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TIME-SERIES PROPERTIES OF STATE-LEVEL PUBLIC EXPENDITURE

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Abstract

Public expenditure reform must be underpinned by some understanding of the time-series properties of public expenditure. This paper examines the univariate properties of aggregate revenue expenditure at the level of State governments in India over the period 1974-98 for three states: Punjab, Haryana and Maharashtra. The empirical exercise is performed on the logarithmic transformation of aggregate revenue expenditure in terms of nominal (rather than ex post real) expenditure, not normalised to State Domestic Product, for reasons justified in the paper, and is confined to the aggregate for lack of a breakdown of the series by economic classification. The data are adjusted for notional entries and other distortionary budgetary practices. There is trend stationarity in Punjab and Haryana, with a deterministic trend growth rate of 16-17 per cent, and clear evidence thereby of fiscal smoothing in the presence of periodic upward shocks of Pay Commission or other origin. In Maharashtra by contrast, aggregate expenditure carries a unit root, with no deterministic trend, and no drift term; expenditure shocks of other than Pay Commission origin appear to have been enabled with no corresponding smoothing, but there is sharp and concurrent smoothing at the time of the Pay Commission shocks, such that aggregate expenditure does not show a spike. The issue of whether the fiscal smoothing in each case was unproductive or productive remains unrevealed in the aggregate figures.

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Keywords: public expenditure reform; time-series analysis.

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I. Introduction

Public expenditure reform is a necessary element of all fiscal reform, but must clearly be underpinned by some understanding of the time-series properties of public expenditure. This paper models public expenditure at the level of State governments in India as a univariate process, as a first step in that direction.

The empirical exercise is confined to three states: Punjab, Haryana and Maharashtra. Reported state-level expenditures are subject to spikes resulting from episodic notional accounting entries, with accompanying notional revenue entries, or other distortionary practices. Knowledge of these requires some measure of immersion in the budgetary practices of each state. Prior fiscal studies by the authors[1] yielded insider information of this kind only for the three states selected. The data series for all three covers the period 1974-98, yielding 25 (annual) observations for each. A discontinuity in the reporting format on state-level finances in 1974 made it impossible to carry back the series to earlier years. This may not be as much of a disadvantage as might appear to be the case at first sight. A long time-series constructed by Rajaraman-Mukhopadhyay, 1999, for consolidated (Centre plus States) public domestic debt as a percent of GDP shows a structural break in the slope in 1974,[2] with a positive slope in debt/GDP subsequent to 1974. The oil price hike of 1973 is a universal structural break in economic time series,[3] supplemented by the Third Pay Commission salary hike for government employees, implemented in 1973.

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1 Rajaraman, et.al 1999; Sen and Rao, 2000; NIPFP, 2000.

2 This break was exogenously imposed, but tested for statistical significance within the framework of structural time-series models; see Rajaraman and Mukhopadhyay, 1999.

3 See for example Perron, 1989; by inserting structural breaks in 1929 and 1973 where Nelson-Plosser, 1982, did not, their finding of a unit root was rejected for all but a few (U.S.)

Section II reviews the surprisingly thin empirical literature on time-series properties of public expenditure. Section III describes the public expenditure determination process, and justifies performance of the analysis in terms of nominal rather than realised (ex post) real expenditure. The exercise is performed only on aggregate revenue (current) expenditure. There is prior evidence that capital expenditure is an accommodative component that is compressed at times of fiscal stress (Rajaraman et.al., 2000). In terms of priors, therefore, total expenditure may exhibit stationarity, where revenue expenditure might not. Disaggregation possibilities within revenue expenditure, as obtainable from budgetary data, permit breakdowns by functional (departmental) category alone. A breakdown by economic category (wages and salaries, purchases of goods) would have enabled a meaningful exploration at disaggregated level, but these are not systematically available in published form.

Section IV describes the adjustments made to the raw data for each state. Section V reports the specifications used and the findings, with details of test results in Appendices I (Punjab), II(Haryana), and III(Maharashtra). Section VI presents the conclusions in terms of implications for public expenditure reform.

II. Review of Literature

To the best of our knowledge, the literature on the time series properties of public expenditure is sparse. Ashworth, 1995, tests the null hypothesis of a unit root in real government expenditure in the United Kingdom, and fails to reject the null. Likewise Afxentiou, et.al, 1999, find the presence of a unit root in real per capita federal and provincial government expenditure in Canada. There is an empirical literature that tests Wagner's Law, which states that the share of government expenditure in total output increases as real per capita income grows. Of these, two (Ansari, et.al., 1997; Chletsos and Kollias, 1997) examine the time series properties of real government expenditure in per capita terms. The first finds that real per capita government expenditure is non-stationary (I(1))

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economic time series. However, the imposition of exogenous breaks has been criticised as methodologically unsound by Christiano, 1992 and others.

in Ghana, Kenya and South Africa. A similar finding is reported in the second study for Greece. It is, however, not clear in either case whether or not the tests reject trend-stationarity in favour of difference-stationarity. Other studies testing for Wagner's Law (Amey and Ashworth, 1993; Murthy, 1993; Oxley, 1994; Anwar, et.al, 1996; Bohl, 1996) look at the time series properties of the share of government expenditure in GDP. Of these, the results of Anwar, et.al, 1996, who report for a large number of countries including India, are summarised in Table 1. No clear pattern emerges from their results, but what is of interest is that public expenditure/GDP for India is found to be I(0), i.e. stationary.

III. The Expenditure Process

This exercise models actual aggregate public expenditure on the revenue (current) account, as reported at the conclusion of each fiscal year, which is the final realised outcome of the budgeted projected expenditure for the year. The budgeted estimate (B.E.) is an aggregation of the projected requirements of the different functional departments, after pruning by a central finance department, often augmented by one or more supplementary "demands for grants" during the course of the year. The final expenditure outcome obtains after further pruning in accordance with actual fund flows from the finance department to the spending departments. This second pruning may result either in expenditure carry-overs into the next fiscal year, which would then be merged with the B.E. for the next year, or by truncation of expenditure programmes. In some cases the reverse might happen, with actual expenditure falling short of funds provided, for any of a number of reasons, including procedural obstacles to expenditure. Revenue expenditure has two components: non-plan (committed expenditures from schemes initiated during past quinquennial plans); and plan (new schemes during the on-going quinquennial plan). This paper ignores the plan-nonplan distinction, and looks at total expenditure aggregating across the two.

Expected inflation enters into the budgetary process formally only in the dearness allowance (D.A.) component of wages and salaries, uniformly across departments. The D.A. is a salary add-on linked to the Consumer Price Index relevant to the region/class of employee. It amounts to a form of partial inflation indexation and is not necessarily concurrently paid; D.A. is often paid in the form of bunched arrears. Indeed, it is the lack of full inflation indexation that motivates the periodic upgradation of wage/salary scales by Central Pay Commissions. Once adopted by the Central government, the adoption of these, or in some cases enhanced, scales by State governments is routine. Other expenditure components are not formally indexed, although clearly departmental budgetary expenditure claims would be underpinned by some kind of expectation formation mechanism regarding inflation, most likely adaptive with a one-period lag. The supplementary grants and expenditure pruning process together determine the adjustment to actual inflation, and thus the real ex-post expenditure outcome. However, the process does not either explicitly target or protect real expenditure.

Further, expenditure reform is posed in terms of nominal absolutes. The exercise here is thus confined to the nominal series, and is confined also to aggregate expenditure for lack of data on components by economic category.[4] Further, the series is not normalised with respect to State-level Domestic Product. State-level estimates of domestic product are available only at factor cost, carry an unknown noise element, but most importantly are available only with a considerable time lag, so that observations for recent years would thereby needlessly be excluded.

[4] The sole exception to this is interest, on which information is routinely provided in budgetary data. Interest follows a known recursive growth dynamic over time, as a function of previous accumulations of state-level public debt, reduced in the case of Punjab state by waivers on debt and interest owed to the Central government. These waivers were justified by the Central government on the grounds that the cost of battling terrorism in the state must be nationally borne.

Table 1

Time Series Properties of the Share of Government Expenditure in GDP

Australia	I(1)
Burundi	I(0)
Columbia	I(1)
Greece	I(1)
Indonesia	I(1)
Korea	I(1)
Malta	I(1)
Somalia	I(1)
Tunisia	I(0)
Belgium	I(1)
Canada	I(1)
El Salvador	I(1)
Guatemala	I(0)
Japan	I(1)
Liberia	I(1)
Mauritania	I(1)
Sri Lanka	I(1)
Uruguay	I(1)
Burkina Faso	I(0)
Finland	I(0)
India	I(0)
Jamaica	I(0)
Mali	I(0)
Mexico	I(0)
Trinidad	I(0)

Source: Anwar, et.al. (1996).

Note: Government expenditure refers to general government that includes Centre, States and local governments.

IV. Data Adjustments

Reported and adjusted revenue expenditure in Punjab are shown in figure 1. The components causing the spikes in revenue expenditure, shown in figure 2, were expenditure on state lotteries (in 1994-95 and 1995-96) and on the subsidy to the Punjab State Electricity Board (in 1991-92). In both cases, there were accompanying revenue spikes. In the lotteries case, a brief experiment in 1994-96 with single-digit lotteries sharply raised both collections and pay-outs. In the PSEB case, there was a bunched book adjustment of the annual subsidy due to the PSEB[5] but not paid over a number of years because it was set-off against interest dues from the PSEB. The accumulated subsidy was routed through the budget in 1991-92, against a corresponding notional interest receipt.[6] As can be seen from figure 2, each spike is very sharp, adding as it does additional expenditures of the order of Rs 1500 crores, equivalent to an increase of between a third and a half of normal expenditure.

Figure 3 shows the annual growth rate of adjusted (nominal) revenue expenditure in Punjab. Three spikes in the growth rate are clearly observable: in 1975-76, the very first data point; in 1987-88; and again in 1996-97. These spikes corresponds to implementation of the Third, Fourth, and Fifth Pay Commission scales of pay (the Fifth Pay Commission was implemented with effect from 1 January 1996, but actual payments with arrears were made only starting January 1998 so that the spike in 1996-97 is surprising; it is possible however, that accounting adjustments were made to backdate arrears due so that the expenditure in the year of actual payment did not bunch alarmingly). Annual growth rates of expenditure in these years rose to more than 30 percent, from a mean level of approximately 15 percent. What is of interest is that these are spikes precisely because the rate of growth comes down in the next period very sharply to a below average rate.

Reported and adjusted revenue expenditure in Haryana are shown in figure 4. The adjustments required occur in the period 1994-99 on account of two components: rural electrification subsidy and lotteries. The corresponding spikes on the receipts side are interest receipts/repayments of loans from HSEB and receipts from lotteries. There is a periodic notional routing of interest arrears from

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[5] Since April 1977, to cover the operating losses of PSEB on account of rural electrification; for details see Rajaraman et.al. 1999.

[6] Another such episode was observable in the RE for 1996-97, but not in the actual figures for the year, perhaps because of an ongoing dispute over the amount of subsidy payable; see Rajaraman et.al. 1999: 27.

HSEB against the rural electrification subsidy payable exactly as in the case of Punjab. Again, like Punjab, Haryana experimented with single digit lotteries, which resulted in large receipts and large lottery payments during 1994-99. The growth rate spikes (figure 5) in the case of Haryana, however, show expenditure surges in addition to those originating from Pay Commissions alone, principally in 1980-81 and 1994-95, arising from an assortment of departmental components.[7]

In the case of Maharashtra, the state has a number of schemes carrying reserve funds with dedicated receipts, like the Employment Guarantee Scheme which has five dedicated cesses. Receipts from these cesses are shown as revenue receipts, with corresponding automatic expenditure entries, showing transfer of an equivalent amount to the reserve fund. When actual expenditures are incurred, these are shown as financed through withdrawals from the reserve fund. If in each year, transfers to and withdrawals from these funds were of matching dimensions, the above practice would not introduce any distortions. However, if there is a net positive transfer to the reserve fund, the accounting convention followed shows reported expenditure higher than actual expenditure. In order to correct for this problem, reported expenditures in the case of Maharashtra have been adjusted to exclude net transfers to reserve funds. There is a growing divergence between reported and adjusted expenditure (figure 6) in the nineties, with adjusted expenditure systematically below reported expenditure, showing that there has been a growing absolute net transfer to reserve funds during this decade.

The growth rates in adjusted expenditure for Maharashtra (figure 7) are very different from those for Punjab and Haryana. There are no marked spikes corresponding to implementation of the Pay Commission scales (except for a starting spike in 1975-76). Instead, there are other sharp spikes, in 1978-79, and again in 1981-82, financed by major withdrawal from rural development funds.

[7] In 1980-81 on account of expenditure surges in interest payments, and education and police departments; in 1994-95, in irrigation, water supply and social security.

Figure 1: Punjab Revenue Expenditure

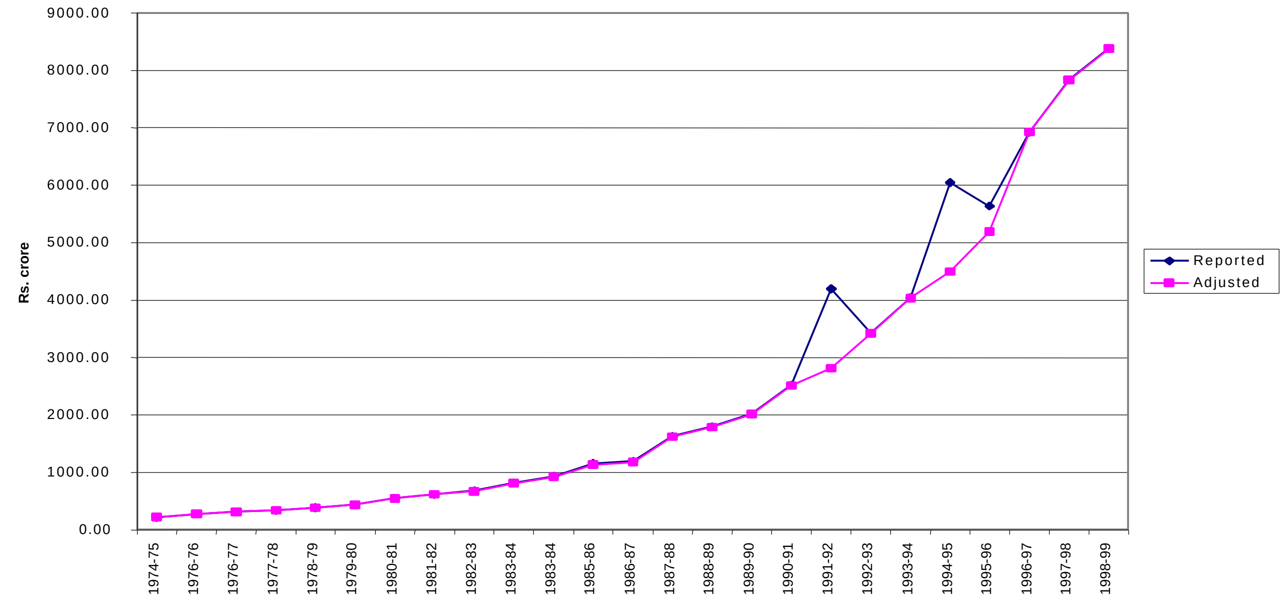


Figure 2: Punjab Expenditure Spikes

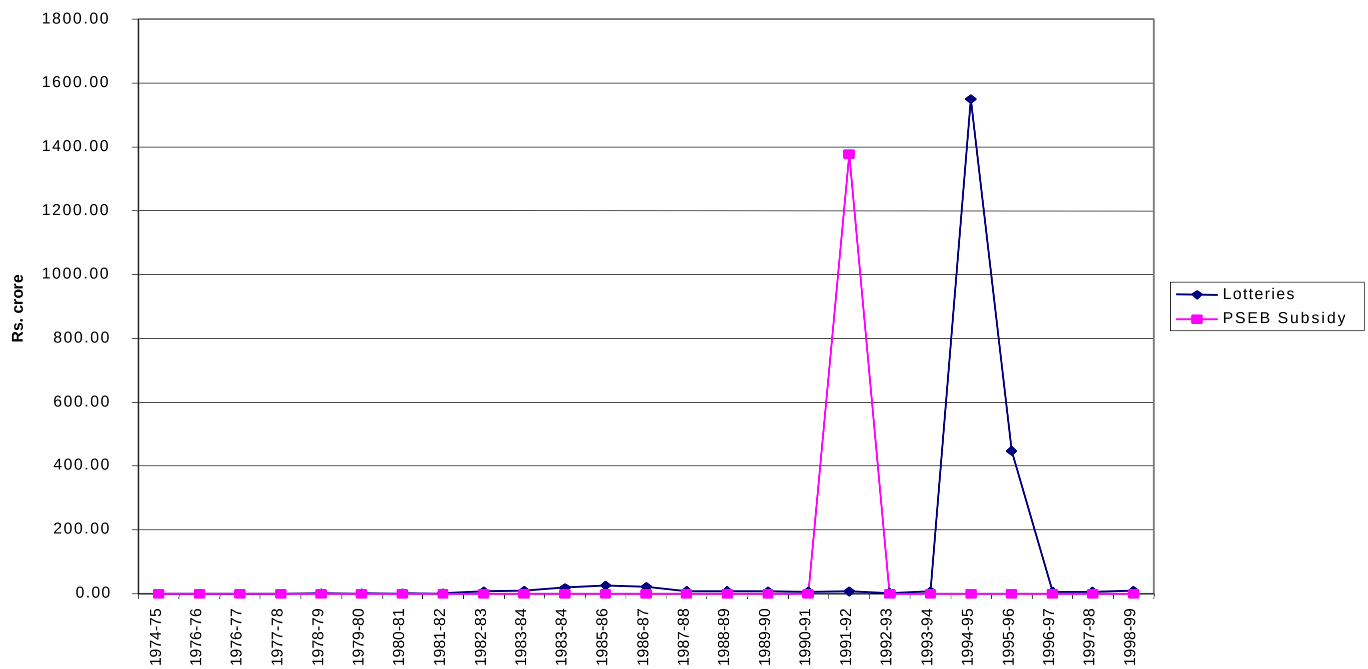


Figure 3: Punjab Revenue Expenditure Growth Rates

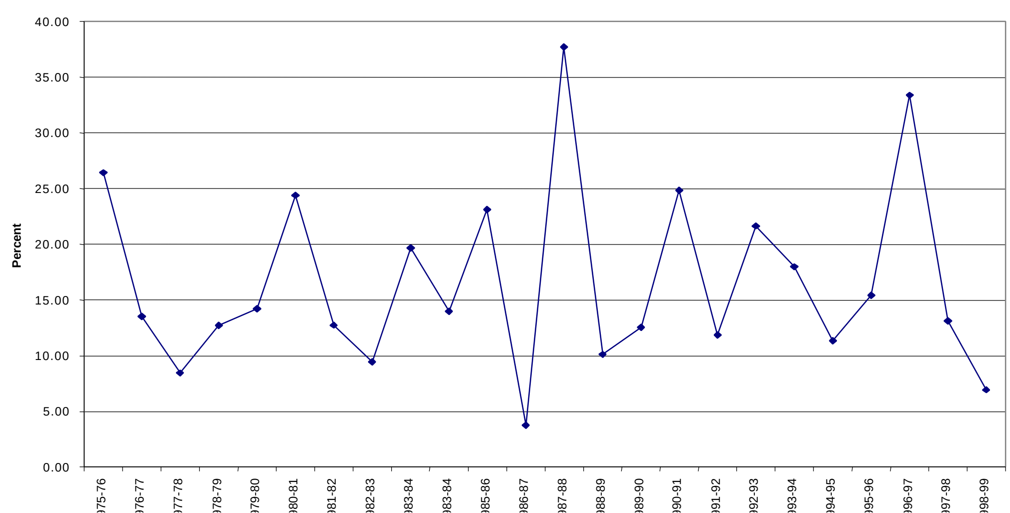


Figure 4: Haryana Revenue Expenditure

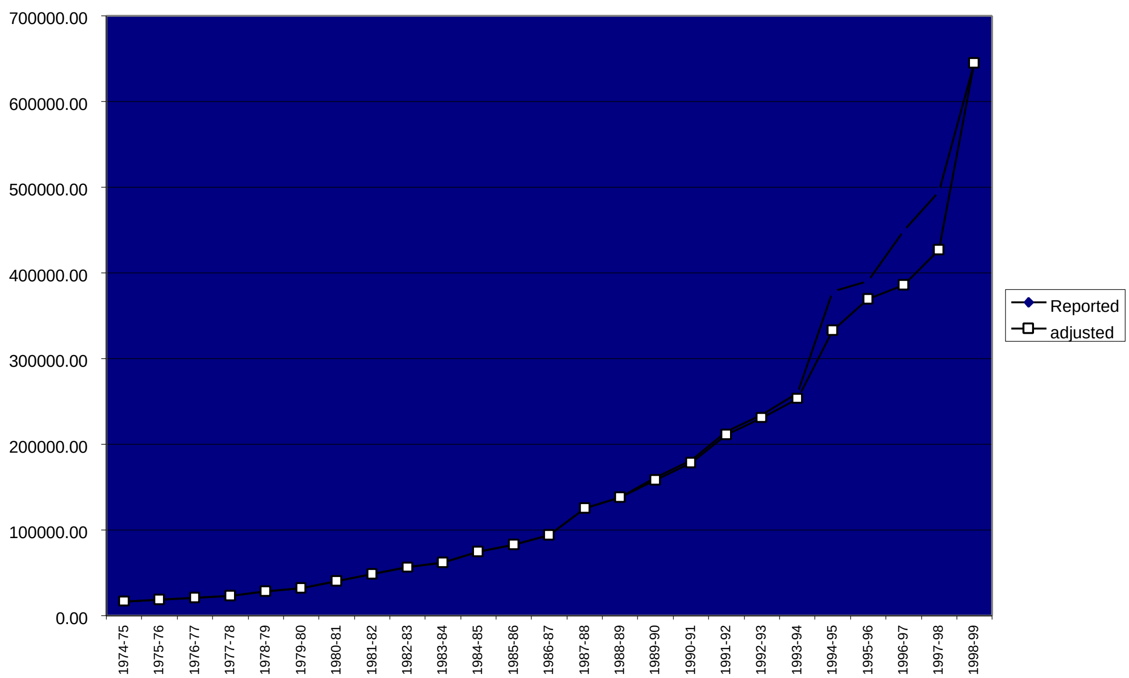


Figure 5: Haryana Revenue Expenditure Growth Rates

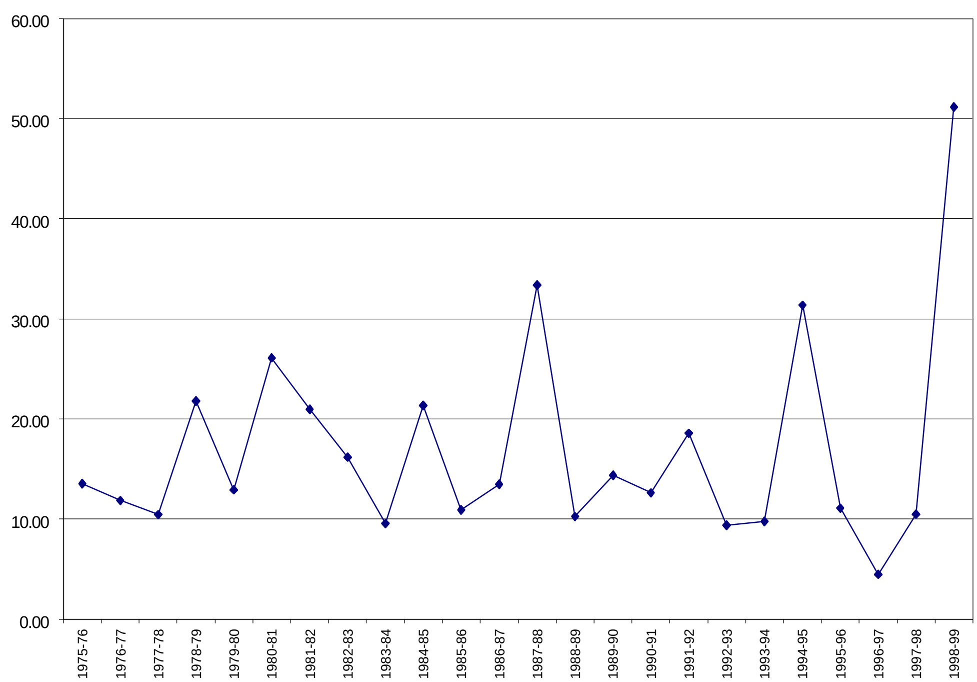


Figure 6: Maharashtra Revenue Expenditure

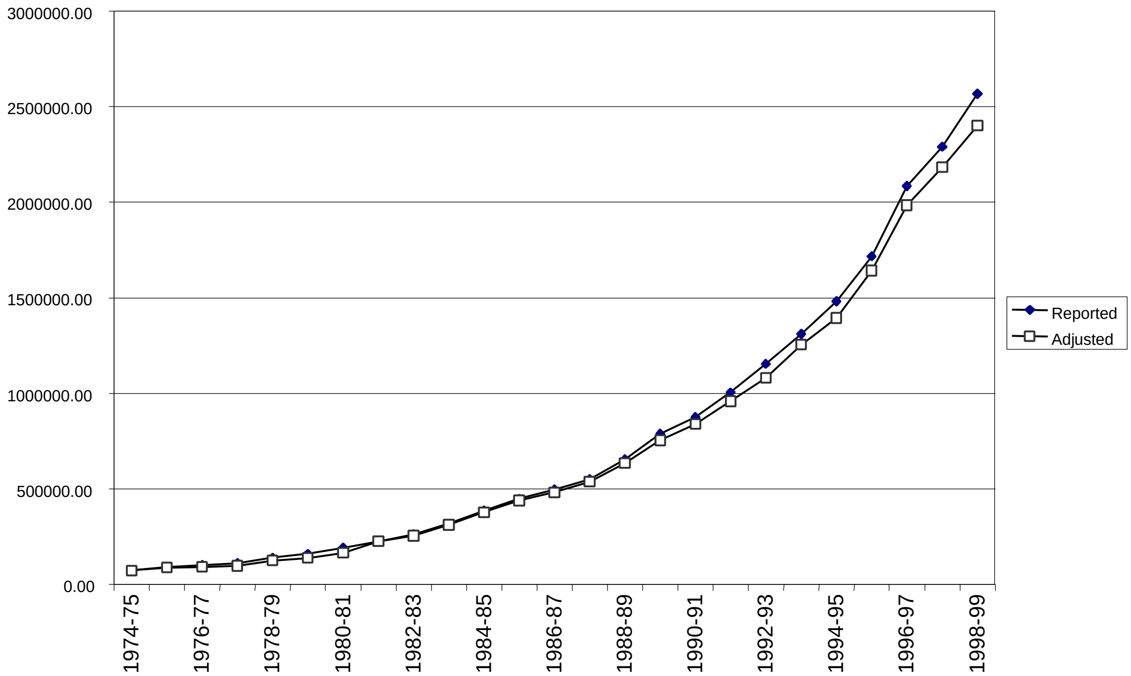
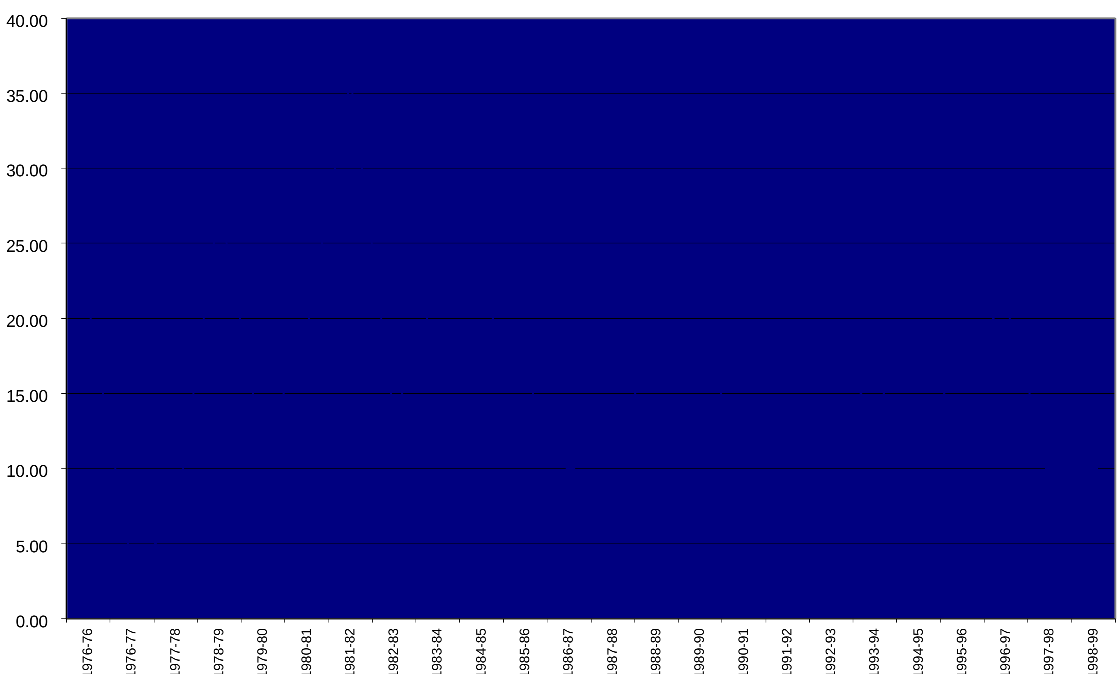


Figure 7: Maharashtra Revenue Expenditure Growth Rates



V. Specifications and Findings

The budgetary process for any forthcoming fiscal year, as described in section II, is predicated on expenditure actuals in the previous year, with no referential carryback to previous years. Therefore, the first tested specification models nominal expenditure levels in logs as an AR(1) process, with both a constant drift and a trend term, and no higher-order lag terms.

$$\ln y_t \;=\; ?\ln y_{t-1} + c + ßt + e_t\,; \qquad e_t \sim \text{NID}\,(0, s^2_e) \qquad \text{…. (1a)}$$

If ¦ ?¦ < 1, $\ln y_t$ is stationary in levels.

If ? = 1, $\ln y_t$ is non-stationary in levels and stationary in first differences.

Thus, stationarity in the series can be determined by testing the null hypothesis of a unit root in the series against a one-sided alternative (since ?>1 is implausible for a public expenditure series, even in India):

H_0 : ? = 1

H_1 : ¦ ?¦ < 1

The specification is transformed for testing into the following form:

$$?\ln y_t \;=\; ?\ln y_{t-1} + c + ßt + e_t\,; \qquad e_t \sim \text{NID}\,(0, s^2_e) \qquad \text{…. (1b)}$$

where

? = ? - 1

H_0 : ? = 0

H_1 : ? < 0

When an LM test on specification (1b) showed serial correlation in the residuals, an augmented form of the tested specification was tried with upto four lags, thus:

$$? \ln y_t \;=\; ? \ln y_{t-1} + c + ßt + e_t + \underset{i=1}{\overset{4}{S}} a_i \; ? \ln y_{t-i} \;; \quad e_t \sim \text{NID}\,(0, s^2_e) \quad \ldots(2)$$

If the tests decisively rejected the null of a unit root and showed the series to be trend stationary, a simple time-trend was estimated on $\ln y_t$.

Findings for Punjab are presented in Appendix I. With specification (1b) and no lag terms, the null hypothesis of a unit root (?=0, corresponding to ?=1) was not rejected using McKinnon critical values at the 1 or 5 percent levels, but was rejected at the 10 percent level. An LM test showed second-order serial correlation in the residuals upto two lags (F=4.50; P=.025), suggesting the need for an augmented specification with lags (equation 2). It is this form which is reported in table I.1. This time, the ADF test statistic falls decisively below the critical values for rejection of the null hypothesis of a unit root even at the 10 percent level. The coefficients of all the lag terms (except at the first lag) are significant at P=0.10, especially at the fourth lag. Therefore all four lags need to be retained in the specification, and an LM test on the residuals showed no further serial correlation (F=0.51; P=.61). The presence of the trend term necessitated a redundant variable test as follows:

H_0 : ? = ß = 0

H_1 : ? ? ß ? 0

The value of F = 8.49 is higher than the critical value (7.24) for rejection of the null (unit root with no trend) at 5 percent, but below the critical value (10.61) for rejection at 1 percent.

Thus the redundant variable test affirms (at 5 percent) the presence of a non-zero deterministic trend (ß?0). Where there is a deterministic trend, the critical values to be applied revert back to the standard normal, and with that the null of a unit root stands decisively rejected (see table I.1).[8]

Thus, the nominal expenditure series for Punjab in logs is a trend stationary series. Estimating a simple time-trend on ln y_t yielded a trend of 0.153, with a DW statistic of 1.39 showing serial correlation in the residuals (table I.2). The residuals are graphed.

Findings for Haryana are presented in Appendix II. With specification (1b) and no lag terms (table II.1), the null hypothesis of a unit root (?=0, corresponding to ?=1) was not rejected using McKinnon critical values at the 1 or 5 percent levels, exactly as in the case of Punjab. An LM test showed no residual serial correlation, either first or second order (F=0.98; P=0.33 for first-order serial correlation, and F=0.65; P=0.53 for second-order serial correlation), Thus, there was no need for augmented specification (2). The statistical significance of the trend coefficient was tested with the redundant variable test. The F-statistic (6.24) is higher than the critical value at 10 percent but not at 1 or 5 percent. Accepting the presence of a deterministic trend at the 10 percent level of significance, the critical values to be applied revert back to the standard normal, and with that the null of a unit root stands decisively rejected, as in the case of Punjab. A simple time-trend on ln y_t yielded a trend of 0.149 (table II.2), with a DW statistic of 1.53 showing serial correlation in the residuals, exactly as in the case of Punjab.

Findings for Maharashtra are presented in Appendix III. Specification (1b) with no lag terms is reported in table III.1; the LM test showed absence of serial correlation upto two lags (F=0.11; P=0.74 for first-order serial correlation, and F=0.22; P=0.80 for second-order serial correlation), thus ruling out the need for further augmentation. The t-statistics for the constant (drift) and trend terms are

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8 Enders, 1995: 257.

Table 2

Summary of Stationarity Test Results

	Punjab	Haryana	Maharashtra (a)	
Dependent Variable	? log (rev exp)	? log (rev exp)	? log (rev exp)	∆lo
Constant	Yes	Yes	No	Ye
Trend	Yes	Yes	No	No
t-stat: log(revexp(t-1))	-2.56	-3.46	11.1	-4.
Critical Value	Std. Normal	Std. Normal	Mackinnon: -2.66	Std
Serial Correlation : F (first order)	1.27 (p=0.27)	0.98 (p=0.33)	0.11 (p=0.74)	2.1
Serial Correlation : F (second order)	4.50 (p=0.02)	0.65 (p=0.53)	0.22 (p=0.80)	1.7
Lag length	4	--	--	
Finding	Trend stationary	Trend stationary	Not stationary I(1)	Sta
Trend growth rate	16.5%	16.1%	-	

Notes: 1. Serial Correlation refers to the LM test.
2. The Mackinnon critical value is for the 1% level of significance.
3.

so low with respect to conventional critical values, that further testing for presence of the constant and trend terms was not done.

Table III.2 shows that the ADF test convincingly fails to reject the null hypothesis of a unit root even at the 1 percent level of significance. This establishes that the log of revenue expenditure in Maharashtra is difference stationary. Thus, the result for Maharashtra is very different from those for Punjab and Haryana, where the null of a unit root was decisively rejected.

Finally, to test the order of integration for Maharashtra, the unit root test was carried out on the first difference of the log of revenue expenditure (table III.3). The null of a unit root is decisively rejected even at 1 percent level. An LM test on the residuals shows no serial correlation upto two lags (F=2.11; P=0.16 and F=1.78; P=0.19) for first and second-order correlation. Thus revenue expenditure in Maharashtra is an I(1) series.

The findings for all three states are summarised in table 2.

VI. Conclusions

This paper examines the time-series properties of public expenditure at the level of sub-national State governments in India. Three states are studied: Punjab, Haryana and Maharashtra. Reported state-level expenditures suffer from episodic notional accounting entries, with matching notional revenue entries, or other distortionary budgetary practices, which call for some measure of inside information so as to obtain an adjusted series that reflects actual expenditure. The authors had knowledge of budgetary practices only for the three selected states.

Contrary to other studies of public expenditure, this exercise examines the time-series properties of state-level revenue expenditure in (the logarithmic transformation of) nominal values, on the grounds that the expenditure generation process neither targets real (ex ante) values, nor protects real (ex post) expenditure. The single exception to the absence of real ex post protection is the dearness allowance (DA) component of wages and salaries, an add-on linked to the Consumer Price Index which constitutes a form of partial, and not always concurrent, indexation. The paper examines nominal absolutes, not normalised to state-level domestic product, because of the noise element in sub-national domestic product estimates.

All three states experienced exogenous expenditure shocks, with implementation of the third, fourth and fifth Pay Commission salary hikes in 1973 (just prior to the start of the data series); in 1986; and in 1997 respectively. These were shocks in the wages and salaries component alone, but in the case of Punjab and Haryana cause visible spikes in aggregate revenue expenditure growth rates. Haryana has spikes of other origin as well. In Maharashtra on the other hand the Pay Commission spikes are not visible at all in growth rates of aggregate revenue expenditure. Instead, there are other spikes caused by large expenditures on particular programmes like the Employment Guarantee Scheme.

Had time-series data been obtainable on public expenditure by economic categories,[9] priors in respect of the wages and salaries component are that it would carry a unit root, by virtue of the lifetime security characteristic of public employment contracts, with a drift imparted by a combination of the partial inflation indexation built into governmental salaries and, more importantly, staff growth over time. The wage/salary bill, y_t, at time t, should have the following form:

$$y_t = y_0 + \sum_n a_n d_n + \beta t + \sum_t e_t$$

where there are n Pay Commissions, and ß is the drift coefficient.

[9] The average share of wages and salaries in total revenue expenditure during the period 1994-97, as calculated in an earlier study on Punjab (Rajaraman et.al., 1999), is 62.41 percent. A matrix of economic by functional categories for Punjab shows a share of wages and salaries ranging between a low of 23.0 per cent for social security and welfare, to highs of 87.1, 84.4 and 76.6 per cent in health, sanitation and education respectively. Corresponding figures for Haryana and Maharashtra are not available.

Thus, the finding in this paper of trend stationarity in aggregate expenditure for Punjab and Haryana, in the presence of periodic upward shocks in the wages and salary component, shows that there has been fiscal smoothing through accommodation in the non-wage component. Within the non-wage component, interest (in the absence of default) would have had its own upward dynamic over time, as a result of both mounting (absolute) debt, and the lifting of financial repression starting in the nineteen eighties, which raised interest rates on government debt.[10] This suggests, but does not establish, that there might have been downward compression in growth of nominal expenditure on the non-salary non-interest residual for trend stationarity in aggregate revenue expenditure to have been possible. The deterministic trend rate of annual growth in nominal absolute expenditure is estimated at 16.5 percent for Punjab, 16.1 percent for Haryana.

The Maharashtra results are different from those for Punjab and Haryana. Aggregate revenue expenditure in Maharashtra carries a unit root, with no deterministic trend, and with no drift term. Thus, the expenditure level in Maharashtra at any time is the sum of stochastic disturbances in all preceding periods, rather than being deterministically given as in Punjab and Haryana. The memory of an expenditure spike is carried forward. This suggests that Maharashtra had access to sources of financing which made it possible to fund such expenditure spikes at least over the twenty-five years 1974-98. It must be reiterated however that the Maharashtra (aggregate) series does not carry a drift. The Pay Commission salary hikes are not visible as spikes in aggregate expenditure for Maharashtra. Such spikes as are visible are of other than Pay Commission origin. This suggests that in Maharashtra, there was very sharp and concurrent fiscal smoothing at the time of the Pay Commission shocks, such that aggregate expenditure did not show a spike, but that expenditure shocks of other origin were enabled with no corresponding smoothing.

[10] For the interest rate path on Central domestic debt, see Rajaraman-Mukhopadhyay, 2000: 218.

Thus, the political economy of public expenditure management differs very sharply between Punjab/Haryana on the one hand, and Maharashtra on the other.

What is of paramount importance is the nature of the fiscal smoothing in each case, and this can clearly not stand revealed in aggregate expenditure. Fiscal smoothing can be productive, if it originates in reduction of wasteful expenditure. It can on the other hand be unproductive, if it originates in reduction of growth-enhancing expenditures.

If fiscal smoothing has been achieved in these states unproductively, and to the extent this smoothing has occurred in response to exogenous shocks of Central government origin, state-level expenditure reform in the long-run will not be possible without Central government leadership. It can be argued of course that the upward drift in the wage/salary bill between Pay Commission revisions, which is accounted for in part by net staff growth, falls entirely within the discretionary latitude of state governments, but it is difficult to control the political pressures to expand government employment when the relative attractions of government service are periodically ratcheted up. Thus, even in respect of staff growth, it is difficult for states to act unilaterally unless the Central government sets an example by attaching staff growth conditionalities to adoption of enhanced pay scales. If on the other hand the Pay Commission revisions are seen as discrete corrections for the lack of complete and concurrent inflation indexation in government salaries, then clearly the fiscal smoothing seen in all three is a reflection of constraints imposed by low own tax buoyancies (remarkably the same at 0.90 for all three states, as estimated over the period 1985-97).[11] This is in line with the finding of fiscal accommodation through capital expenditure compression pointed out in an earlier study for Punjab (Rajaraman et.al., 2000).

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[11] Chand et.al., 2000: 29. However, estimates for earlier periods show higher buoyancies, at 1.25 for the period 1980-87 for Maharashtra for example.

There remains a great deal of room for unilateral public expenditure reform at state-level, in the direction of improving procedures, and altering the inter and intra-departmental allocations of expenditure and staff towards greater productivity. Most importantly, there is a need for constructing outcome indicators for each functional department so that the productivity of public expenditure becomes objectively measurable.

References

Afxentiou, P.C., and A. Serletis, 1999, "Testing for Government Spending: Convergence Across Canadian Provinces" Public Finance Review 27:4; 434-457.

Amey, M. and J. Ashworth, 1993 "Wagner's Law: Is it A Long Term Phenomenon?" Working Paper, Department of Economics, University of Durham.

Ansari, M.I., D.V. Gordon, and C. Akuamoah, 1997 "Keynes versus Wagner: Public Expenditure and National Income for Three African Countries" Applied Economics 29; 543-550.

Anwar, Muhammad Sarfraj, S. Davies, and R.K. Sampath, 1996 "Causality Between Government Expenditures and Economic Growth: An Estimation Using Cointegration Techniques" Public Finance 51:2; 166-184.

Ashworth, John, 1995 "The Empirical Relationship Between Budgetary Deficits and Government Expenditure Growth: An Examination Using Cointegration" Public Finance 50:1; 1-18.

Bohl, M., 1996 "Some International Evidence on Wagner's Law" Public Finance 51:2; 185-200.

Chand, Diwan, O.P. Mathur, J.V.M. Sarma, Tapas K. Sen and Sandeep Thakur, 2000 Tax Revenue Forecasts of Central, State and Local Governments in India: 2000-01 to 2004-05 (New Delhi: National Institute of Public Finance and Policy; mimeo).

Chletsos, M. and C. Kollias, 1997 "Testing Wagner's `Law' Using Disaggregated Public Expenditure Data in the Case of Greece: 1958-93" Applied Economics 29; 371-77.

Christiano, L., 1992 “Searching for a Break in GNP” Journal of Business and Economic Statistics 10; 237-250.

Enders, Walter, 1995 Applied Econometric Times Series (New York: John Wiley).

Murthy, N.R.V., 1993 "Further Evidence of Wagner's Law for Mexico: An Application of Cointegration Analysis" Public Finance 48:1; 92-96.

National Institute of Public Finance and Policy, 2000 Study of Maharashtra's Finances (February; mimeo).

Nelson, C.R. and C. Plosser, 1982 “Trends and Random Walks in Macro-economic Time Series: Some Evidence and Implications” Journal of Monetary Economics 10; 139-162.

Oxley, L., 1994 "Cointegration, Causality and Wagner's Law: A Test for Britain 1870-1913", Scottish Journal of Political Economy 41:3; 286-293.

Perron, Pierre, 1989 “The Great Crash, The Oil Price Shock, and the Unit Root Hypothesis” Econometrica, 57:6 (November); 1361-1401.

Rajaraman, Indira, Hiranya Mukhopadhyay and H.K. Amar Nath, 1999 State Fiscal Studies: Punjab (New Delhi: National Institute of Public Finance and Policy).

_____________, 2000 "The Anatomy of Sub-National Fiscal Reform" in M.G. Rao, ed. Festschrift Volume for Dr. R.J. Chelliah, forthcoming.

Rajaraman, Indira and Abhiroop Mukhopadhyay, 1999 Univariate Time-Series Analysis of Public Debt (mimeo; January).

Sen, Tapas K. and R. Kavita Rao, 2000 State Fiscal Studies: Haryana (New Delhi: National Institute of Public Finance and Policy).

Appendix I: Punjab

Table I.1

ADF Test Statistic	-2.555402	1%	Critical Value*	-4.5000
		5%	Critical Value	-3.6591
		10%	Critical Value	-3.2677

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LADJREVEX)
Sample(adjusted): 1979 1998
Included observations: 20 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LADJREVEX(-1)	-0.921335	0.360544	-2.555402	0.0239
D(LADJREVEX(-1))	-0.580667	0.329775	-1.760798	0.1018
D(LADJREVEX(-2))	-0.943360	0.322491	-2.925229	0.0118
D(LADJREVEX(-3))	-0.797534	0.312003	-2.556177	0.0239
D(LADJREVEX(-4))	-0.419677	0.220533	-1.903017	0.0794
C	9.457912	3.465512	2.729153	0.0172
T	0.151139	0.056062	2.695916	0.0183

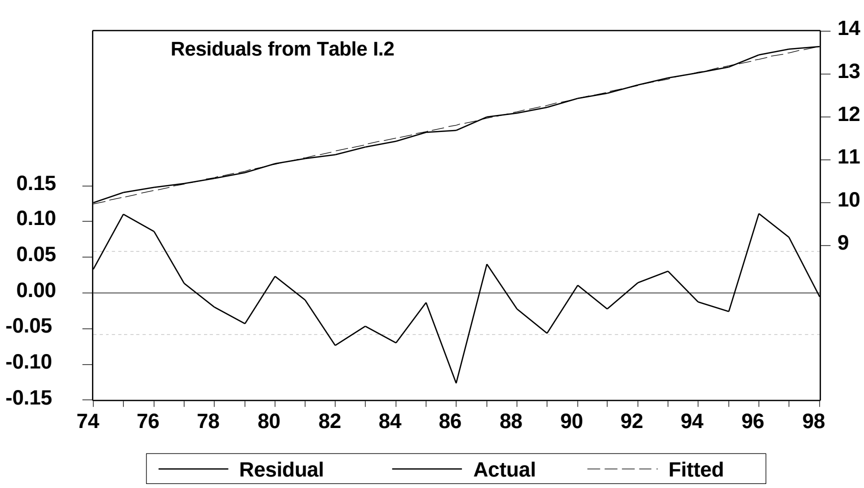
R-squared	0.751042	Mean dependent var	0.154000
Adjusted R-squared	0.636138	S.D. dependent var	0.071185
S.E. of regression	0.042940	Akaike info criterion	-3.188821
Sum squared resid	0.023970	Schwarz criterion	-2.840314
Log likelihood	38.88821	F-statistic	6.536272
Durbin-Watson stat	2.202935	Prob(F-statistic)	0.002332

Table I.2

Dependent Variable: LADJREVEX
Sample: 1974 1998
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.813900	0.024085	407.4710	0.0000
T	0.153269	0.001620	94.60328	0.0000

R-squared	0.997437	Mean dependent var	11.80640
Adjusted R-squared	0.997325	S.D. dependent var	1.129480
S.E. of regression	0.058414	Akaike info criterion	-2.765888
Sum squared resid	0.078482	Schwarz criterion	-2.668378
Log likelihood	36.57360	F-statistic	8949.780
Durbin-Watson stat	1.391342	Prob(F-statistic)	0.000000



Appendix II: Haryana

Table II.1

ADF Test Statistic	-3.460556	1% Critical Value*	-4.3942
		5% Critical Value	-3.6118
		10% Critical Value	-3.2418

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LADJREVEX)
Sample(adjusted): 1975 1998
Included observations: 24 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LADJREVEX(-1)	-0.799330	0.230983	-3.460556	0.0023
C	7.765469	2.205141	3.521530	0.0020
T	0.119734	0.034245	3.496337	0.0022

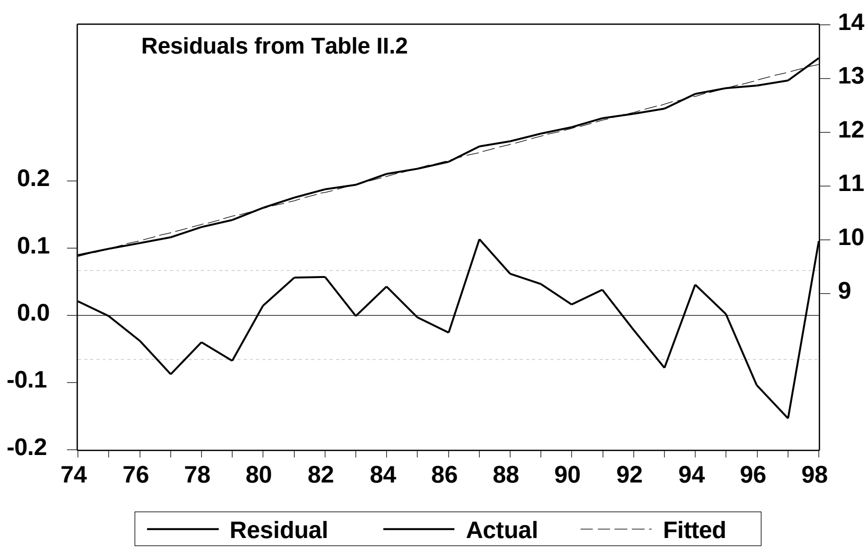
R-squared	0.372847	Mean dependent var	0.152942
Adjusted R-squared	0.313119	S.D. dependent var	0.081866
S.E. of regression	0.067849	Akaike info criterion	-2.426590
Sum squared resid	0.096674	Schwarz criterion	-2.279334
Log likelihood	32.11908	F-statistic	6.242338
Durbin-Watson stat	1.737898	Prob(F-statistic)	0.007454

Table II.2

Dependent Variable: LADJREVEX
Sample: 1974 1998
Included observations: 25

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	9.684760	0.025688	377.0222	0.0000
T	0.149207	0.001835	81.31981	0.0000

R-squared	0.996534	Mean dependent var	11.47525
Adjusted R-squared	0.996383	S.D. dependent var	1.100045
S.E. of regression	0.066155	Akaike info criterion	-2.517000
Sum squared resid	0.100661	Schwarz criterion	-2.419490
Log likelihood	33.46251	F-statistic	6612.912
Durbin-Watson stat	1.534682	Prob(F-statistic)	0.000000



Appendix III: Maharashtra

Table III.1

ADF Test Statistic	-1.480434	1% Critical Value*	-4.3942
		5% Critical Value	-3.6118
		10% Critical Value	-3.2418

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LADJREVEX)
Sample(adjusted): 1975 1998
Included observations: 24 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LADJREVEX(-1)	-0.233986	0.158052	-1.480434	0.1536
C	2.745287	1.745875	1.572442	0.1308
T	0.034135	0.023966	1.424322	0.1690

R-squared	0.114380	Mean dependent var	0.145249
Adjusted R-squared	0.030036	S.D. dependent var	0.059737
S.E. of regression	0.058833	Akaike info criterion	-2.711742
Sum squared resid	0.072689	Schwarz criterion	-2.564486
Log likelihood	35.54091	F-statistic	1.356107
Durbin-Watson stat	1.836085	Prob(F-statistic)	0.279316

Table III.2

ADF Test Statistic	11.21587	1% Critical Value*	-2.6649
		5% Critical Value	-1.9559
		10% Critical Value	-1.6231

*MacKinnon critical values for rejection of hypothesis of a unit root.
Dependent Variable: D(LADJREVEX)
Sample(adjusted): 1975 1998
Included observations: 24 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LADJREVEX(-1)	0.011093	0.000989	11.21587	0.0000

R-squared	-0.108153	Mean dependent var	0.145249
Adjusted R-squared	-0.108153	S.D. dependent var	0.059737
S.E. of regression	0.062885	Akaike info criterion	-2.654247
Sum squared resid	0.090954	Schwarz criterion	-2.605161
Log likelihood	32.85096	Durbin-Watson stat	1.875810

Table III.3

ADF Test Statistic	-4.822294	1% Critical Value*	-3.7497
		5% Critical Value	-2.9969
		10% Critical Value	-2.6381

*MacKinnon critical values for rejection of hypothesis of a unit root.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(LADJREVEX,2)
Sample(adjusted): 1976 1998
Included observations: 23 after adjusting endpoints

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LADJREVEXM(-1))	-1.053924	0.218552	-4.822294	0.0001
C	0.151232	0.034687	4.359957	0.0003

R-squared	0.525472	Mean dependent var	-0.004142
Adjusted R-squared	0.502876	S.D. dependent var	0.087380
S.E. of regression	0.061609	Akaike info criterion	-2.653071
Sum squared resid	0.079709	Schwarz criterion	-2.554332
Log likelihood	32.51032	F-statistic	23.25452
Durbin-Watson stat	1.717126	Prob(F-statistic)	0.000091