Budgetary Forecasting in India: Partitioning Errors and Testing for Rational Expectations

Chakraborty, Lekha S and Sinha, Darshy

National Institute of Public Finance and Policy, New Delhi, India, Centre for Development Studies (JNU), Kerala, India

January 2008

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Lekha S Chakraborty*
Associate Professor
Centre for Development Studies (JNU)
Prasanth Nagar, Ulloor
Trivandrum, Kerala 695005, India
Tel: 91-471-2448881
Email: lekhachakraborty@gmail.com ; lekha@cds.ac.in

Darshy Sinha
Research Associate
National Institute of Public Finance and Policy
18/2 Satsang Vihar Marg, Special Institutional Area
New Delhi, India
Email: darshy@nipfp.org.in

Abstract

According to the theory of efficient markets, economic agents use all available information to form rational expectations. Fiscal marksmanship, the accuracy of budgetary forecasting, can be one important piece of such information the rational agents must consider in forming expectations. Using Theil's inequality coefficient (U) based on the mean square prediction error, the paper estimates the magnitude of errors in the budgetary forecasts in India for the period 1990-91 to 2003-04 and also decomposed the errors into biasedness, unequal variation and random components to analyze the source of error. The test of rational expectations revealed that neither revenue nor expenditure forecasts in India is rational. However, capital budget revealed more forecast errors than revenue budget. The results also revealed that degree of errors in forecasting of receipts was relatively higher than that of expenditure. However there is no specific trend in the forecasting errors, which reveals that budgetary estimates are made not based on *adaptive expectations.* The proportion of error due to random variation has been significantly higher (which is beyond the control of the forecaster), while the errors due to bias has been negligible. The analysis related to efficiency of forecasts also showed that no significant improvement in forecasts over time.

Key words: fiscal marksmanship, Theils' inequality coefficient, rational expectations, budgetary forecast errors.
JEL code: E62, H68

Budgetary Forecasting in India: Partitioning Errors and Testing for Rational Expectations

According to the theory of efficient markets, economic agents use all available information to form rational expectations. The rational expectations hypothesis asserts that information is scarce, and the economic system generally does not waste information and that expectations depend specifically on the structure of entire system[1]. Fiscal marksmanship, the accuracy of budgetary forecasting, can be one important piece of such information the rational agents must consider in forming expectations. The significant variations between actual revenue and expenditure from the forecasted budgetary magnitudes could be an indicative of non-optimization or non-attainment of set objectives of fiscal policy. In this context, the role of budget estimates needs to be emphasized as *fiscal signals*[2]. This point has gained much momentum especially when expectations are based, not on what has happened in the past, but on the data relating to future. That is, if expectations are rational rather than adaptive, it is the estimate of taxes and spending in any given budget - the ex-ante data, not the observed data, available only with a lag – that will be used by forward-looking private agents who base their decisions in whole or in part on fiscal variables (Morrison, 1986).

The wide variations in forecast errors have significant macroeconomic implications. For instance, excessive financing of deficits – seigniorage financing or bond financing – results if actual expenditure exceeds budgeted/expected expenditure. Similarly, cutbacks of crucial public expenditure – in particular, capital expenditure – results when actual revenue falls short of budgeted. The errors in budgetary forecast can occur due to

[1] That expectations of economic variables may be subject to error has been recognized as an important part of most explanations of the changes in the level of economic activity (Muth, 1961). However, there is little evidence to suggest the explanation of the way expectations are formed. He further noted that what kind of information is used and how it is put together to frame an estimate of future conditions is important to understand because the character of dynamic processes is typically very sensitive to the way expectations are influenced by the actual course of events. It is often necessary to make sensible predictions about the way expectations would change when either the amount of available information or the structure of the system is changed. As he further put it, the area is important from a statistical standpoint as well, because parameter estimates are likely to be seriously biased towards zero if the wrong variable is used as the expectation.

endogenous and exogenous factors; which include overestimation/underestimation of buoyancy related to revenue and expenditure, poor assessment of GDP growth, price level; bad drought or monsoon failure, oil price shocks etc[3]. The paper examines the accuracy of budgetary forecasts of Central Government of India for the period from 1990-91 to 2003-04 and analyses the systematic and random components from the partitioned forecast errors, before testing the forecasts for rational expectations.

The paper is divided into four sections. Apart from Introduction, Section II briefly explores the theoretical and empirical survey of literature, while section III deals with the methodology of evaluation. Section IV interprets data, provides the estimates of fiscal marksmanship while section V estimates the sources of errors in the budgetary forecasts. Section VI provides the estimates of rational expectations while section VII concludes.

II. THEORETICAL AND EMPIRICAL REVIEW OF LITERATURE

Allan's (1965) was one of pioneering studies on errors in budgetary forecasts, which studied the accuracy of budget forecasts in the context of UK over the period of 1951-63. Davis (1980) was extended by Allan (1965) covering more time series, viz., 1951-78. These studies emphasized the need for accurate budget forecasts if fiscal policy was to be used to move the economy towards full employment without engendering excessive inflation. The analysis of the accuracy of budget estimates pertains to the impact of the economy on the budget rather than fiscal impact on the economy (Davis, 1980). Auld (1970) investigated the forecast errors in budgetary estimates in the context of Canada. In these studies, 'budget measures' rather than 'fiscal impact' measures are analysed.

In the context of India, the studies on the accuracy of budgetary forecasts are Paul and Rangarajan (1974), Asher (1978), Chakrabarty and Varghese (1982), Pattnaik (1990) and Bhattacharya and Kumari (1988). These studies are confined to the earlier decades and

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[2] Davis (1980) noted that budget estimates have an important 'signal effect' on outside forecasters and analysts, with particular attention in recent years focussed on the estimated borrowing requirement.

[3] The other factors can be wrong forecast of cost and profit of public enterprises, underestimation of cost of public programmes and projects, unanticipated increase in wage bill etc (Bhattacharyya and Kumari, 1988).

most of the studies has not looked into the sources of error components, but confined to the magnitude of errors. Asher (1998) examined the errors in the budget estimates and revised estimates of both revenue and expenditures of the Central Government of India during the period 1967-68 to 1975-76. The study revealed that both revenues and expenditures were grossly underestimated and the error for expenditures had been greater. He emphasized the need to increase the technical sophistication of the forecasting process as it has wider implications not only for stabilization policy but also for the credibility of the political process and for the strategy of planned development itself. Chakrabarty and Varghese (1982) revealed that revenues were underestimated, expenditures too were, more often than not, underestimated during the period 1970-71 to 1979-80. The study found that there was no specific trend in the forecasting errors and there was no reflection of these errors on the formulation of budgets. The study also made a policy recommendation that in order to reduce the significant errors in the estimates, forecasts should be linked to movements of exogenous variables in the economy. On revenue side, through fitting tax rate functions, Srivastava (1975) suggested a tax-revenue forecasting in a partial equilibrium framework and estimated non-corporate income tax revenue forecast in India for the period 1961-62 to 1972-73.

Bhattacharyya and Kumari (1988) has tested the budgetary forecasts for rational expectations in the context of India and also tested for the efficiency of budget forecasts over time; in addition to the magnitude and sources of errors in budgetary forecast. Their study revealed that neither budget estimates nor revised estimates were based on rational expectations of forecasting during sixties, and the estimates were not even unbiased predictors of actual receipts and expenditure. The biases in the forecasts worsened in seventies and eighties when compared to sixties, the study noted. Concomitant with this study, the present study looks into the magnitude and sources of errors in the budgetary forecasts for the nineties and test for rational expectations.

III. METHODOLOGICAL ISSUES

In the paper, Theil's inequality coefficient (U) is used to analyze the measure of accuracy of the budget forecasts. Theils' inequality coefficient is based on the mean square prediction error. The forecast error of Theil (1958) is defined as:

$$\mathbf{U_1} = \frac{\sqrt{1/n\sum(P_t - A_t)^2}}{\sqrt{1/n\sum P_t^{\,2}} + \sqrt{1/n\sum A_t^{\,2}}} \qquad \mathbf{(1)}$$

where

U_1 = inequality coefficient
P_t = Predicted value
A_t = Actual value

This inequality coefficient ranges from zero to one. When $P_t = A_t$ for all observations (a perfect forecast), U_1 equals zero. When there is non-positive proportionality between the P_t and A_t, U equals to one.

Theils' second equation for inequality coefficient, which uses a revised measure of forecast error. Theil's (1966 and 1971) revised measure of inequality is as follows.

$$\mathbf{U_2} = \frac{\sqrt{1/n\sum(P_t - A_t)^2}}{\sqrt{1/n\sum A_t^{\,2}}} \qquad \mathbf{(2)}$$

This measure has an advantage that denominator does not contain P and the inequality coefficient does not depend on the forecast[4]. In perfect forecast, U_2 equals to zero. U_2 does not have an upper bound. However, if P and A are defined in terms of changes then no change forecast (p_t =0 for all t) would lead to a value of one. When U_2 equals unity, the forecast has the same accuracy that would have been achieved by means of a 'naïve no change extrapolation' (Theil, 1971). As Theil (1971) noted, it is "tantamount to saying that this is possible to do considerably worse than by extrapolating on a no-change basis".

A more rigorous measure of Theil's inequality statistics is also used, by incorporating the lags in the actuals and the difference of predicted value from the lag of the actuals to capture the magnitude of error.

$$\mathbf{U\ 3} \quad = \sqrt{\frac{1/n\sum[P(t)-a(t)]^2}{1/n\sum[P(t)]^2+1/n\sum[a(t)]^2}} \qquad \mathbf{(3)}$$

Where a(t) = A(t)-A(t-1)

P (t) = P (t)-A (t-1)

After analyzing the magnitude of error, partitioned forecast error has been applied to budgetary estimates for the fiscal years 1990-91 to 2003-04. The mean square prediction error has been decomposed in order to indicate systematic and random sources of error. The systematic component is further divided into the proportion of the total forecast error due to bias and the proportion of total forecast error attributable to unequal variation.

[4] Davis, 1980

$$\mathbf{1} = \frac{(\overline{P} - \overline{A})^2}{1/n\sum(P_t - A_t)^2} + \frac{(Sp - Sa)^2}{1/n\sum(P_t - A_t)^2} + \frac{2(1-r)\,Sp.Sa}{1/n\sum(P_t - A_t)^2} \quad \textbf{(4)}$$

In equation (4), P and A are mean predicted and mean actual changes respectively; Sp and Sa are the standard deviations of predicted and actual values respectively; and r is the coefficient of correlation between predicted and actual values. The first expression of RHS of equation (4) is the proportion of the total forecast error due to bias. It represents a measure of proportion of error due to over prediction or under prediction of the average value. The second expression of the RHS of equation (4) is the proportion of total forecast error attributable to unequal variation. In other words, it measures the proportion of error due to over prediction or under prediction of the variance of the values. The third expression on the RHS of the equation (4) measures the proportion of forecasting error due to random variation.

The first two sources of error are systematic. Presumably they can be reduced by the improved forecasting techniques; while the random component is beyond the controller of the forecaster (Intriligator, 1978, Pindyck and Rubenfield, 1998; Theil, 1966). In the paper, partitioned forecast error will be applied to budgetary estimates for the fiscal years 1990-91 to 2003-04.

IV. INTERPRETING DATA

Budgetary data in India is published in three stages: (a) Budget Estimates (b) Revised Estimates and (c) Actuals. Budget estimates are released at the time of budget presentation. It presents expenditure estimates in the form of Ministry wise demand for Grants and in turn categorized into revenue account and capital account[5].

[5] In India, the Demands for Grants are normally taken up for consideration by Parliament in two distinct stages. First, during the recess of Parliament, by the Departmental Standing Committees attached to various Ministries/ Departments. Later, on Parliament's reassembling, the Demands are formally debated in the

Table 1: Errors in Forecasting Revenue

	Revenue Receipts			Capital Receipts		
	Actual (in Rs. cr.)	% Error (Budget)	% Error (Revised Budget)	Actual (in Rs. cr.)	% Error (Budget)	% Error (Revised Budget)
1990-91	54954	5.43	4.42	39015	-12.43	-1.16
1991-92	66047	2.24	0.76	38528	-0.92	2.58
1992-93	74128	2.10	5.60	36178	5.06	8.48
1993-94	75453	11.60	0.94	55440	-22.80	5.78
1994-95	91083	-5.49	-2.54	68695	-13.22	-1.74
1995-96	110130	-8.48	0.06	58338	13.76	11.78
1996-97	126279	3.22	3.57	74728	-9.36	-13.53
1997-98	133901	14.37	3.45	98167	-19.49	-1.46
1998-99	149510	8.35	5.45	129856	-18.42	-4.32
1999-00	181513	0.73	-1.11	116571	-13.32	6.57
2000-01	192624	5.74	7.03	132987	1.37	-2.73
2001-02	201449	15.04	5.52	161004	-10.89	-5.68
2002-03	231748	5.76	2.24	168648	-2.04	-0.93
2003-04	263027	-3.46	-	211228	-12.48	-

Source: (Basic data), Budget Documents, Ministry of Finance, Government of India

The results showed that both revenue and expenditure components of the budget revealed errors in forecast. Table 1 presents the actual revenue and capital receipts along with the forecasting errors during the period 1990-91 to 2003-04. The analysis showed that broadly revenue receipts has been overestimated for most of the years, while capital receipts have been grossly underestimated. On the expenditure side, both revenue and capital expenditure has been grossly underestimated with respect to BE and actuals, while overestimated in case of RE and actuals (Table 2).

The disaggregated level of analysis revealed that the degree of errors in forecasting receipts was relatively higher than expenditure in the period 1990-91 to 2003-04. The pattern of error thus gave a systemic upward increase in the estimation of deficit of the government.

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backdrop of the Reports of the Standing Committees and put to vote. Specific hours are allotted for these discussions. The Demands of Ministries that are to be discussed and voted are formally listed. These number only a few, and all the other Demands are finally guillotined and passed on the conclusion of the debate.

Table 2: Percentage of Error in Estimates of Expenditure Budget

	Revenue Expenditure			Capital Expenditure		
	Actual (in Rs. cr.)	% Error (Budget)	% Error (Revised Budget)	Actual (in Rs. cr.)	% Error (Budget)	% Error (Revised Budget)
1990-91	73516	-3.46	1.97	31800	-10.88	-0.15
1991-92	82308	-1.12	1.61	29122	10.02	1.20
1992-93	92702	-3.38	2.46	29916	-1.33	-0.56
1993-94	108169	-5.85	1.90	33684	-12.47	-0.11
1994-95	122112	-2.70	0.65	38627	-14.86	1.92
1995-96	139860	-2.53	2.62	38415	-6.75	2.78
1996-97	158933	1.82	0.03	42074	1.82	2.94
1997-98	180350	1.70	1.03	51718	-5.70	2.57
1998-99	217419	-3.38	0.33	61947	-6.59	2.95
1999-00	249109	-4.87	1.58	48975	-4.25	3.53
2000-01	277858	1.17	2.04	47753	20.18	8.87
2001-02	301611	2.97	0.89	60842	6.27	-1.17
2002-03	339627	0.25	0.60	60769	14.91	2.63
2003-04	362887	0.92	-	111368	-34.84	-

Source: (Basic data), Budget Documents, Ministry of Finance, Government of India

The forecasting errors in revenue deficit, fiscal deficit and primary deficit are shown separately in Table 3, with respect to budget estimates and revised estimates.

Table 3: Forecasting Errors in Deficit

	Revenue Deficit			Fiscal Deficit			Primary Deficit		
	Actual (in Rs. cr.)	% Error (Budget)	% Error (Revised Budget)	Actual (in Rs. cr.)	% Error (Budget)	% Error (Revised Budget)	Actual (in Rs. cr.)	% Error (Budget)	% Error (Revised Budget)
1990-91	18562	-29.79	-5.26	44650	-17.59	-2.95	22800	-30.07	-5.79
1991-92	16261	-14.80	5.04	36325	3.86	4.04	9762	5.28	7.99
1992-93	18574	-25.26	-10.09	40173	-14.35	-8.59	9138	-73.65	-53.80
1993-94	32716	-46.11	4.10	60257	-38.66	-2.83	23562	-104.42	-10.66
1994-95	31029	5.47	10.00	57704	-4.83	5.77	13655	-34.71	24.75
1995-96	29730	19.55	12.11	60243	-4.33	6.25	10212	-44.83	17.61
1996-97	32654	-3.61	-13.62	66733	-6.69	-5.40	7255	-68.77	-36.17
1997-98	46449	-34.84	-5.95	88937	-26.40	-2.91	23300	-110.93	-11.39
1998-99	67909	-29.22	-10.95	113349	-19.69	-8.48	35467	-54.82	-25.31
1999-00	67596	-19.8961	8.78	104717	-23.6466	3.99	14468	-155.60	20.77
2000-01	85234	-9.16	-9.23	118816	-6.35	-5.76	19502	-48.68	-42.03
2001-02	100162	-21.31	-8.42	140955	-17.48	-6.55	33495	-88.02	-26.96
2002-03	107879	-11.59	-2.94	131306	3.21	10.78	13502	34.31	120.73
2003-04	99860	12.45	-	132103	16.30	-	7548	302.94	-

Source: (Basic data), Budget Documents, Ministry of Finance, Government of India

The root mean square errors of revenue receipts, expenditure and deficits are given in Table 4. RMSE has two limitations. It does not distinguish between under and over predictions. Also, there is no theoretical upper bound for RMSE. Based on root mean square error, Theil's inequality coefficient is calculated. The budget estimates are considered as the expectations of government revenue, expenditure and deficit.

Table 4: Root Mean Square Error (RMSE) for Central Budget Forecasting

	RMSE (BE, Actual)	RMSE (RE, Actual)
Revenue Receipts	12094.52	6009.45
Capital Receipts	13574.43	5568.32
Revenue Expenditure	5358.03	2607.06
Capital Expenditure	11348.71	2233.08
Revenue Deficit	11915.54	4720.94
Fiscal Deficit	15772.39	6599.16
Primary Deficit	16624.63	6854.36

Source: (Basic data), Budget Documents, Ministry of Finance, Government of India

Like RMSE, Theil's U also cannot distinguish between under or over prediction. However, the magnitude of error can be examined from the inequality coefficients (Us). U will be zero when the forecast is perfect. The three inequality coefficients estimated using variants of Theils' U are given in Table 5.

Table 5: Theil's Inequality Statistic (U) for Central Government Budget Forecasting

	Theils' U (BE, Actual)			Theils' U (RE, Actual)		
	U1	U2	U3	U1	U2	U3
Revenue Receipts	0.04	0.08	0.40	0.02	0.04	0.23
Capital Receipts	0.06	0.12	0.59	0.03	0.06	0.25
Revenue Expenditure	0.01	0.02	0.16	0.01	0.01	0.08
Capital Expenditure	0.11	0.21	0.66	0.02	0.05	0.22
Revenue Deficit	0.10	0.19	0.99	0.04	0.08	0.35
Fiscal Deficit	0.09	0.17	0.89	0.04	0.07	0.38
Primary Deficit	0.52	0.85	0.83	0.18	0.34	0.44

Source: (Basic data), Budget Documents, Ministry of Finance, Government of India

Capital budget revealed more forecast errors than Revenue budget. In other words, capital receipts and capital expenditure have shown relatively more forecasting errors than revenue receipts and revenue expenditure during the period 1990-91 to 2003-04. In the

backdrop of Fiscal Responsibility and Budget Management Act in India, the emphasis has been given to contain revenue deficit. The results revealed that equally important emphasis needs to be given on the Capital Account of the budget.

The accuracy of budget estimates for the fiscal deficit might have benefited from some offsetting errors between the forecasts of revenue and expenditure. Fiscal deficit, the net borrowing requirement of the Central government, represents the difference between total expenditure and non-debt creating receipts. Relatively small errors in forecasting fiscal deficit can cause large errors in budget estimates of the borrowing requirement. However it is to be noted that the magnitude of errors in the budget estimates of net borrowing requirement is a matter of grave concern in the context of the increasing attention paid to its aggregate in the policy making and its significance for macroeconomic stability. Deducting the interest payment from fiscal deficit, the primary deficit is computed and the forecast error in primary deficit is also analysed. The magnitude of error has increased significantly when interest payment was deducted from fiscal deficit. In other words, error component is very high in the primary fiscal expenditure as significant share of which is discretionary in nature.

V. PARTITIONING THE SOURCES OF ERROR

The sources of errors can be divided into two: (a) errors on account of miscalculation and wrong judgement and (b) errors on account of unanticipated and exogenous shocks. The former can occur partly on account of wrong judgement of key economic variables like national income, investment, savings, inflation etc which influences government revenue and expenditure; and partly on account of improper estimation of key parameters of budgeting, like tax and expenditure elasticities (Bhattacharya and Kumari, 1988).

Table 6: Partitioning the Error Components

	Bias	Unequal variation	Random
Revenue Receipts	0.24	0.07	0.69
Capital Receipts	0.45	0.14	0.41
Revenue Expenditure	0.05	0.15	0.80
Capital Expenditure	0.06	0.22	0.72
Revenue Deficit	0.36	0.01	0.63
Fiscal Deficit	0.31	0.01	0.68
Primary Deficit	0.32	0.00	0.67

Source: (Basic data), Budget Documents, Ministry of Finance, Government of India

The decomposition of error reveals that the proportion of error due to random variation has been significantly higher, leaving less scope for the elimination of systematic error (Table 6). It is to be noted that there is no specific trend in the forecasting errors, which reveals that budgetary estimates are made not based on *adaptive expectations*. Though the proportion of error in the forecast due to bias and unequal variation is relatively less, better forecasts based on the buoyancy estimates of revenue and expenditure as well as periodic assessment of the stochastic errors of the budgetary forecast may improve the efficiency and reliability of budgetary forecasts.

VI. TESTING FOR RATIONAL EXPECTATIONS

While testing the rational expectations, the necessary condition is that the forecast (P) should be an unbiased predictor of actual (A) (Muth, 1961). The sufficient condition is that the predicted error must be uncorrelated with the historical information, which can be tested whether the lagged value of the actuals is related to the present value of actuals (Lovell, 1986; Bhattacharyya and Kumari, 1988). In other words, the rational expectations hypothesis can be tested by the following equation:

$$A_t = \alpha + \beta P_t + \gamma A_{t-1} + \mu_t$$

Where,

A_t = Error

P_t = Predicted Value

The condition for Rational Expectations would be satisfied if:

$\propto = 0$; $\beta = 1$; $\gamma = 0$ and $\rho E_t . P_t = 0$

According to Muth (1961), the forecast is rational if it is not only an unbiased predictor of the actual but also the forecast error is uncorrelated with the predicted value, which implies that the correlation coefficient ρ E_t. P_t should be zero. Table 7 presents the coefficients of the test of rationality and the coefficients revealed that rational expectations hypothesis is invalid in the case of fiscal variables in India during the nineties. In other words, neither receipts nor expenditure forecasts turn – both in revenue and capital budget- out to be the rational expectations of actual.

Table 7: Testing Rational Expectations

Variable	α	β	γ	R^2	ρ
BE-Actuals					
Revenue Receipts	3593.76	0.04	1.05*	0.98	-0.31
Capital Receipts	831.66	1.06*	0.03	0.97	0.43
Revenue Expenditure	-795.48	0.91*	0.09	0.99	-0.43
Capital Expenditure	-7235.62	1.08*	0.13	0.71	0.21
Revenue Deficit	6566.41	0.20	0.79	0.92	-0.05
Fiscal Deficit	11683.66	0.36	0.58	0.90	-0.31
Primary Deficit	*16788.07*	*-0.13*	*0.06*	*0.62*	*-0.76*
RE-Actuals					
Revenue Receipts	296.98	1.23*	-0.30	0.99	-0.40
Capital Receipts	-1281.00	1.15*	-0.14	0.99	0.23
Revenue Expenditure	6423.41	0.80*	0.21	0.99	-0.17
Capital Expenditure	951.71	1.04*	-0.09	0.99	-0.06
Revenue Deficit	-1817.06	1.24*	-0.19	0.98	0.32
Fiscal Deficit	1298.44	1.33*	-0.36	0.99	-0.09
Primary Deficit	7959.37	1.05	-0.42	0.64	-0.22

Source: (Basic data), Budget Documents, Ministry of Finance, Government of India

The results showed that coefficients of $\propto$ of all macrovariables are significantly different from zero; while β is closer to one, but not significant in most of the cases, which showed the bias in forecasting. It is also revealed that revenue receipts seems to be underestimated by a constant amount every year, which is reflected in $\propto > 0$. Similarly, capital receipts and capital expenditure seem to be underestimated by a fixed rate, as $\beta > 1$, in relation to budget and revised forecast. In the budget estimates, the correlation coefficient, ρ, greater than one, (that is, $\rho > 1$), for capital receipts and

capital expenditure signifies that the forecast errors of capital receipts and capital revenue are correlated with respective budget forecast. In the revised estimates, revenue expenditure is simultaneously underestimated by a constant amount ($\propto > 0$) and overestimated by fixed rate ($\beta < 1$). It is also to be noted that γ, which is the partial derivative of A_t with respect to A_{t-1}, given P_t is are not significant for all variables except revenue receipts. However, in case of revenue receipts also, γ is significantly different from zero. Thus the coefficients in Table 7 suggests that neither BE nor RE are forecast based on the rational expectations of actual revenue and expenditure. Fiscal deficit and revenue deficit in revised budgetary forecasts are underestimated by a fixed rate, as the coefficient β is greater than one and significant.

The budgetary forecasts did not fulfil the necessary condition for rational expectations; that is, the forecast should be an unbiased predictor of actuals. As $\propto$ is not equal to zero and β is significantly different from one; forecasts are not unbiased. The sufficient condition for rational expectations that the predicted error must be uncorrelated with the historical information is also ruled out as γ is significant different from zero.

Finally, we examine whether the efficiency of budgetary forecasts improves over time or not. This can be examined by estimating the following function:

$$Q_t = \delta + \theta T + \xi_t$$

where,

$$Q_t = \frac{100\ E_t}{A_t}$$

T= linear time trend

Table 8: Efficiency of Budgetary Forecasts

	BE			RE		
Variables	**δ**	**θ**	**R^2**	**δ**	**θ**	**R^2**
Revenue Receipts	-2.577	-0.201	0.014	-2.133	-0.053	0.006
Capital Receipts	6.669	0.208	0.007	-3.644	0.451	0.085
Revenue Expenditure	4.035 *	-0.362 *	0.296	-2.107 *	0.112 *	0.287
Capital Expenditure	4.582	-0.187	0.003	-0.585	-0.183	0.092
Revenue deficit	24.331 *	-1.262	0.081	203.453 *	-6.085 *	0.453
Fiscal deficit	18.962 *	-1.036	0.093	1.888	-0.131	0.008
Primary deficit	103.482	-9.303	0.129	21.449	-2.667	0.069

Source: (Basic data), Budget Documents, Ministry of Finance, Government of India

The efficiency of forecasting improves if $\theta < 0$.The illustrative results suggest that all the variables except revenue expenditure in budget forecasts have no significant improvement over time. However, the forecasts of revenue expenditure in terms of revised estimates have shown deterioration over time.

VII. CONCLUSION

Using Theil's inequality coefficient (U) based on the mean square prediction error, the paper estimated the magnitude of errors in the budgetary forecasts in India for the period 1990-91 to 2003-04 and also decomposed the errors into biasedness, unequal variation and random components to analyze the source of error, before testing for rational expectations. The results showed that degree of errors in forecasting receipts was relatively higher than expenditure. However there is no specific trend in the forecasting errors, which reveals that budgetary estimates are made not based on *adaptive expectations.* Capital budget revealed more forecast errors than revenue budget. The proportion of error due to random variation has been significantly higher, which is beyond the control of the forecaster, while the errors due to bias has been negligible. The test of rational expectations revealed that neither budget estimates nor revised estimates are forecast based on the rational expectations of actual revenue and expenditure; limiting the applicability of rational expectations hypothesis in fiscal estimates in India. The efficiency of forecasts also has no significant improvement over time.

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* This is the revised version of the paper presented at the 41st Annual Conference of Indian Econometric Society held at Jadavpur University, Kolkotta, January 2005. Special thanks are due to Ravindra Dholakia and Pinaki Chakraborty for their useful comments.