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REVENUE-EXPENDITURE NEXUS FOR SOUTHERN STATES: SOME POLICY ORIENTED ECONOMETRIC OBSERVATIONS

Kausik Chaudhuri and Bodhisattva Sengupta

MSE
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MADRAS SCHOOL OF ECONOMICS
Gandhi Mandapam Road
Chennai 600 025
India

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Kausik Chaudhuri
Professor, Madras School of Economics,
Email : kausik@mse.ac.in

and

Bodhisattva Sengupta
Assistant Professor, Madras School of Economics,
Email : bsengupta@mse.ac.in

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MADRAS SCHOOL OF ECONOMICS
Gandhi Mandapam Road
Chennai 600 025
India

Phone: 2230 0304/2230 0307/2235 2157
Fax : 2235 4847/2235 2155
Email : info@mse.ac.in
Website: www.mse.ac.in

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Abstract

The paper examines the temporal relationship between revenues and expenditures for the four southern states during 1980 to 2005. Using an error-correction model and Granger causality test, it finds that the tax-spend hypothesis is supported by the analsysis. The spend-tax hypothesis is valid for Karnataka; fiscal synchronization hypothesis is supported for Andhra Pradesh and Kerala, while the data for Tamil Nadu failed to show any causality.

Key Words: *Revenue Expenditure, Indian States, Cointegration*
JEL Codes: *H7,C22*

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INTRODUCTION

In this paper, we ask the following set of questions: do the governments in Southern states of India (namely, Andhra Pradesh, Kerala, Tamil Nadu and Karnataka) incur large fiscal deficits? If so, then what is the mode of incurring such deficits? What would be the appropriate measure to curb deficits?

These questions are important because, Keynesian endorsements notwithstanding, persistent budget deficits are always a concern among the economists. If governments earn less than what it spends (and finances the gap through borrowing), and if the spending is not adequate to boost up the growth rate above the interest rate a debt trap is generated. On the other hand, if, in order to reduce higher volume of accumulating deficit, government increases the tax rate and cuts social expenditure heavily, it may face adverse consequences for economic development. A third option is to print more money, which is associated with inflation tax. Since all remedies are associated with a cost, institutions must be designed in such a way that the power of the government to create fiscal deficits is reduced. As it turns out, the nature of such institutions depend on the so called revenue-spending nexus.

The causal relationship between revenues and government expenditure is a classic problem of Public Economics. There are four propositions that can potentially explain observed spending-revenue behaviour. The propositions are briefly discussed as follows: the tax-to-spend hypothesis suggests that the government first determines the budget and then decides how much to spend. Conventional wisdom suggests that such a policy necessarily reduces budget deficit. However, this is not strictly correct. As Friedman (1978) suggests, if changes in government revenue leads to changes in government expenditure, then an existing deficit does not shrink in volume. If revenues have a positive impact on expenditure, then decreasing revenues will lead to lower deficit.

A slightly different proposition comes from Buchanan and Wagner (1977, 78). According to them, although government revenue determines government expenditure, the relationship is opposite to what Friedman predicts. Government expenditures financed by means other than taxation results in the public's perception that the price of government expenditure is less than what it would be under taxation (and they favour such an outcome). Although the agents are paying less in terms of tax, fiscal illusion arises because they do not see the cost in terms of higher interest rate and crowding out. So lowering of taxes is associated with higher government spending. Formally, this hypothesis can be expressed as

$$G_t = f(R_{t-j})$$

Or

$$\Delta G_t = f(\Delta R_{t-j})$$

Here, G_t is expenditure in time t, R_t is revenue in time t, j = 0, 1, 2, 3… and Δ is the change. f' is expected to be positive if the Friedman version is true, while it is negative if the Buchanan-Wagner version is true.

At the other extreme, we have the spend-to-tax hypothesis: (changes in) government expenditure leads to (a change in) government revenue. This view has been well summarized by Dalton (1923), "while an individual adjusts income to expenditure; a public authority adjusts expenditure to income". Notice that such an act always creates or widens a pre-existing deficit in the first place. It is argued that government can not postpone expenditure on certain sectors, such as health, education or defence, and hence, it can not or does not care about the deficit.1 If spend-to-tax hypothesis is true, then, in order to reduce budget deficits, the ability of the government to spend above its means should be minimized. This hypothesis can be expressed as

$$R_t = f(G_{t-j})$$

Or

$$\Delta R_t = f(\Delta G_{t-j})$$

Here we expect $f' > 0$. One can see that the two competing hypotheses prescribe opposite institutional reforms in order to contain budget deficit.

Spend-and-tax hypothesis suggests that revenue and spending decisions are taken and executed at the same time. Typically, government, as a rational agent, equates the marginal cost of taxation with the marginal benefit of government spending. Revenue and government expenditure are linked through balanced budget, so that, either

$$R_t = f(G_t)$$

Or

$$\Delta R_t = f(\Delta G_t)$$

Last, but not the least, in US, some spending decisions and revenue decisions are institutionally uncoupled. If this is the case, then expenditure and revenue are causally independent.

For the sake of completeness, let us remember that there is another angle to the whole issue. From a political economy point of view, incumbent governments (that are unsure to win any election) may indulge in spending just before the election in order to leave the next

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1 Such reasoning forms the intellectual backbone for the modern interpretation of Ricardian equivalence hypothesis (Barro, 1974) that current expenditure translates into higher future tax revenue and agents are perfectly able to see through it.

government (ruled by, presumably, another party) in trouble.1 On the other hand governments are fiscally prudent if firmly ensconced.

The importance of the problem is can be hardly overstated, especially in a federal country like India. In a federal economy, sub national governments (SNG's) must rely on central transfer in presence of vertical inequality. If the SNG's anticipate that, in moment of fiscal crisis, a (weak)central authority will bail them out through lump sum(i.e. non formulaic) transfers, then such a belief generates perverse incentive to generate a deficit at the sub national level through lower local revenue.2 This has two (related) implications. Either the SNG's accumulate large debts and (unproductive) debt servicing becomes responsibility of the central government3 or they rely increasingly on central grants (vis-à-vis local revenue) in order to provide (productive) local public goods. To arrest such trends, the Twelfth Finance Commission has recommended that states that ratify Fiscal Responsibility Act (i.e. committed to reduce the deficit by a certain limit), will receive substantial debt relief. However, there is no indication of how this would be achieved: states are left with their own devices in order to reduce the deficit. Yet, as the discussion suggests, it is vitally important to establish the link between revenue and expenditure.

The issue essentially becomes an empirical one involving the standard time series investigations of long run relationships among variables (cointegration and unit root), short run deviation from long run DGP and the associated adjustment process (error correction) as well as causality analysis (Granger Causality, VAR). As expected, the literature is not unanimous regarding the conclusion. Among recent attempts, Bohn (1991), Mounts and Sowell(1997), Koren and Stiassny (1998) as well as

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[1] See, for example, Alesina and Tabellini (1990).

[2] This fear was implicit in Madison's famous caveat. See *The Federalist*, 10.

[3] During the 1990's, in Brazil and Argentina, bailouts created Macroeconomic problems.

Change, Liu and Caudill (2002) support the tax-to-spend hypothesis, wheareas Jones and Joulfaian (1991) and Ross and Payne(1998) argue in favour of spend to tax hypothesis. At a more disaggregated level, Payne (1998) finds that, in US, the tax-to-spend hypothesis is supported by the budgetary decision of 24 states; the spend-to-tax hypothesis is valid for 8 states while the fiscal synchronization pattern is observed for 11 states. In addition, Miller and Russek (1989), Hasan and Sukar (1995) as well as Owoye (1995) found evidence to support the fiscal synchronization hypothesis. Finally, Hoover and Sheffrin (1992) and Baghestani and McNown (1994) have provided evidence for the institutional separation hypothesis.

This ambiguity is present even in the context of Indian data. Dhanasekaran (2001) found that results do depend on model specification. For example, Granger causality test suggests unidirectional causality from expenditure to revenue, while Gweke type modeling finds partial (only when revenue is a dependent variable) evidence of bi directional causality. In a more recent study, Raju (2008) has desegregated the revenue receipts and expenditure patterns. According to her, "Support for … spend and tax hypothesis is observed for *three* of the seven revenue-expenditure pairs… whereas … tax-and-spend hypothesis is seen for *two* of the seven revenue-expenditure pairs".[1]

However, in Indian context, disaggregated state-specific studies (in line of Payne, *op. cit*) are somewhat rare. Bhat *et al*. (1993) analyzed the states' total expenditure and tax revenue using data from 1969 to1989, and found evidence of bi-directional causality using Granger causality test as well as the Sims test. It is not clear from the study if tax revenue consists of only own tax revenue or if it includes the share of central tax.[2] Of some interest is the work by Vadlamannati and Veni

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[1] Emphasis added.

[2] Data description for this work leaves a lot to be desired.

(2007) that analyzes the state of Andhra Pradesh and establishes a causal relationship from revenue to expenditure. The political economy angle has been analyzed in Chaudhuri and Dasgupta (2006). They obtain the result that, during election years, state governments[1] collect less commodity tax revenue and spend more on capital accounts (that has higher visibility). Thus, in the vicinity of election years, spending gets precedence over taxation. The focus of the paper, however, is not the tax-expenditure nexus *per se*, and hence does not employ the standard time series techniques.

The objective of the present paper is a modest attempt to fill the gap. We use data on four southern states (namely Andhra Pradesh, Karnataka, Kerala and Tamil Nadu), and try to obtain temporal relationship between the relevant variables. The range of time period is from 1980-81 to 2003-04. We have focused on states' own revenue as expenditure side variable, since that would give us some idea regarding their own effort in containing the budget deficit.. We have used the standard econometric techniques of cointegration, error correction and Granger causality. Results are somewhat mixed. For Andhra Pradesh, total revenue and total expenditure seems synchronized, while for expenditure without interest payments, spend-to-tax hypothesis is supported. For Karnataka, we obtain presence of unidirectional causality running from total own revenue to total revenue expenditure. For Kerala, we found the evidence for fiscal synchronization. For Tamil Nadu, we failed to detect any indication of either cointegration or causality. It seems that the decisions are institutionally uncoupled. It seems that, within the states, we find a lot of variations *á la* Payne (1998).

The paper is organised as follows. The first section discusses about the data and its brief description; the next section presents the methodology as well as the results, followed by the conclusion section.

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[1] For 14 major Indian states.

DATA AND DESCRIPTIVE STATISTICS

Our data source is the Reserve Bank of India and annual in nature.[1] We use the state's total own revenue receipts and state's total own tax revenue. We do not include variables like states' share on central taxes or the grants that the states get from the central government. On the expenditure side we use states' revenue expenditure with and without interest payments. We work with real per capita data (base year is 1993/94) and the net state domestic product price deflator is being used for converting the nominal variables in real terms. All the variables are expressed in natural logarithms. We focus mainly on four southern states, namely, Andhra Pradesh, Karnataka, Kerala and Tamil Nadu. Our sample is period is from 1980/81 to 2004/05, thus giving us twenty five observations per state.

Table 12.1 presents descriptive statistics of the variables that we use in our analysis. We present three alternative revenue deficit variables (all expressed as a proportion of state domestic product). Revenue deficit 1 is defined as the difference between total own tax revenue and revenue expenditure. Revenue deficit 2 is defined as the difference between total own tax revenue and revenue expenditure without the interest payments. Revenue deficit 3 is defined as the difference between total own revenue and revenue expenditure.

Several observations can be made from Table 12.1. The average total own revenue and the average total own tax revenue is highest for the state of Tamil Nadu and lowest in case of Andhra Pradesh. The same is true with the expenditure variables. Second, the variability of the revenue variable is lowest for Andhra Pradesh. Third, the state of

[1] Data on tax and expenditure variables are from Handbook of Statistics on State Government Finances and the data on per capita net state domestic product from the Handbook of Statistics on Indian Economy.

Karnataka and Tamil Nadu shows greater dispersion with the expenditure variables. Fourth the average revenue deficit except for revenue deficit 2, is highest in case of Andhra Pradesh. Last, the standard deviation of the revenue deficit is largest in Tamil Nadu. To get a better understanding of the movements in all these variables, we carry out a detailed examination of the time-series properties of our data in the next section.

Empirical Results

We divide this section in three sub-sections: sub-section 1 deals with the univariate unit root test; the results from the cointegration is reported in sub-section 2, whereas in sub-section 3, given the results of cointegration test, we present the error-correction models.

Univariate Unit Root Tests

We begin with an analysis of univariate unit root results. The univariate unit root tests provide time series information about the stationarity properties of the individual series. We have performed the augmented Dickey-Fuller (ADF) unit root tests to serve as a benchmark for the subsequent analysis. We estimate the following equation:

$$\Delta P_t = \alpha + \beta P_{t-1} + \delta t + \sum_{j=1}^{k} \gamma_j \Delta P_{t-j} + \varepsilon_t \qquad \text{...(1)}$$

where P_t is the series in question. To select the lag length k, we follow the modified Akaike information criteria suggested by Ng and Perron (2001). Since we only have 25 observations through time, we start with $k = k_{max} = 3$. We include a trend term in (1). The null hypothesis of a unit root is rejected in favour of the alternative if □is significantly different from zero.

Table 12.1: Descriptive Statistics for the Selected Variables

Variables	States							
	Andhra Pradesh		Karnataka		Kerala		Tami Nadu	
	MMean	SS.D.	MMean	SS.D.	MMean	SS.D.	MMean	SS.D.
Total Own Revenue[a]	6.65	0.28	6.85	0.34	6.70	0.31	6.88	0.34
Total Own Tax Revenue[a]	6.38	0.31	6.62	0.39	6.54	0.37	6.73	0.37
Total Revenue Expenditure[a]	7.13	0.31	7.20	0.37	7.20	0.37	7.29	0.37
Total Revenue Expenditure without Interest Payments[a]	6.99	0.26	7.08	0.33	7.04	0.32	7.18	0.33
Revenue Deficit 1	-0.082	0.012	-0.074	0.012	-0.070	0.020	-0.065	0.015
Revenue Deficit 2	-0.093	0.011	-0.079	0.011	-0.094	0.014	-0.078	0.021
Revenue Deficit 3	-0.057	0.009	-0.047	0.005	-0.053	0.013	-0.048	0.011
Per Capita Real SDP	8.86	0.324	8.92	0.360	8.84	0.388	9.01	0.376

Note: All the variables are in per capita real terms (1993/94 as the base) and in natural logarithm.

Total own Revenue is defined as the sum of total own tax revenue and total own non-tax revenue. Revenue deficit 1 is defined as the difference between total own tax revenue and revenue expenditure expressed as a proportion of State Domestic Product. Revenue deficit 2 is defined as the difference between total own tax revenue and revenue expenditure without the interest payments expressed as a proportion of State Domestic Product. Revenue deficit 3 is defined as the difference between total own revenue and revenue expenditure expressed as a proportion of State Domestic Product.

The results of the ADF '*studentized-t*' tests are reported in Table 12.2. Of the 32 cases considered, we reject the null hypothesis in only 5 cases at the 10% marginal significance level, and just 2 at the 5% level.

Table 12.2: Unit Root test for the Selected Variables

Variables	States			
	Andhra Pradesh	Karnataka	Kerala	Tamil Nadu
Total Own Revenue[a]	-1.348	-0.343	-3.149	-3.117
Total Own Tax Revenue[a]	-1.347	-2.074	-3.652**	-3.267*
Total Revenue Expenditure[a]	-1.727	-1.567	-1.042	-2.527
Total Revenue Expenditure without Interest Payments[a]	-2.171	-1.568	-4.301**	-2.464
Revenue Deficit 1	-3.088	-1.225	-2.211	-2.589
Revenue Deficit 2	-3.544*	-2.490	-2.673	-2.356
Revenue Deficit 3	-3.503*	-1.971	-2.048	-1.732
Per Capita SDP	-2.601	-2.417	-2.634	-1.943

Note: All the variables are in per capita real terms (1993/94 as the base) and in natural logarithm.

Total own Revenue is defined as the sum of total own tax revenue and total own non-tax revenue. Revenue deficit 1 is defined as the difference between total own tax revenue and revenue expenditure expressed as a proportion of State Domestic Product. Revenue deficit 2 is defined as the difference between total own tax revenue and revenue expenditure without the interest payments expressed as a proportion of State Domestic Product. Revenue deficit 3 is defined as the difference between total own revenue and revenue expenditure expressed as a proportion of State Domestic Product. We include a constant and a trend term while testing for the presence of unit root in the variables. We use Modified Akaike Information Criteria for selecting the lag-length while testing for the unit root starting with a maximum lag-length of four. The critical values are -4.394 (at 1%), -3.612(at 5%) and -3.243 (at 10%) respectively. * (**) denotes significance at 10% (5%) level.

We obtain the revenue deficit variable is non-stationary in most cases except for Andhra Pradesh, where it is stationary in case of revenue deficit 2 and revenue deficit 3. This in turn can be considered as support for the "strong form" of the revenue deficit sustainability. Non-stationary behavior in other cases implies an unsustainable budgetary process. Our result is consistent with Hamilton and Flavin (1986) for Andhra Pradesh but in all other cases corroborates the findings of Wilcox (1989), Trehan and Walsh (1988, 1991), and Kremers (1989).

Cointegration Tests

Methodology

The Engle-Granger (1987) test is the most commonly employed (single equation) approach to the analysis of cointegration. Given two variables of interest $\{y_t, x_t\}$, the first stage of this two-step procedure involves the estimation of the following static cointegrating regression:

$$y_t = \alpha_t + \beta x_t + u_t \qquad \text{...(2)}$$

where α_t denotes a deterministic term which may be either an intercept or an intercept and linear trend. In the second step, potential cointegration between $\{y_t, x_t\}$ is examined by analysing the order of integration of the estimated residuals $\{\hat{u}_t\}$ from equation (2) using Dickey-Fuller as outlined in equation (1). If the estimated residuals is stationary, then we claim that $\{y_t, x_t\}$ are cointegrated.

However, note that the Engle-Granger (1987) test is a single-equation procedure and thus ignores the potential endogeneity. We also cannot conduct any statistical tests on cointegration vector coefficients as the standard errors are unreliable. Given these problems, we apply the cointegration methodology of Johansen (1988, 1991) and Johansen and Juselius (1990). These methods have been shown to have sound large and finite-sample properties. Let X_t denote a px1 vector of I(1) variables. To implement an amalgam of these procedures, the least squares residuals are estimated, assuming that a k-dimensional vector autoregressive process can describe the data. Consequently, the data can be represented as:

$$X_t = -\varphi_t + \prod_1 X_{t-1} + \prod_2 X_{t-2} + \ldots + \prod_k X_{t-k} + \varepsilon_t \qquad \ldots(3)$$

where ε_t is an independent and identically distributed Gaussian process, φ_t is the unrestricted constant and Π_i are p x p matrices. In order to distinguish between stationarity by linear combinations (cointegration) and by differencing, one subtracts X_{t-1} from both sides of the above equation and obtains:

$$\Delta X_t + \prod X_{t-k} = -\varphi + \Gamma_1 X_{t-1} + \Gamma_2 X_{t-2} + \ldots + \Gamma_{k-1} X_{t-k+1} + \varepsilon_t \ldots(4)$$

where $\Gamma_i = \sum_{j=1}^{i} \prod_j - I; \prod = I - \sum_{j=1}^{k} \prod_j$ and I is the identity matrix. There are three possible cases to consider: (1) Rank (Π) = p (X_t is stationary); (2) Rank (Π) = 0 (absence of any stationary long-run relationship among the variables in X_t) and (3) Rank (Π) = $r < p$ where r determines the number of cointegrating relationship. When $r < p$, the equation has an error correction representation (Engle and Granger (1987)). Johansen's multivariate cointegration is equivalent to the estimation of the rank of Π. Johansen derives two tests of the hypothesis that there are at most r cointegrating relationships, namely the maximum eigenvalue statistics and the trace statistics. In case of trace statistics, the null hypothesis that there is at most r cointegrating relationship is tested against a general alternative that it is greater, whereas in the maximum eigenvalue test the alternative is defined explicitly (at most r cointegrating relationship is tested against an alternative that it is $r + 1$).

RESULTS

We report the results from Johansen's procedure in Tables 12.3a – 12.3d. We start with a maximum lag-length of two in vector-autoregressive model and use the Akaike information criteria (*AIC*) to select the lag-length. Our model includes a constant and a trend in the cointegrating relationship. We consider four pairs: a) Total Own Revenue-Total Revenue Expenditure; b) Total Own Tax Revenue-Total Revenue Expenditure; c) Total Own Revenue - Total Revenue Expenditure with Interest Payments and d) Total Own Tax Revenue - Total Revenue Expenditure without Interest Payments. In case of Andhra Pradesh (Table 12.3a), we obtain the presence of one cointegrating relationship in all the four cases by the maximum eigenvalue test and in two cases by the trace test. Our result for Karnataka (Table 12.3b) is mixed in nature.

Table 12.3a: Cointegration Test Results

Variables	Andhra Pradesh			
	Maximum Eigen Value		*Trace*	
	None	At Most One	None	At Most One
Total Own Revenue-Total Revenue Expenditure	20.116 (0.03)	2.375 (0.94)	22.491 (0.12)	2.375 (0.94)
Total Own Tax Revenue-Total Revenue Expenditure	21.671 (0.02)	2.912 (0.89)	24.582 (0.07)	2.912 (0.89)
Total Own Revenue - Total Revenue Expenditure without Interest Payments	20.961 (0.03)	2.070 (0.96)	23.031 (0.11)	2.070 (0.96)
Total Own Tax Revenue - Total Revenue Expenditure without Interest Payments	22.354 (0.02)	2.685 (0.91)	25.039 (0.06)	2.685 (0.91)

Note: For the definition of all the variables, please see notes to Table 12.1 and Table 12.2. The numbers in parenthesis are the p-values based on MacKinnon, Haug and Michelis (1999). We use a lag-length of two based on Akaike Information Criteria. Our model includes a constant and a trend in the cointegrating relationship.

Table 12.3b: Cointegration Test Results

Variables	Karnataka			
	Maximum Eigen Value		*Trace*	
	None	At Most One	None	At Most One
Total Own Revenue-Total Revenue Expenditure	12.494 (0.37)	5.114 (0.58)	17.608 (0.37)	5.114 (0.58)
Total Own Tax Revenue-Total Revenue Expenditure	18.471 (0.07)	6.513 (0.40)	24.984 (0.06)	6.513 (0.40)
Total Own Revenue - Total Revenue Expenditure without Interest Payments	13.458 (0.29)	4.456 (0.68)	17.917 (0.35)	4.456 (0.68)
Total Own Tax Revenue - Total Revenue Expenditure without Interest Payments	20.255 (0.04)	5.574 (0.52)	25.829 (0.05)	5.574 (0.52)

Note: For the definition of all the variables, please see notes to Table 12.1 and Table 12.2. The numbers in parenthesis are the p-values based on MacKinnon, Haug and Michelis (1999). We use a lag-length of one based on Akaike Information Criteria. Our model includes a constant and a trend in the cointegrating relationship.

We provide the evidence in favour of cointegration when we consider the relationship between use of total own tax revenue and total revenue expenditure (with or without interest payments). However, if we use total own revenue and total revenue expenditure ((with or without interest payments), we find that there exists no cointegration between the variables. In Table 12.3c, we report the results for the state of Kerala. We could not perform the analysis for total own tax revenue-total revenue expenditure without interest payments as both the variables are stationary at 5% level of significance. Although the maximum eigenvalue test statistic fails to detect the presence of cointegrating relationship between total own revenue-total revenue expenditure, the trace statistics indicate the presence of cointegration at 10% level of significance.

Table 12.3c: Cointegration Test Results

Variables	Kerala			
	Maximum Eigen Value		*Trace*	
	None	At Most One	None	At Most One
Total Own Revenue-Total Revenue Expenditure	14.975 (0.19)	9.186 (0.17)	24.162 (0.08)	9.186 (0.17)
Total Own Tax Revenue-Total Revenue Expenditure	28.668 (0.00)	5.430 (0.54)	34.099 (0.00)	5.430 (0.54)
Total Own Revenue - Total Revenue Expenditure without Interest Payments	47.251 (0.00)	8.854 (0.19)	56.106 (0.00)	8.854 (0.19)

Note: For the definition of all the variables, please see notes to Table 12.1 and Table 12.2. The numbers in parenthesis are the p-values based on MacKinnon, Haug and Michelis (1999). We use a lag-length of one based on Akaike Information Criteria except for the Total Own Revenue-Total Revenue Expenditure relationship, where the lag-length was set to be equal to two. Our model includes a constant and a trend in the cointegrating relationship. We could not perform the analysis for total own tax revenue-total revenue expenditure without interest payments as both the variables are stationary at 5% level of significance (see Table 12.2). However the Granger Causality Test suggests that there exists unidirectional causality from own tax revenue to total revenue expenditure without interest payments.

In case of total own tax revenue-total revenue expenditure (with or without interest payments), we get the presence of cointegration by both the statistics. The results for the state of Tamil Nadu are presented in Table 12.3d. Note, in all the four cases that we have considered, we find no evidence in favour of cointegration.

In sum, we infer that in three out of the four states that we have considered, the presence of cointegration between the state's own revenue and revenue expenditure is present. The existence of cointegration between revenues and expenditures can be considered as evidence consistent with the intertemporal budget constraint and the 'weak form' of the sustainability of budget deficits. Our results in case of Andhra Pradesh, Karnataka and Kerala confirm the findings of Haug

(1991), Tanner and Liu (1994), Quintos (1995), Payne (1997), Martin (2001) and Cunado *et al*. (2004).

Table 12.3d: Cointegration Test Results

Variables	Tamil Nadu			
	Maximum Eigen Value		*Trace*	
	None	At Most One	None	At Most One
Total Own Revenue-Total Revenue Expenditure	13.857 (0.26)	5.631 (0.51)	19.488 (0.25)	5.631 (0.51)
Total Own Tax Revenue-Total Revenue Expenditure	15.942 (0.15)	5.631 (0.51)	21.925 (0.14)	5.982 (0.46)
Total Own Revenue - Total Revenue Expenditure without Interest Payments	13.786 (0.27)	5.253 (0.56)	19.039 (0.28)	5.253 (0.56)
Total Own Tax Revenue - Total Revenue Expenditure without Interest Payments	15.836 (0.15)	5.546 (0.52)	21.381 (0.16)	5.546 (0.52)

Note: For the definition of all the variables, please see notes to Table 12.1 and Table 12.2. The numbers in parenthesis are the p-values based on MacKinnon, Haug and Michelis (1999). We use a lag-length of two based on Akaike Information Criteria. Our model includes a constant and a trend in the cointegrating relationship.

Error-correction Models

In order to focus on the short-run dynamics, we build up the error-correction mechanism for those cases where we have obtained evidence in favour of cointegration. We can also use the error-correction model to test for the direction of causality. The error-correction model for the two-variable $\{y_t, x_t\}$ system can be specified as:

$$\begin{aligned} \Delta y_t &= \lambda_1 + \sum_{i=1}^{k-1} \alpha_{11i} \Delta y_{t-i} + \sum_{i=1}^{k-1} \alpha_{12i} \Delta x_{t-i} + \delta_1 ect_{t-1} \\ \Delta x_t &= \lambda_2 + \sum_{i=1}^{k-1} \alpha_{21i} \Delta y_{t-i} + \sum_{i=1}^{k-1} \alpha_{22i} \Delta x_{t-i} + \delta_2 ect_{t-1} \end{aligned} \quad \ldots(5)$$

where k denotes the lag-length in the original *VAR* model, λ_1 (λ_2) are constants, *ect* denotes the estimated error-correction term. Johansen

(1992) shows that if a variable is weakly exogenous for the purpose of estimating the elements of the cointegrating vector, then the corresponding elements of δ should be zero. Therefore, weak exogeneity of the variable y_t (x_t) can be tested by testing the null that $\delta_1 = 0$ ($\delta_2 = 0$).

Table 12.4a: Error-Correction Model (Andhra Pradesh)

Variables	Total Own Revenue – Total Revenue Expenditure		Total Own Tax Revenue- Total Revenue Expenditure	
	(1)	(2)	(3)	(4)
Error-Correction	-0.398	0.466	-0.351	0.438
$Term_{t-1}$	(-1.843)*	(2.148)**	(-1.768)*	(2.174)**
ΔTotal Own $Revenue_{t-1}$	0.160	0.002		
	(0.815)	(0.011)	--	--
ΔTotal Own Tax			0.185	-0.075
$Revenue_{t-1}$	--	--	(1.014)	(-0.427)
ΔTotal Revenue	0.124	0.174	0.335	0.218
$Expenditure_{t-1}$	(0.426)	(0.593)	(1.055)	(0.718)
Constant	0.029	0.038	0.021	0.039
	(1.481)	(1.889)*	(1.002)	(1.926)*
Variables	Total Own Revenue – Total Revenue Expenditure without Interest Payments		Total Own Tax Revenue- Total Revenue Expenditure without Interest Payments	
Error-Correction	-0.178	0.478	-0.269	0.230
$Term_{t-1}$	(-1.105)	(3.000)***	(-1.752)*	(1.300)
ΔTotal Own $Revenue_{t-1}$	0.073	0.027		
	(0.363)	(0.135)		
ΔTotal Own Tax		--	0.155	-0.087
$Revenue_{t-1}$			(0.866)	(-0.421)
ΔTotal Revenue	0.253	0.237	0.410	-0.101
Expenditure without	(0.968)	(0.921)	(1.801)*	(-0.385)
$Interest_{t-1}$				
Constant	0.029	0.028	0.023	0.045
	(1.505)	(1.471)	(1.226)	(2.145)**

Note: We work with the first-differenced series for all the variables. For the definition of all the variables, please see notes to Table 12.1 and Table 12.2. The numbers in parenthesis are the *t*-statistics. *, **, and * ** denotes significant at 10%, 5% and 1% level respectively. (1) uses ΔTotal Own Revenue as the dependent variable and in (2) ΔTotal Revenue Expenditure is being used as the dependent variable. Similarly in (3) ΔTotal Own Tax Revenue is the dependent variable and in (4) ΔTotal Revenue Expenditure without interest payments is being used as the dependent variable.

The coefficient has a standard *t*-distribution since all the variables in the regression are stationary. We report the results for Andhra Pradesh, Karnataka and Kerala in Tables 12.4a, 12.4b and 12.4c respectively. The results are reported only for those cases where we have obtained the evidence in favour of cointegration.

The result for Andhra Pradesh is mixed in nature (Table 12.4a). When we analyze the relationship using total revenue expenditure, we find that the error correction term is significant in both equations (Column (1) & Columns (2), Column (3) & Column (4)). This implies that errors from cointegrating vector affect both the changes in total own per capita real revenue (own per capita tax revenue) and changes in per capita revenue expenditure. This in turn provides support for the fiscal synchronization (revenue and spending decisions are taken and executed at the same time). However, when we use revenue expenditure without interest payments, our results change.

In case of Total Own Revenue – Total Revenue Expenditure without Interest Payments relationship, errors from cointegrating vector influences the changes in revenue expenditure but not that in own total revenue providing us support that own revenue acts as the weakly exogenous variable and therefore an evidence in favour of the revenue-to-spend hypothesis. In case of Total Own Tax Revenue – Total Revenue Expenditure without Interest Payments relationship, errors from cointegrating vector influences the changes in own tax revenue but not that in revenue expenditure providing us support for the spend-to-tax hypothesis.

Table 12.4b: Error-Correction Model (Karnataka)

Variables	Total Own Tax Revenue-Revenue Expenditure		Total Own Tax Revenue – Revenue Expenditure without Interest Payments	
	(1)	(2)	(3)	(4)
Error-Correction	-0.026	0.062	-0.016	0.075
Term_{t-1}	(-0.954)	$(2.351)^{**}$	(-0.610)	$(2.788)^{**}$
Constant	0.057	0.055	0.057	0.051
	$(4.607)^{***}$	$(4.472)^{***}$	$(4.550)^{***}$	$(3.878)^{***}$

Note: We work with the first-differenced series for all the variables. For the definition of all the variables, please see notes to Table 12.1 and Table 12.2. The numbers in parenthesis are the *t*-statistics. *, **, and * ** denotes significant at 10%, 5% and 1% level respectively. (1) uses ∆Total Own Tax Revenue as the dependent variable and in (2) ∆Total Revenue Expenditure is being used as the dependent variable. Similarly in (3) ∆Total Own Tax Revenue is the dependent variable and in (4) ∆Total Revenue Expenditure without interest payments is being used as the dependent variable. Given the absence of any cointegrating relationship in case of Total Own Revenue and Total Revenue Expenditure with or without interest payments, we have conducted the Granger Causality test using the first-differenced series for these variables. In both cases, we have obtained the presence of unidirectional causality from total own revenue to total revenue expenditure.

In Table 12.4b, we report the results for Karnataka. Given the absence of any cointegrating relationship in case of Total Own Revenue and Total Revenue Expenditure with or without interest payments, we have conducted the Granger Causality test using the first-differenced series for these variables. In both cases, we have obtained the presence of unidirectional causality running from total own revenue to total revenue expenditure. When we examine the Total Own Tax Revenue and Total Revenue Expenditure with or without interest payments relationship, we found that tax revenues are weakly exogenous since they do not respond to the errors in the cointegrating vector. Only the revenue expenditure adjusts to eliminate errors in the cointegrating vector. Therefore, our results in case of Karnataka can be used as evidence favouring the tax-to-spend hypothesis.

Table 12.4c: Error-Correction Model (Kerala)

Variables	Total Own Revenue – Total Revenue Expenditure		Total Own Tax Revenue- Total Revenue Expenditure		Total Own Revenue- Total Revenue Expenditure without Interest Payments	
	(1)	(2)	(3)	(4)	(5)	(6)
Error-Correction Term$_{t-1}$	-0.790 (-6.275)***	-0.701 (-3.553)***	-0.183 (-2.795)**	-0.313 (-4.762)***	-0.638 (-6.916)***	-0.473 (-3.221)***
ΔTotal Own Revenue$_{t-1}$	0.354 (2.847)**	0.335 (1.719)	--	--	--	--
ΔTotal Revenue Expenditure$_{t-1}$	0.266 (1.880)*	-0.044 (-0.198)	--	--	--	--
Constant	0.021 (2.071)*	0.046 (2.881)**	0.050 (4.045)***	0.048 (3.853)***	0.033 (3.201)***	0.041 (2.507)**

Note: We work with the first-differenced series for all the variables. For the definition of all the variables, please see notes to Table 12.1 and Table 12.2. The numbers in parenthesis are the *t*-statistics. *, **, and * ** denotes significant at 10%, 5% and 1% level respectively. (1) uses ΔTotal Own Revenue as the dependent variable and in (2) ΔTotal Revenue Expenditure is being used as the dependent variable. Similarly in (3) ΔTotal Own Tax Revenue is the dependent variable and in (4) ΔTotal Revenue Expenditure is being used as the dependent variable. In (5) we use ΔTotal Own Revenue as the dependent variable and in (6) □Total Revenue Expenditure without interest payments is being used as the dependent variable.

In case of Kerala, we could not perform the analysis for total own tax revenue-total revenue expenditure without interest payments as both the variables are stationary at 5% level of significance (see Table 12.2). The Granger Causality Test suggests that there exists unidirectional causality from own tax revenue to total revenue expenditure without interest payments. In all the other three cases (Table 12.4c) the errors from cointegrating vector affect both the changes in total own per capita real revenue (own per capita tax revenue) and changes in per capita revenue expenditure. This in turn provides support for the fiscal synchronization (revenue and spending decisions are taken and executed at the same time).

Table 12.4d: Granger Causality Test Results (Tamil Nadu)

Relationship	Test-Statistic and Inference
Total Own Revenue causes Total Revenue Expenditure	0.03 (0.97), NO
Total Revenue Expenditure causes Total Own Revenue	0.47 (0.63), NO
Total Own Tax Revenue causes Total Revenue Expenditure	0.31 (0.74), NO
Total Revenue Expenditure causes Total Own Tax Revenue	0.12 (0.89), NO
Total Own Revenue causes Total Revenue Expenditure without Interest Payments	0.09 (0.91), NO
Total Revenue Expenditure without Interest Payments causes Total Own Revenue	0.51 (0.61), NO
Total Own Tax Revenue causes Total Revenue Expenditure without Interest Payments	0.38 (0.69), NO
Total Revenue Expenditure without Interest Payments causes Total Own Tax Revenue	0.18 (0.83), NO

Note: We work with the first-differenced series for all the variables. For the definition of all the variables, please see notes to Table 12.1 and Table 12.2. The numbers in parenthesis are the *p*-values based on *F*-Statistic.

We do not obtain any evidence in favour of cointegration using data from Tamil Nadu. Therefore, we conduct the Granger causality test after taking the first-differenced of the data. The result is reported in Table 12.4d. We do not find any evidence for the Granger causality and infer that expenditure and revenue decisions may be institutionally uncoupled.

CONCLUSION

This paper, we believe, is the first attempt to investigate the revenue-expenditure hypothesis for the Southern states taken separately such that we can avoid any aggregation problem. To this end, we used cointegration tests to see if the series move together in time, and, if they do, the direction of causality. As in other studies in context of US states, we did not find any monotonic result. For Kerala and Andhra Pradesh, fiscal synchronization seems to be the mode; for Karnataka revenues lead to expenditure. For Tamil Nadu, the data failed to show any evidence of causality.

Given these mixed nature of the conclusion, the next question is why such inconclusive results emerge? We believe that a full scale analysis must include the role of (discretionary) central grants as well as some political factors. Moreover, increasing the database to include all (at least 14 major) Indian states is another extension that we are looking forward to.

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