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Government Expenditures and Receipts: A Causality Analysis for India

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Abstract

Deficits measure the excess of government spending over revenues and reflect the fiscal health of an economy. Fiscal consolidation has been the focus of the reform process initiated in 1991-92. Fiscal reforms have seen tax reforms, rationalization and restructuring of the tax structure to augment revenues as well as expenditure management which in turn can influence deficit containment. Interdependence between revenues and expenditures can lead to ambiguous impact on deficit and the efforts to contain the deficit. This paper examines the relation between revenues and expenditures – Friedman hypothesis and Barro hypothesis employing cointegration and causality tests for 1970-71 to 2002-03. Bivariate causality tests (Hsiao and Granger) were performed on the cointegrated variables – total expenditure and three variants of revenues viz. tax revenues, revenue receipts and total revenues. Our results indicate bi-directional causality between total government expenditures and tax revenues and revenue receipts. Instantaneous causality is observed for all variants of revenue. Our results find support for the Barro as well as the Friedman hypothesis. The presence of instantaneous causality gives greater credence to the Barro hypothesis.

Key Words: - Expenditure, Revenues, Causality

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Government Expenditures and Receipts: A Causality Analysis for India

Swati Raju

I Introduction

Deficits measure the excess of government spending over receipts and the various measures of government deficits provide different facets of this gap between revenues and expenditures. Deficits, thus, reveal the fiscal health of an economy. Deficits may, therefore, emerge either due to the deliberate decisions to spend beyond revenue constraints or because established flows of spending and taxing react differently to shifts in the aggregate bases in the economy. The fiscal situation of the central government represented by the various deficit indicators has worsened since the mid-1980s. The latter half of the 1980s saw fiscal deficits in the range of 7-8% of GDP and gross primary deficit and revenue deficit were also in the ranges of 4-5% of GDP and 2-3% of GDP respectively. Fiscal consolidation was hence a major focus of the reform process introduced in 1991-92. The 1990s have also seen varied performance on the deficit indicators. The period 1991-92 to 1996-97 with the exception of 1993-94 has seen a decline in the fiscal deficit and other deficit indicators as a percentage of GDP. However, the later half of the 1990s and the early 2000s have seen a reversal of this trend and the major deficit indicators climbed back to near-about their early 1990-91 levels.

Fiscal reforms at the central level focused on tax reforms, expenditure management, restructuring of PSUs and better co-ordination between monetary and fiscal policies. Restructuring of the tax system formed a major component of fiscal reforms with the aim of augmenting revenues and removing anomalies in the tax structure. Tax rates were rationalized and brought down to levels comparable to the developed economies. On the expenditure side, measures were taken to curb the built-in growth in expenditure and to bring about structural changes in the composition of expenditure. These included subjecting all ongoing schemes to zero based budgeting and assessment of manpower requirements of the government departments. Further, the government constituted an Expenditure Reforms Commission (ERC) to look into areas of expenditure correction. During the reform period, the perception was in favour of reducing the size of the public sector and the government adopted the twin approach of reduction in budgetary support to the public sector along with the privatization of existing PSUs. The

central government also enacted the Fiscal Responsibility and Budget Management Bill, 2000 as an institutional measure to strengthen fiscal discipline (Reserve Bank of India, 2001).

Deficits, thus, can be influenced through the interaction between expenditures and receipts – either by raising revenues or reducing expenditures or attempting both. While an inter dependence between expenditures and receipts could hamper efforts at deficit reduction/control. However, if revenue increases lead to increased expenditure then raising revenues would lead to increased spending. Likewise, if the decision to raise revenues and increased expenditure decisions are taken simultaneously then it would have an ambiguous impact on deficits. The paper tries to study whether there exists a causal relation between central government expenditures and revenues. Section II of the paper provides the theoretical background while Section III contains the empirical evidence. Section IV provides the conclusions of the study.

II Theoretical Background

The relation between government expenditures and revenues is studied by testing (i) the Friedman hypothesis: *increased revenues cause increased expenditures* and (ii) the Barro hypothesis: *expenditures cause revenues*.

Friedman opines that ‘increasing taxes will simply lead to more government spending’. That is, the deficit cannot be reduced by raising taxes (revenues) as increasing revenues results in more spending. According to Friedman, “Political Rule Number One is government spends what government receives plus as much more as it can get away with.” (Friedman, 1982). Hence increasing taxes (revenues) would imply as large a deficit but at a higher level of government spending. Barro (1979) offers a contrasting view. Barro suggests that higher spending forces taxes (revenues) upwards. In other words, the causal mechanism is opposite to that of Friedman – spending causes taxes. That is, the path of government expenditures is taken to be exogenously given and taxes are adjusted to minimize distortions – the tax smoothing hypothesis (Hoover, 2001) The causality exercise can result in any of the following: (i) revenue growth can cause

growth in government expenditure – Friedman hypothesis (ii) expenditure growth can cause growth in revenues – Barro hypothesis (iii) bi-directional causality between revenue receipts growth and expenditure increases (iv) instantaneous causality between expenditure growth and revenue growth and (v) causal independence between revenues and expenditures.

III Cointegration and Causality: Empirical Evidence

The paper employs annual data for 1970-71 to 2002-03 in its study on the causal relation between central government revenues and expenditures. Stationarity of a time series is very essential as the use of a non-stationary time series can result in spurious and dubious relationships. Accordingly, unit root tests and cointegration tests were carried out on all the variables used in the study. The variables used in the study are:

REVREG – revenue receipts as a ratio of GDP

TEG – total expenditure as a ratio of GDP

TRG – tax receipts as a ratio of GDP

TOTREG – total receipts as a ratio of GDP

Each of these variables was tested for stationarity using the DF and ADF tests. All the variables were integrated of order one i.e. were I(1) processes. Cointegration exercises were conducted on the variables and the results of our cointegration tests are presented in Table 1. The results of our cointegration tests reveal that all the variables are cointegrated. The CRDW test statistic is significant for all variables at the 1% level. We, thus, find cointegration and thereby reject the null hypothesis: x_t and y_t are not cointegrated. The ADF test statistic on residuals indicates to the absence of autocorrelation in the error term. The results of our cointegration tests thus suggest that there exists a long term equilibrium relationship between our fiscal variables and it would be interesting to see whether they share a causal relation as well.

Table 1 Results of Cointegrating Regression between fiscal variables

Variables	CRDW	ADF
TRG	1.100#	-3.5693
REVREG	1.459#	-4.5410
TOTREG	1.488#	-4.2636
TEG	1.201#	-3.5327
Critical values for CRDW: # 1% 0.511; ** 5% 0.386; * 10% 0.322 (Engle and Granger, 1987)		
Critical value for the ADF test: 10% -3.04 (McKinnon, 1990)		

Since all our fiscal variables were cointegrated, we conducted bivariate causality tests on the following sets of fiscal variables

Set I: TRG and TEG

Set II: REVREG and TEG

Set III: TOTREG and TEG

The paper thus tries to study the relation between total government expenditure and three variants of revenues viz. tax revenue, revenue receipts and total receipts. The causal relation between these sets of fiscal variables is studied by employing the Hsiao and Granger causality tests. Both these tests are used as 'dependence on any single test could result in the misinterpretation of results' (Karnik, 1988).

The Hsiao Test of Causality

The procedure for Hsiao's test of causality is as follows:

- (i) Perform autoregression on Y_t upto some fixed order, say L ;
- (ii) Determine the lag order of Y_t by computing AIC for each of the autoregressions.

Denote the minimum AIC by $AIC(m)$;

- (iii) Keeping the lag order of Y_t fixed (as determined by Step 2) regress Y_t on $Y_{t-1} \dots Y_{t-m}$ and current and past values of X (upto a lag of k);

- (iv) Compute AICs for each of the $(k+1)$ regressions of Step 3, to determine the lag order of X_t . If the minimum AIC occurs at lag $k=n$, denote it by $AIC(m,n)$;

- (v) If $AIC(m,n) < AIC(m)$ then we say X causes Y ;

- (vi) Repeat steps (i) to (v) to test the hypothesis Y causes X .

We can infer the results of Hsiao causality from Tables 2 and 3 for the three sets of fiscal variables. The causal relation between DTEG and DTRG can be observed by comparing columns 3 and 4 of Table 2 with columns 2 and 3 of Table 3. We can see that there exists bi-directional causality (feedback) between DTRG and DTEG. The minimum log AIC of columns 2 and 3, Table 3 is lower than the minimum log AIC of the univariate regressions seen in columns 2 and 3, Table 2. Likewise for the second set of fiscal variables – DTEG and DREVREG also bi-directional causality can be observed as the minimum log AIC of the bivariate regression columns(4) and (5), Table 3 is smaller

than the log AIC of the univariate regression, columns (2) and (3), Table 2. However, for the third set of fiscal variables – DTEG and DTOTREG, it can be observed that DTEG causes DTOTREG instantaneously (Column 3, Table 2 with column 6, Table 3) whereas DTOTREG causes DTEG (column 5, Table 2 with column 7, Table 3).

Table 2 Results of Hsiao’s Test: Univariate Regression

Lags	DREVREG	DTEG	DTRG	DTOTREG
(1)	(2)	(3)	(4)	(5)
1	-1.2633	-0.19927	-1.5306	-0.25022
2	-1.2538	-0.15288	-1.5772	-0.18737
3	-1.2791	-0.080919	-1.5509	-0.11520
4	-1.2063	-0.050848	-1.4912	-0.046321
5	-1.1623	-0.14266	-1.4319	-0.019122

The figures in bold indicate the minimum log AIC

Table 3 Results of Hsiao’s Test: Bivariate Regression between Revenues and Expenditures

Lags	DTEG causes DTRG	DTRG causes DTEG	DTEG causes DREVREG	DREVREG causes DTEG	DTEG causes DTOTREG	DTOTREG causes DTEG
(1)	(2)	(3)	(4)	(5)	(6)	(7)
0	-1.6023	-0.16013	-1.3818	-0.23231	-1.0165	-0.96064
1	-1.6792	-.086419	-1.3834	-0.19873	-0.95627	-0.89010
2	-1.7430	-0.15574	-1.5164	-0.26257	-0.92677	-1.1120
3	-1.7269	0.086731	-1.4632	-0.19074	-0.89199	-1.0513
4	-1.6921	0.031468	-1.4349	-0.12292	-0.81821	-1.1286
5	-1.6200	-0.46925	-1.3667	-0.35121	-0.82965	-1.1871

The Hsiao test of causality, thus, reveals that bi-directional (feedback) causality exists between two of the three sets of fiscal variables viz. between (i) total government expenditures as a percentage of GDP and tax revenue as a percentage of GDP and; (ii) total government expenditures as a percentage of GDP and revenue receipts as a percentage of GDP. Unidirectional causality is observed between total receipts as a percentage of GDP and total government expenditures as a percentage of GDP.

The Granger Causality Framework

The causality tests were undertaken using the following canonical representations given in the equations below. Aij, Bij, Cij and Dij are constants and Uit and Vit are the disturbances (Nachane et.al, 1988). In the above set of equations, equations (1) to (3) indicate whether Y causes X while equations (4) to (6) indicate whether X causes Y.

$$X_t = \sum_{s=1}^{\infty} A_{1s}X_{t-s} + U_{1t}$$

$$X_t = \sum_{s=1}^{\infty} A_{2s}X_{t-s} + \sum_{s=1}^{\infty} B_{2s}Y_{t-s} + U_{2t}$$

$$X_t = \sum_{s=1}^{\infty} A_{3s}X_{t-s} + \sum_{s=0}^{\infty} B_{3s}Y_{t-s} + U_{3t}$$

$$Y_t = \sum_{s=1}^{\infty} C_{1s}Y_{t-s} + V_{1t}$$

$$Y_t = \sum_{s=1}^{\infty} C_{2s}Y_{t-s} + \sum_{s=1}^{\infty} D_{2s}X_{t-s} + V_{2t}$$

$$Y_t = \sum_{s=1}^{\infty} C_{3s}Y_{t-s} + \sum_{s=0}^{\infty} D_{3s}X_{t-s} + V_{3t}$$

Equations (1) to (6) are truncated using the FPE criterion as the lag parametrization scheme. Using equation (1) to (6) we perform the Granger causality tests. The null hypothesis being Y_t does not Granger cause X_t . It must be noted here that since all the variables are integrated of order one (i.e. are I (1) processes), the X_t and Y_t in equations (1) to (6) should be identified with Δ REVREG, Δ TEG and so on.

Granger causality tests were performed on the same three sets of fiscal variables.

Set I: TRG and TEG **Set II:** REVREG and TEG **Set III:** TOTREG and TEG

The results of Granger causality are presented in Table 4.

Table 4 Results of Granger Causality between Revenues and Expenditures

DTEG does not cause DREVREG F test	DREVREG does not cause DTEG F test	DTEG does not cause DTRG F test	DTRG does not cause DTEG F test	DTEG does not cause DTOTREG F test	DTOTREG does not cause DTEG F test
2.6539** (2,22)	2.2086** (5,21)	3.8589*** (2,23)	3.8529*** (5,21)	0.5365 (1,25)	0.1506 (1,25)
No Instantaneous Causality					
DTEG and DREVREG		DTEG and DTRG		DTEG and DTOTREG	
5.7849*** (1,21)		2.2801* (1,22)		31.2033# (1,24)	
# 1 percent level of significance; *** 1-5% level of significance, ** 5-10% level of significance; * 10-15% level of significance					

The results of Granger causality reinforced the results of the Hsiao test. As can be seen from Table 4 the *null hypothesis of 'no causality between revenues and expenditures'* has been rejected for two of the three sets of variables: (i) DTEG and DREVREG (ii) DTEG and DTRG. In fact for both these sets of fiscal variables show the existence of bi-directional causality (feedback). Strong instantaneous causality is also shown to exist between DTEG and DREVREG (i.e. between government expenditures and revenue receipts) while instantaneous causality is not very strong between DTEG and DTRG. In the third set of fiscal variables, only instantaneous causality (at a high level of significance) is observed between DTEG and DTOTREG. Hoover (2001) writes, 'one of the crucial implications of the tax smoothing model (is) if current government spending conveys any information about future spending, then the changes in taxes should be correlated with the current change in government spending'. The empirical exercises in the paper has found instantaneous causality for all sets of fiscal variables i.e. between total government spending as a percentage of GDP and the three variants of revenues – tax receipts, revenue receipts and total receipts as a percentage of GDP. Thus, given the bi-directional causality between (i) DTEG and DTRG (ii) DTEG and DREVREG, we find support for both the tax smoothing model of Barro (i.e. spending forces taxes upwards) as well as the Friedman hypothesis – revenue growth causes increases in expenditure. This coupled with the evidence of instantaneous causality between expenditures and revenues and the observation of Hoover (2001), we could say that between the Friedman hypothesis and the Barro hypothesis, the support for the Barro hypothesis is stronger.

IV. Conclusion

The paper, thus, employs annual data for the period 1970-71 to 2002-03 to determine the existence of a causal relationship between central government revenues and expenditures. The finding of bi-directional causality between government expenditures and revenues along with the presence of instantaneous causality leads us to believe that while we find support for both the Friedman and Barro hypotheses, the support for Barro's hypothesis – spending causes increases in revenues is stronger. We can thus conclude that efforts to

reduce the deficit by increasing revenues may not be very effective while attempts to reduce the deficit through expenditure containment would be more effective. Thus, while successive government budgets since 1991-92 have contemplated measures to curb expenditure growth, we support efforts to reduce expenditures either by looking at the various items of expenditure (through the Expenditure Reforms Commission) or setting an institutional setting like having rules for reducing the various levels of expenditure so as to reduce the fiscal deficit.

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