_i are 3×3 matrices of parameters, μ is a vector of constant and v_t is a vector of normally and independently distributed error term.

Equation (2) can be reformulated in a vector error correction model (VECM) as follows:

$$\Delta Z_t = \Gamma_1 \Delta Z_{t-1} + \Gamma_2 \Delta Z_{t-2} + \cdots\cdots + \Gamma_{k-1} \Delta Z_{t-k-1} + \Pi Z_{t-1} + \mu + v_t \ , \qquad (3)$$

where, $\Gamma_i = (I - A_1 - A_2 \ldots\ldots - A_i)$ (i= 1,2,3…..k-1) and $\Pi = -(I - A_1 - A_2 - A_3 \ldots\ldots - A_k)$. The 3×3 coefficient matrix Π provides information about the long-run relationships among the variables. Π can be factored into $\alpha\beta'$ where α will include the speed of adjustment to the equilibrium while β' will be the long-run matrix of coefficients. The presence of *r* cointegrating vectors between the elements of *Z* implies that Π is of the rank r ($0 < r < 3$). To determine the number of cointegrating vectors, Johansen developed two likelihood ratio tests: trace test (λ_{trace}) and maximum eigenvalue test (λ_{max}). If there is any divergence of results between these two tests, it is advisable to rely on the evidence based on the λ_{max} test because it is more reliable in small samples (Dutta and Ahmed, 1997; Odhiambo, 2005).

3.3 Causality Test

If a pair of variables is cointegrated, there must be Granger causality in at least one direction, which reflects the direction of influence between series. Theoretically, if the current or lagged terms of a variable, for example X_t, determine another variable, for example Y_t, then there exists a Granger-causality relationship between X_t and Y_t, in which Y_t is Granger-caused by X_t. Thus, the model is specified as follows:

$$\Delta Y_t = \theta_{11} \Delta Y_{t-1} + \ldots + \theta_{1n} \Delta Y_{t-n} + \theta_{21} \Delta X_{t-1} + \ldots + \theta_{2n} \Delta X_{t-n} - \gamma_1 (Y_{t-1} - a X_{t-1} - b) + \vartheta_{1t} \qquad (4)$$

$$\Delta X_t = \theta_{31} \Delta X_{t-1} + \ldots + \theta_{3n} \Delta X_{t-n} + \theta_{41} \Delta Y_{t-1} + \ldots + \theta_{4n} \Delta Y_{t-n} - \gamma_2 (Y_{t-1} - a X_{t-1} - b) + \vartheta_{2t} \ . \qquad (5)$$

The following two assumptions are tested using the above two models to determine the Granger-causality relationship between the variables:

$\theta_{21} = \cdots = \theta_{2n} = \gamma_1 = 0$ (no causality from X_t to Y_t)

$\theta_{41} = \cdots = \theta_{4n} = \gamma_2 = 0$ (no causality from Y_t to X_t).

4 Data, Estimation and Interpretation of Results

This study uses quarterly observations for the period 1960-2007 for three variables: the consumer price index (CPI), money supply (M2) and government budget deficit (BD) in order to analyze the possibility of cointegration and causality relationship among them. Despite the fact that CPI has limited coverage, it is the most reliable measure of inflation and is consequently commonly used in empirical studies (Metin, 1998; Solomon and De Wet, 2004; Agha and Khan, 2006). Therefore, following the standard practice, inflation is proxied by CPI. The data, seasonally unadjusted and expressed in nominal terms, have been collected from quarterly and annual reports by the State Bank of Pakistan and from *Pakistan Economic Survey* published by the Government of Pakistan.

The first step in cointegration analysis is to test the unit roots in each variable. Consequently, we apply augmented Dickey-Fuller (ADF) unit root tests on logarithms of CPI, M2 and BD (LCPI, LM2 and LBD). From the results of the ADF test presented in Table 1 we find that all series are stationary in first differences. This implies that all the series are integrated of order one [i.e. I(1)]. Multivariate cointegration analysis is sensitive to lag length selection. In order to determine optimal lag length we use the Schwarz Bayesian criteria (SBC). As far as our study is concerned, the Schwarz Bayesian criteria (SBC) suggest a lag length of 4. The cointegration test is carried out assuming an intercept in the cointegrating equation.

The cointegrating relationship among LCPI, LM2 and LBD has been investigated using the Johansen technique. Table 3 reports results based on Johansen's maximum likelihood method. Both trace statistics (λ_{trace})

and maximal eigenvalue (λ_{max}) statistics indicate that there is at least one cointegrating vector among the three variables. We can reject the null hypothesis of no cointegrating vector in favor of one cointegrating vector under both test statistics at the 5 percent significance level. In addition, we cannot reject the null hypothesis of at most one cointegrating vector against the alternative hypothesis of two cointegrating vectors. Consequently, we can conclude that there is only one cointegrating relationship among LCPI, LM2 and LBD. In sum, there is a long-run equilibrium relationship among inflation, money supply and budget deficit in Pakistan.

Table 1 **Augmented Dickey Fuller (ADF) Unit Root Tests**

Variables	Level	First Differences	MacKinnon Critical Values for Rejection of Hypothesis of a Unit Root			Decision	Order of Integration
			1%	5%	10%		
LCPI	11.9966	-5.8379	-2.58	-1.94	-1.62	Non-stationary in level but stationary in first differences	I(1)
LM2	12.6753	-9.9963	-2.58	-1.94	-1.62	Non-stationary in level but stationary in first differences	I(1)
LBD	-0.9667	-9.6820	-2.58	-1.94	-1.62	Non-stationary in level but stationary in first differences	I(1)

Source: Authors' calculations.

The cointegrating equation, given in Table 2, is normalized for LCPI in order to interpret the estimated coefficients. We may say that a 1 percent increase in money supply is associated with a 0.71 percent increase in price level in Pakistan, holding budget deficit constant. If we are willing to accept these parameters as elasticities, then the results show that inflation in Pakistan is moderately elastic to money supply or, conversely, money demand is elastic to inflation (with elasticity equal to 1.41, i.e., inverse of 0.71). Since the estimated coefficient with budget deficit is statistically insignificant, it implies that there is no significant long-run relationship between inflation and budget deficit. This result is in line with Bilquees (1988) and Neyapti (1998), but contrary to the findings of Chaudhary and Ahmad (1995), and Agha and Khan (2006).

Table 2 **Cointegration Test Based on Johansen's Maximum Likelihood Method**

Null Hypothesis	Alternative Hypothesis			Critical Value 5%	p-values†
		Eigenvalues	λ_{trace} rank value		
$H_0 : r = 0$	$H_1 : r = 1$	0.1643	51.6970**	35.1928	0.0004
$H_0 : r = 1$	$H_1 : r = 2$	0.0774	19.5759	20.2618	0.0619
$H_0 : r = 2$	$H_1 : r = 3$	0.0284	5.1559	9.1645	0.2668
			$\lambda_{\max}$ rank value		
$H_0 : r = 0$	$H_1 : r > 0$	0.1643	32.1211**	22.2996	0.0016
$H_0 : r \leq 1$	$H_1 : r > 1$	0.0774	14.4200	15.8921	0.0839
$H_0 : r \leq 2$	$H_0 : r \leq 2$	0.0284	5.1559	9.1645	0.2668

Normalized Cointegrating Equation:

$$LCPI = \underset{}{3.808} + \underset{(2.542)^*}{0.714} \times LM2 + \underset{(4.513)^{**}}{0.006} \times LBD \quad (0.598)$$

*Notes: t-values are in parentheses. ** indicates significance at the 1 percent level and * indicates significance at the 5 percent level. † MacKinnon, Haug and Michelis (1999) p-values. Trace test indicates 1 cointegrating equation at the 1 percent significance level. Max-eigenvalue test indicates 1 cointegrating equation at the 1 percent significance level.*
Source: Authors' calculations.

The estimated coefficient of the error-correction term in the inflation variable equation has the expected sign and it is statistically significant at the 5 percent level, with the speed of convergence to the equilibrium of 72 percent (see Table 3).[3] In the short-run, inflation is adjusted by 72 percent of the previous quarter's deviation from equilibrium. The coefficients of the error-correction terms in the money supply and budget deficit equations have the correct signs (negative). However, the error-correction term is statistically significant at the 5 percent level in the money supply equation only. Its insignificance for the budget deficit variable indicates that this variable is weakly exogenous to the model. To test the robustness of the VECM, we apply a number of diagnostic tests. These tests involve χ^2 tests

[3] *Schwarz Bayesian criteria (SBC) have suggested a lag length of 4 as optimal to be used in the VECM.*

for the hypothesis that there is no serial correlation; that the residuals follow the normal distribution; that there is no heteroscedasticity; and lastly, that there is no autoregressive conditional heteroscedasticity. In all equations the diagnostics suggest that the residuals are Gaussian as the Johansen method presupposes.

Table 3 **Summary Results from VECM**

	$\Delta(LCPI)$	$\Delta(LM2)$	$\Delta(LBD)$
Constant	0.008* (2.716)	0.032** (5.796)	0.355* (2.568)
ECT(-1)	-0.717* (-2.235)	-0.061** (-4.658)	-0.031 (-1.517)
R^2	0.377	0.483	0.203
Adjusted R^2	0.332	0.446	0.145
S.E. of regression	0.016	0.027	0.839
F-statistics	8.371*	12.938**	3.516
Diagnostic tests χ^2 (p-values are in brackets)			
Serial correlation (Breusch–Godfrey serial LM)	1.44 [0.671]	0.811 [0.623]	1.38 [0.351]
Heteroscedasticity (White heteroscedasticity test)	0.05 [0.991]	1.59 [0.548]	1.212 [0.331]
Normality (Jarque-Bera)	0.482 [0.564]	0.685 [0.417]	0.725 [0.337]
Autoregressive conditional heteroscedasticity (ARCH LM test)	0.007 [0.964]	1.344 [0.224]	0.004 [0.983]

*Notes: t-values are in parentheses. ** indicates significance at the 1 percent level and * indicates significance at the 5 percent level.*
Source: Authors' calculations.

Now we can turn our attention to the question of direction of causality. It contains three elements: (a) does money supply cause inflation, or does inflation cause money supply? (b) does budget deficit cause inflation, or does inflation cause budget deficit? and (c) does money supply cause budget deficit, or does budget deficit cause money supply? The results of Granger causality in Table 4 reveal a unidirectional causality running from money supply (LM2) to inflation (LCPI). This result confirms our previous finding that a positive cointegrating relationship exists between inflation and money supply. With regard to the relationship between budget deficit and inflation, no statistically significant causation is found. This

result is also in line with our previous findings that no significant long-run relationship exists between budget deficit and inflation in Pakistan. This finding is compatible with Bilquees (2003) who shows that the budget deficits were excessively financed through non-bank borrowings under the National Saving Schemes that are a non-inflationary source of financing. Furthermore, since the 1980s Pakistan has been under the Structural Adjustment Programs of the International Monetary Fund, which imposed strong conditionality on bank borrowing. This has led to the rigorous use of the non-bank debt instrument to finance the deficits.[4] Therefore, the widely accepted belief that the budget deficit tends to be inflationary seems to be ill-founded in the case of Pakistan in the analyzed period. These findings imply that the notion of hard government budget constraint does not find empirical support in Pakistan.

Table 4 **Pairwise Granger Causality Tests**

Null Hypotheses	Number of Observations	F-statistics	p-value
Causality between *LM2* and *LCPI*			
LM2 does not Granger cause *LCPI*	182	4.8775	0.0010**
LCPI does not Granger cause *LM2*		1.6982	0.1526
Causality between *LBD* and *LCPI*			
LBD does not Granger cause *LCPI*	183	0.4252	0.7903
LCPI does not Granger cause *LBD*		0.9999	0.4092
Causality between *LBD* and *LM2*			
LBD does not Granger cause *LM2*	182	1.1852	0.3191
LM2 does not Granger cause *LBD*		1.3938	0.2382

*Note: ** indicates the rejection of the null hypothesis at the 1 percent significance level.*
Source: Authors' calculations.

Finally, the results show no causation between budget deficit and money supply. This means that we do not find any evidence which suggests that changes in budget deficits today lead to future monetization. All this means that there is a lack of empirical support for the accommodation

[4] *The reasons included: it was beyond the purview of the conditionality of the Structural Adjustment Programs, it was available on tap and there was no legislation to prevent its excessive use, and it was non-inflationary (Bilquees, 2003).*

hypothesis in Pakistan.[5] Therefore, in Pakistan, the fiscal sector is not dominant in explaining price movements. The empirical findings of the study suggest that the policy of reducing inflation should shift from budget deficit reduction to other macroeconomic determinants of inflation.[6]

5 Conclusion

Public sector deficits have a bad reputation because, among other things, it is believed that sooner or later the government will resort to money creation, and hence, to inflation, in order to finance the deficit. That is why inflation is generally associated with monetary expansion. Pakistan has been grappling with inflationary pressures of varying intensity during the last 60 years. Although the immediate cause of inflation is associated with money growth, developments in monetary stance are indicative of other sectors of the economy. In Pakistan, it is by and large claimed that budget deficits might have played an important role in explaining price fluctuations.

Using the quarterly data covering the period 1960-2007, the existence of a stable long-run relationship among inflation, money supply and budget deficit has been tested in this study for Pakistan. The study indicates that inflation in Pakistan is mainly attributable to an increase in money supply. There is no significant long-run relationship between inflation and budget deficit. This implies that the hard government budget constraint does not find empirical support. Furthermore, we do not find any evidence which suggests that changes in budget deficit lead to changes in monetary expansion in Pakistan. Therefore, it may be argued that there is a lack of empirical support for the accommodation hypothesis in Pakistan.

[5] *According to the accommodation hypothesis, not only are the budget deficit and money growth positively correlated but the higher budget deficit also unidirectionally causes higher money growth and generates inflation.*

[6] *Khan and Qasim (1996) have, for example, already suggested that a 10 percent increase in real GDP would reduce the general price level by 4.6 percent.*

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