WORKING PAPER 52/2010

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This paper is based partly on the study "Review of Trends in Fiscal Transfers in India" submitted to the Thirteenth Finance Commission in July 2009. The full study is available at http://fincomindia.nic.in/ShowContentOne.aspx?id=27&Section=1

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Price : Rs. 35

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Measuring Accuracy of Projections of Central Taxes by the Finance Commission

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Abstract

This paper looks at the quality of forecasts/assessments made by some of the recent Finance Commissions for the shareable central taxes and own tax revenues of selected states. The Commissions covered under this analysis are Ninth to Twelfth Finance Commissions. It is observed that while direct taxes are underestimated in general, revenues from indirect taxes partially Union excise duties and custom duties have been over estimated. In respect of states, four selected states viz., Andhra Pradesh, Gujarat, Orissa and Assam are examined. While there is similarity between the approaches of Ninth, Tenth and Twelfth Finance Commissions in regard to middle and high income states, the Eleventh Finance Commission required that they raise tax revenues higher than what they were able to achieve.

Key Words: *Central Taxes, Own Tax Revenues, Finance Commission*
JEL Codes: *H2, H5, H7*

INTRODUCTION

Under the constitutional provisions, the Finance Commissions are required to determine the shares of divisible central taxes for each state. However, in order to determine the grants under article 275, the Finance Commissions follow a methodology that requires forecasts of states' non tax revenues as well as the shares of central taxes that will accrue to the states be forecasted. This is because the revenue gap grants are determined as the difference between the assessed needs and assessed own tax and non-tax revenues as well as the respective shares in central taxes during the recommendation period. The quality of the forecasts of central taxes is quite important for the determination of the amount of grants that are fixed in nominal terms. If the share of states in the central taxes is overestimated, grants would be less than what is actually required. If, on the other hand, states' shares in central taxes are underestimated, larger grants would be recommended as compared to what is actually required. We have considered four states, viz., Andhra Pradesh, Gujarat, Orissa and Assam to examine the relationship between assessed own tax revenues and actual own tax revenues for these states.

The paper is organised in four sections. Section 1 discusses the methodology of forecast evaluation. Section 2 analyses the forecast errors of central tax revenues by Finance Commissions. Section 3 makes a comparison of state's own tax revenue assessment with actuals for four states. The final part of the paper summaries the findings.

1. Methodology of Forecast Evaluation

In this section, we briefly describe the methodology for measuring forecast errors and the diagnostic checks used for this analysis. Once a forecast series P_t and a series of realizations A_t for t = 1,2,…n are available, there are various ways to describe how closely the predictions emulate the realizations. Many of the descriptive measures of forecast

accuracy can be defined with reference to levels of variables as well as changes in the levels.

The mean square error and the root mean square errors are the frequently used summary measures of forecast accuracy. These are defined respectively as

$$Mp = [\ 1/n\ \Sigma\ ((P_t - A_t)^2\ ]\ \text{and}\ RMSQ = \sqrt{}\ Mp$$

These have a minimum value of zero in the case of perfect forecasts. There is no upper limit. Their inadequacy lies in not having a proper unit of measurement. They give the same weight to a deviation whether a variable is measured in rupees or crore of rupees or percentages. They however, have interesting mathematical and statistical properties and lend themselves to useful decompositions.

Another summary measure is Theil's inequality coefficient [Theil (1961, 1966)]. This is also based on the mean square error. But, in addition, a suitable unit of measurement is provided. It is defined with respect to levels as well as changes in levels.

$$\text{Levels: } U = [\Sigma\ ((P_t - A_t)^2 / \Sigma\ A_t^2\ ]^{½}$$

With respect to changes, Theil's inequality coefficient may be defined as follows:

$$U_{c1} = \frac{[\Sigma\ (\Delta\ P_t - \Delta\ A_t)^2]^{½}}{(\Sigma\ \Delta\ A_t^2)^{½}}$$

The intuitive basis of these measures is the belief that the more closely predictions follow realizations, the better they are. This must however be qualified by the consideration that for all stochastic processes, forecasts will be made with errors even if all the information in the universe is used (Granger, 1973). In such a case, optimal predictors are not necessarily those where the variances of predictions are equal to the variance of realizations. The point has been illustrated by

decomposing the expected squared forecast error in the following manner

$$S = E(P- A)^2 = (\mu_P - \mu_A)^2 + \sigma^2_P + \sigma^2_A - 2\rho\sigma_P\sigma_A$$

where μ_P, μ_A and σ_p and σ_A are respectively the population means and variances of predictions and realizations and ρ is the correlation coefficient. Assuming S to be a function of μ_P, σ_p and ρ, the following necessary conditions for minimizing S can be obtained. Thus S is minimised by taking ρ as large as possible with $\mu_P = \mu_A$ and $\sigma_p = \rho\sigma_A$. Thus, whereas the mean of the two series should coincide, the variances need not be equal.

Apart from ranking forecasts, a comparison of predictions and realizations may also be used for diagnostic checks on the forecasting procedures with a view to modify. Some insight into the nature of prediction errors is obtained by regressing realizations as shown in Chart 1.

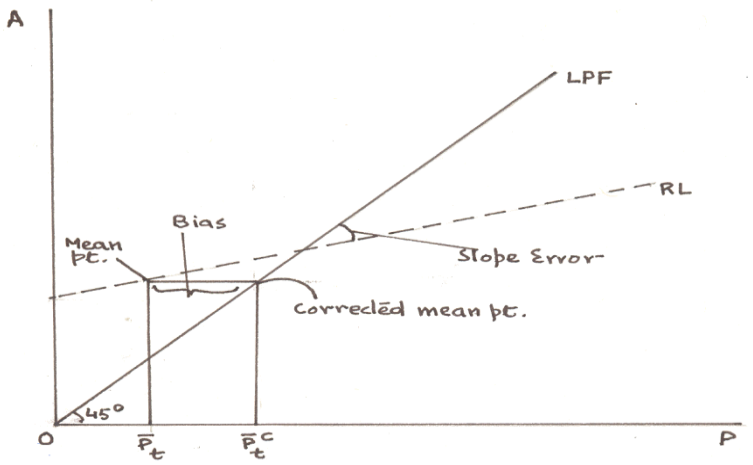

Chart 1: Errors of Bias and Slope

$$A_t = \alpha + \beta P_t + U_t$$

A zero value of α means that the regression line passes through the origin, and a unit value of β means that it coincides with the line of perfect forecasts (LPF). In the case of unit correlation between P_t and A_t, we expect the two means to coincide ($\mu_P = \mu_A$) and $\beta = 1$. Thus, the non-zero values of α and non-unity values of β have been interpreted as 'systematic' errors in the forecast.

We observe that the mean point (μ_P, μ_A) does not lie on the LPF. This is a source of systematic bias and can be removed by shifting the regression line until the mean point lies on the LPF. As it is desirable for the mean point to be on the LPF, so also it is intuitively desirable that the whole regression line coincides with the LPF. If this is so, the forecast is called efficient (Mincer and Zarnotwitz, 1969).

Theil (1961) has suggested that the mean square error M_P can be decomposed as follows

$$M_P = (\mu_P - \mu_A)^2 + (S_p - r\, S_A)^2 + (1- r^2)S^2_A$$

where μ_P and μ_A are the sample means of predictions and realizations, S_P and S_A are their standard deviations and r is the correlation coefficient between them. The division of the terms on the right-hand side by the mean square error gives rise to the following quantities which have been called 'inequality proportions'

$U^M = (\mu_P - \mu_A)^2 / M_P$ mean proportion

$U^R = (S_P - r\, S_A)^2 / M_P$ slope proportion

$U^D = (1-r^2)\, S^2_A / M_P$ disturbance proportion

The terms thus provide information on the relative importance of different sources of error rather than another. The mean proportion has a positive value if $\mu_P \neq \mu_A$. This is due therefore to 'bias'. The deviation of S_P from $r\, S_A$ is due to slope error, and the third term is a disturbance component.

2. Analysing Forecast Errors of Central Tax Revenues by Finance Commissions

For looking at the quality of forecasts implicit in the assessments undertaken by the Finance Commissions, we consider recommendation periods under the Ninth to Twelfth Finance Commissions. For the Seventh and Eighth Commissions, there is information only about the assumed growth rates for given central taxes. For the Ninth Finance Commission, the First Report covered one year (1989-90) and the Second Report, five years (1990-95). For the Twelfth Finance Commission, we consider the first three years viz., 2005-06 to 2007-08. In all cases we make a comparison of Finance Commission forecasts of central tax revenues against the corresponding actuals. This exercise has been done for the following taxes: income tax, corporation tax, union excise duties, customs duties and centre's total gross tax revenues.

a. Income Tax

Table 1 gives a comparison of income tax revenues as projected by the Finance Commissions against the corresponding actuals alongwith the absolute and percentage errors involved in these projections. For the Ninth Finance Commission period, there was an underestimation of income tax revenues in all the years. This underestimation grew over time and it was as high as 43 percent by 1994-95, which was the last year of the projection period. For the Tenth Finance Commission period also, there was implicit underestimation but the extent of error was comparatively less ranging from a minimum of 1.6 percent to a maximum of 19.3 percent. For the Eleventh Finance Commission period, the nature of error changed. The Finance Commission overestimated the income tax revenue of the central government in four out of five years. However, for the first year, the forecast was very close to the actuals, the extent of error being 0.5 percent. For the remaining four years the extent of overestimation ranged from 17.3 to 27.9 percent. For the Twelfth Finance Commission, the extent of error is negligible for the first year being close to zero percent. For the second and third years, there is an

underestimation. Chart 2 indicates the departures of Finance Commission projections against the actuals. Chart 3 gives the percentage error for projections for income tax revenues. The percentage error was less than 5 percent only in two years during the period from 1989-90 to 2007-08. It was between 8 to 10 percent in only one year. It was between 10 to 20 percent in five years. In all the remaining years, the forecast error was higher than 20 percent.

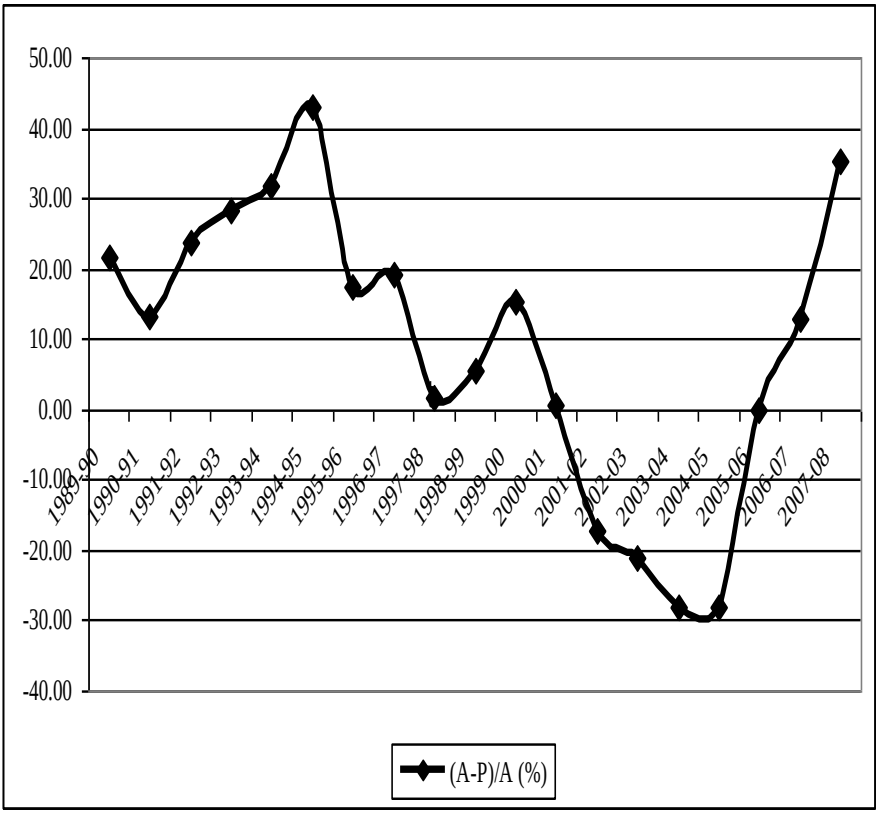

Chart 2: Income Tax: FC Projections and Actuals

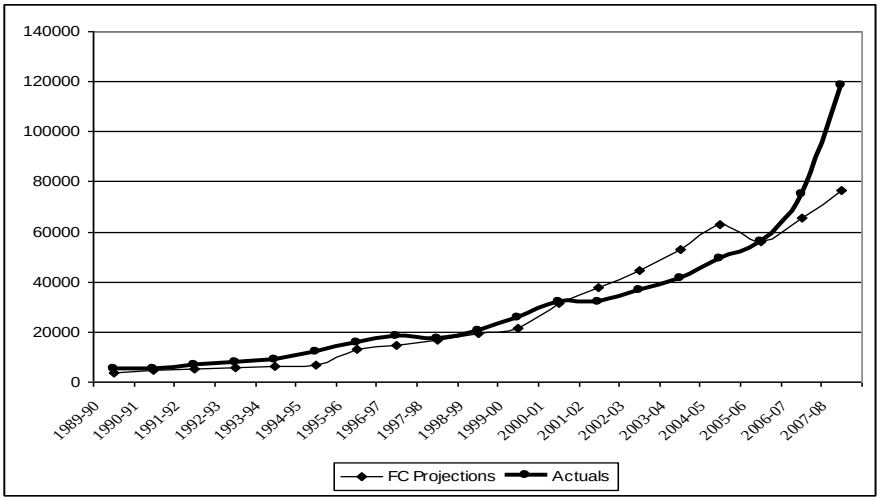

Chart 3: Income Tax: Percentage Error

Table 1: Forest Errors: Income Tax

(Rs. crore)

Years	FC Projections (P)	Actuals (A)	A-P	(A-P)/A (%)
1989-90	3915	5004.0	1089.0	21.8
1990-91	4670	5377.1	707.1	13.2
1991-92	5136	6731.1	1595.1	23.7
1992-93	5650	7895.7	2245.7	28.4
1993-94	6215	9122.6	2907.6	31.9
1994-95	6837	12029.3	5192.3	43.2
1995-96	12860	15591.8	2731.8	17.5
1996-97	14712	18231.0	3519.0	19.3
1997-98	16831	17097.0	266.0	1.6
1998-99	19154	20240.3	1086.3	5.4
1999-00	21682	25654.5	3972.5	15.5
2000-01	31590	31764.0	174.0	0.5
2001-02	37545	32004.0	-5541.0	-17.3
2002-03	44622	36866.0	-7756.0	-21.0
2003-04	53033	41387.0	-11646.0	-28.1
2004-05	63030	49268.0	-13762.0	-27.9
2005-06	55981	55985.0	4.0	0.0
2006-07	65386	75093.0	9707.0	12.9
2007-08	76371	118320.0	41949.0	35.5

Source (Basic Data): Budget Documents and Reports of the Finance Commission.

Table 2 gives Commission wise summary statistics for the extent of error in regards to income tax in terms of the root mean square error and Theil inequality coefficient. Measured by these, the best forecasts are given by the Tenth Finance Commission followed by Eleventh and Twelfth Finance Commissions. Among these four Commissions, as far as income tax is concerned, the least satisfactory forecast was given by the Ninth Finance Commission. It will further be seen that the most important reason for forecast error was mis-prediction of the mean of the forecasted variable. Error of bias (difference between predicted and actual means) is able to explain 71 to 74 percent of the mean square error.

As for as the Eighth, Ninth and the Eleventh Finance Commissions 0are concerned the least bias is shown by the Twelfth Finance Commission but even here it accounts for 50 percent of the mean square error. The forecast done by Tenth Finance Commission was the most efficient in the sense that the slope error was close to zero. The contribution of the slope error is the highest for the Twelfth Finance Commission.

Table 2: Income Tax: Forecast Errors: Summary Measures

Forecast Evaluation Measures	Ninth (Second Report)	Tenth	Eleventh	Twelfth (3 years)
RMSQ	2949.6	2715.8	9120.4	24859.2
Theil Inequality Coefficient	0.345	0.138	0.235	0.285
Decomposition of Mean Square Error				
Bias	0.735	0.727	0.714	0.480
Slope	0.249	0.001	0.267	0.487
Covariance	0.0157	0.2728	0.0188	0.0334
Sum	1.000	1.000	1.000	1.000

Source (Basic Data): As in Table 1.

b. Union Excise Duties

Until the 80th constitutional amendment, which made the sharing of all central taxes possible with the states, the Union excise duties provided the other important shareable tax for the state governments. Leaving 1989-90 (First Report of the Ninth Finance Commission), for all the years during 1990-91 to 2007-08, revenues from the Union excise duties were over-projected by the Finance Commissions and there was always a shortfall in the actuals as compared to the projected amounts (Table 3).

Table 3: Forecast Errors: Union Excise Duties

(Rs. crore)

Years	FC Projections (P)	Actuals (A)	A-P	(A-P)/A (%)
1989-90	20670	22406.3	1736.3	7.75
1990-91	25426	24514.4	-911.6	-3.7
1991-92	28477	28109.8	-367.2	-1.3
1992-93	31894	30831.5	-1062.5	-3.4
1993-94	35721	31696.6	-4024.4	-12.7
1994-95	40008	37347.2	-2660.8	-7.1
1995-96	45822	40187.3	-5634.8	-14.0
1996-97	52420	45007.8	-7412.2	-16.5
1997-98	59969	47961.6	-12007.4	-25.0
1998-99	68245	53246.2	-14998.8	-28.2
1999-00	77254	61901.8	-15352.2	-24.8
2000-01	73452	68526.1	-4925.9	-7.2
2001-02	84911	72555.0	-12356.0	-17.0
2002-03	98157	82310	-15847.0	-19.3
2003-04	113469	90774	-22695.0	-25.0
2004-05	131170	99125	-32045.0	-32.3
2005-06	114741	111226	-3515.0	-3.2
2006-07	127133	117613	-9520.0	-8.1
2007-08	140864	127947	-12917.0	-10.1

Source (Basic Data): Budget Documents and Reports of the Finance Commission.

The extent of this shortfall was the highest for the Tenth and Eleventh Finance Commissions and more limited for the Ninth and Tenth

Finance Commission periods. There are four years out of this period when the forecast error was less 5 percent of the corresponding actual. Chart 4 shows that the projected tax revenues were almost always higher than the corresponding actuals and that the error was least in the initial years of the Finance Commission award periods. The extent of error progressively increased as time increased and this pattern is repeated for all the four Finance Commission studied here.

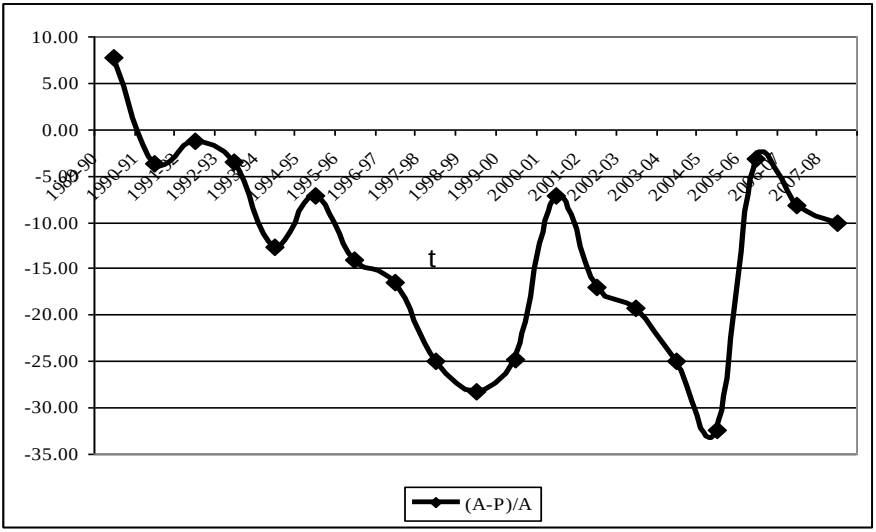

Chart 4: Union Excise Duties: FC Forecasts and Actuals

Chart 5 shows the pattern of percentage error for the Union excise duties. The summary measures of forecast error indicate that in terms of the Theil inequality coefficient, the smallest error were for the Ninth and Twelfth Finance Commission periods. The magnitudes of errors are particularly large for the last 3 years of both the Tenth and Eleventh Finance Commission periods. An analysis of the mean square error in terms of decomposition once again shows that the systematic error of bias in mis-predicting the mean of the forecasted series was very largely responsible for the forecast errors (Table 4).

Table 4: Union Excise Duties: Forecast Errors: Summary Measures

Forecast Evaluation Measures	Ninth (Second Report)	Tenth	Eleventh	Twelfth (3 Years)
RMSQ	2252.6	11760.3	19849.5	9483.9
Theil Inequality Coefficient	0.073	0.234	0.238	0.080
Decomposition of Mean Square Error				
Bias	0.642	0.888	0.784	0.832
Slope	0.202	0.104	0.214	0.162
Covariance	0.1556	0.0086	0.0024	0.0059
Sum	1.000	1.000	1.000	1.000

Source (Basic Data): Budget Documents and Reports of the Finance Commission.

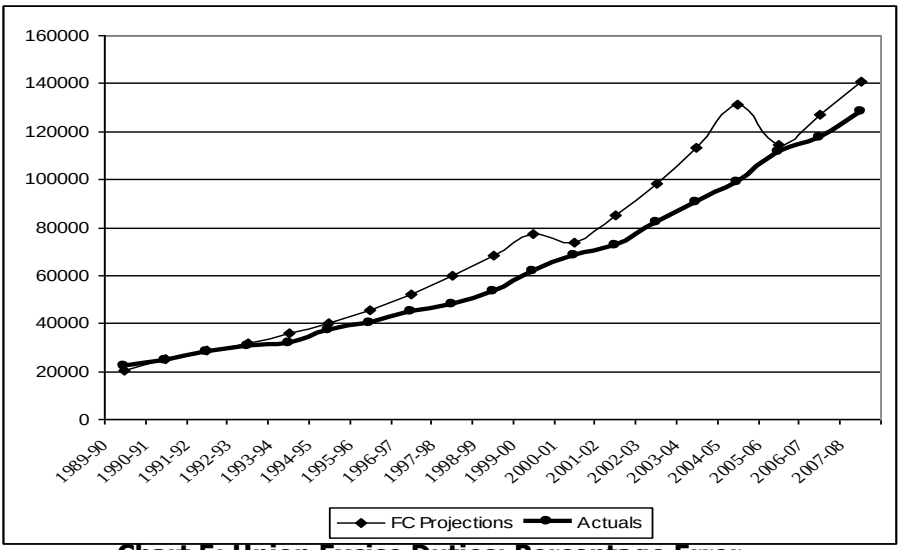

Chart 5: Union Excise Duties: Percentage Error

c. Corporation Tax

Table 5 indicates the forecast errors in the case of corporation tax. For the corporation tax, the projection errors were smallest for the

projections given by the Tenth Finance Commission although all of these represented underestimation (Charts 6 and 7). For the Eleventh Finance Commission, for four out of five years there were over-projections. For the Ninth and Twelfth Finance Commissions there was under-projection and the magnitude of errors seem to increase in the later years of the respective recommendation periods. Except for the Eleventh Finance Commission, as shown by Table 6, the bias error was rather large for the Ninth, Tenth and Twelfth Finance Commissions and the slope error is relatively high for the Twelfth Finance Commission.

Table 5: Forecast Errors: Corporation tax

Years	FC Projections (P)	Actuals (A)	A-P	(A-P)/A (%)
1989-90	4630.0	4728.9	98.9	2.1
1990-91	5326.0	5335.3	9.3	0.2
1991-92	5965.0	7853.0	1888.0	24.0
1992-93	6681.0	8898.5	2217.5	24.9
1993-94	7483.0	10060.1	2577.1	25.6
1994-95	8381.0	13821.8	5440.8	39.4
1995-96	14586.0	16487.1	1901.1	11.5
1996-97	16949.0	18566.6	1617.6	8.7
1997-98	19695.0	20016.0	321.0	1.6
1998-99	22753.0	24529.1	1776.1	7.2
1999-00	26132.0	30692.3	4560.3	14.9
2000-01	37978.0	35696.3	-2281.7	-6.4
2001-02	45384.0	36609.0	-8775.0	-24.0
2002-03	54233.0	46172.0	-8061.0	-17.5
2003-04	64809.0	63562.0	-1247.0	-2.0
2004-05	77447.0	82680.0	5233.0	6.3
2005-06	96845.0	101277.0	4432.0	4.4
2006-07	116601.0	144318.0	27717.0	19.2
2007-08	140388.0	186125.0	45737.0	24.6

Source (Basic Data): Budget Documents and Reports of the Finance Commission.

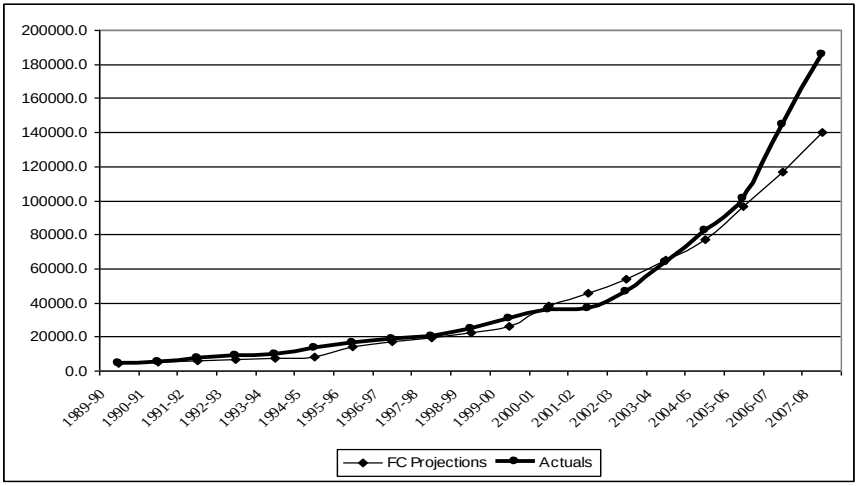

Chart 6: Corporation Tax: FC Forecasts and Actuals

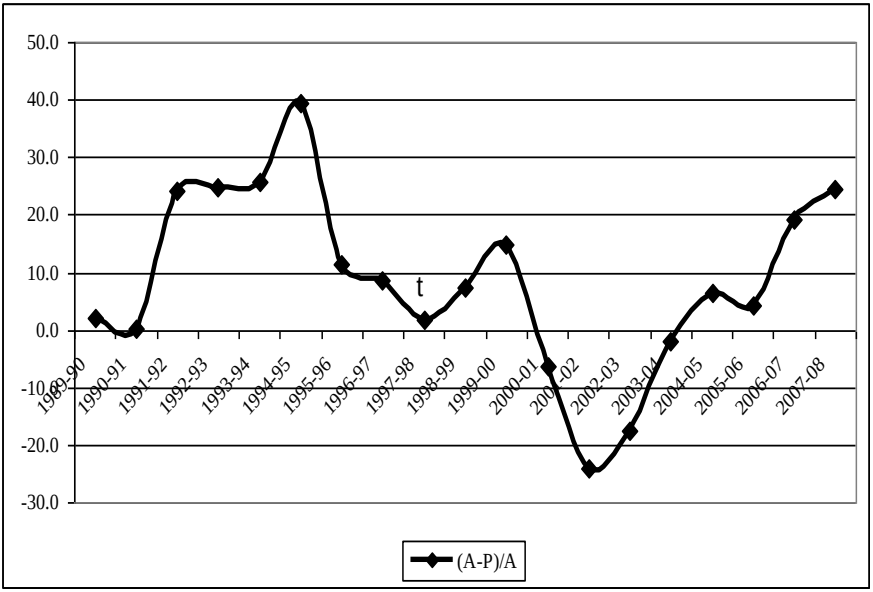

Chart 7: Corporation Tax: Percentage Error

Table 6: Corporation Tax: Forecast Errors: Summary Measures

Forecast Evaluation Measures	Ninth (Second Report)	Tenth	Eleventh	Twelfth (3 Years)
RMSQ	2990.8	2461.1	5935.1	30982.5
Theil Inequality Coefficient	0.311	0.109	0.106	0.209
Decomposition of Theil Inequality Coefficient				
Bias	0.658	0.684	0.260	0.702
Slope	0.303	0.118	0.361	0.293
Covariance	0.0383	0.1984	0.3792	0.0048
Sum	1.000	1.000	1.000	1.000

Source (Basic Data): Budget Documents and Reports of the Finance Commission.

d. Customs Duties

In the case of customs duties, out of the nineteen years under consideration, there was an underestimation for twelve years. This related to most of the years covered by the Ninth Finance Commission, all the years covered by the Eleventh Finance Commission and two of the years covered by the Tenth Finance Commission. It is clear that the impact of custom duty reforms undertaken in the nineties, particularly since the latter half of the nineties, where the peak tariff rates were brought down significantly to bring these in line with internationally more competitive levels, was not fully taken into account by the Finance Commissions. In fact, for the years covered by the Eleventh Finance Commission, the errors have been as large as 52 -65 percent (Table 7). Charts 8 and 9 provide a comparison of projections of customs duty revenues by the Finance Commission and the corresponding actuals and the related percentage errors, respectively.

Table 7: Forecast Errors: Customs Duty Revenues

(Rs. crore)

Years	FC Projections (P)	Actuals (A)	A-P	(A-P)/A (%)
1989-90	18529	18036.13	-492.87	-2.73
1990-91	20473	20643.8	170.8	0.8
1991-92	23441	22256.7	-1184.3	-5.3
1992-93	26840	23776.4	-3063.6	-12.9
1993-94	30732	22192.7	-8539.3	-38.5
1994-95	35188	26789.1	-8398.9	-31.4
1995-96	29901	35756.8	5855.8	16.4
1996-97	34208	42851.0	8643.0	20.2
1997-98	39135	40192.8	1057.8	2.6
1998-99	44537	40668.3	-3868.7	-9.5
1999-00	50417	48420.0	-1997.0	-4.1
2000-01	53572	47542.2	-6029.8	-12.7
2001-02	61233	40268.0	-20965.0	-52.1
2002-03	69989	44852	-25137.0	-56.0
2003-04	79998	48629	-31369.0	-64.5
2004-05	91437	57611	-33826.0	-58.7
2005-06	58156	65067	6911.0	10.6
2006-07	62343	86327	23984.0	27.8
2007-08	66832	100766	33934.0	33.7

Source (Basic Data): Budget Documents and Reports of the Finance Commission.

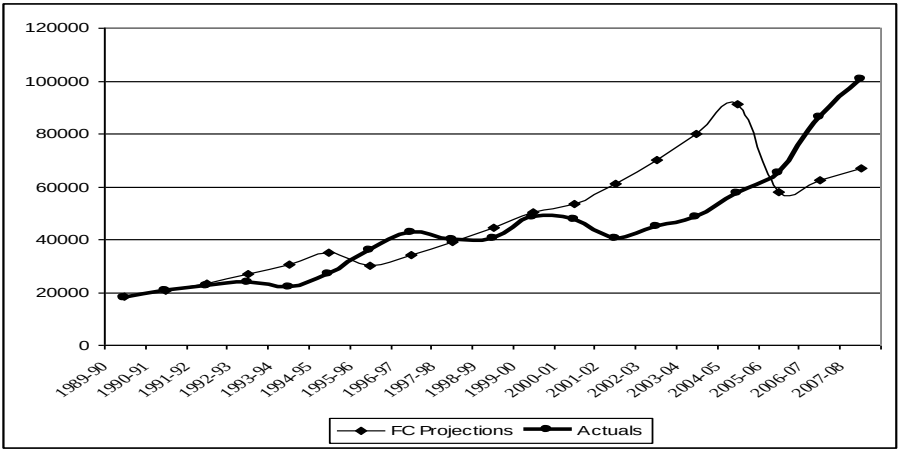

Chart 8: Custom Duty Revenues: FC Forecasts and Actual

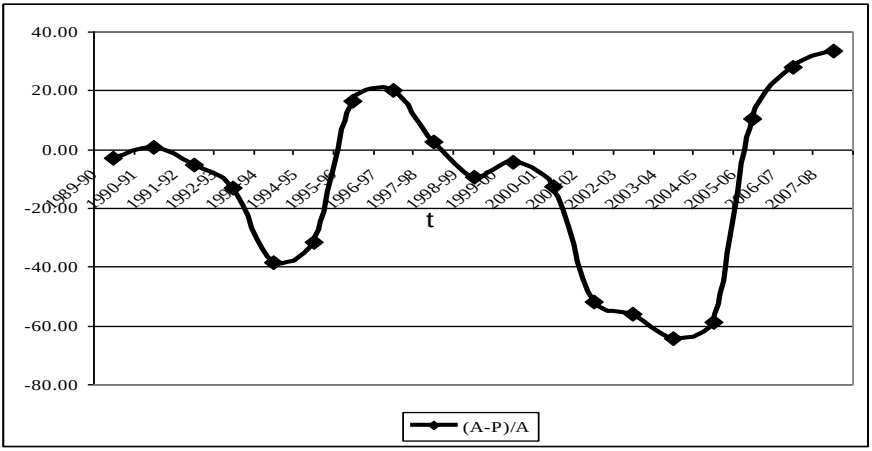

Chart 9: Customs Duties: Percentage Error

An analysis of the decomposition of the summary measures of forecast errors indicates that the error of bias, i.e., mis-prediction of the means accounted for nearly 85 percent of the total error as far as the Eleventh Finance Commission was concerned. In the case of the Twelfth Finance Commission also, although we now have a case of over estimation, the error of bias accounts for nearly 79 percent of the total error (Table 8).

Table 8: Customs Duty Revenues: Forecast Errors: Summary Measures

Forecast Evaluation Measures	Ninth (Second Report)	Tenth	Eleventh	Twelfth (3 years)
RMSQ	5554.8	5080.7	25440.0	24320.8
Theil Inequality Coefficient	0.239	0.122	0.529	0.285
Decomposition of Theil Inequality Coefficient				
Bias	0.573	0.146	0.851	0.789
Slope	0.387	0.615	0.128	0.204
Covariance	0.0405	0.2393	0.0215	0.0061
Sum	1.000	1.000	1.000	1.000

Source (Basic Data): Budget Documents and Reports of the Finance Commission.

e. Total Central Tax Revenues

While the quality of projections of individual taxes like income tax and Union excise duties was material upto the Ninth Finance Commission, since the application of the global sharing mechanism of all central taxes except earmarked cesses and surcharges after the 80th Constitution amendment, it is the quality of projection of the overall central tax revenues, which is critical. Some of the individual errors of over-estimation and under estimation may cancel out and for the central tax revenues as a whole the mis-prediction may be more limited in its impact. Table 9 and Chart 10 give a comparison of Finance Commission projections and corresponding actuals for total central tax revenues.

Table 9: Forecast Errors: Total Central Tax Revenues

(Rs. crore)

Years	Total Central Tax Revenues			
	FC Projections (P)	Actuals (A)	A-P	(A-P)/A(%)
1989-90	49000.0	51636.0	2636.0	5.1
1990-91	57356.0	57577.0	221.0	0.4
1991-92	64670.0	67361.0	2691.0	4.0
1992-93	72931.0	74636.0	1705.0	2.3
1993-94	82260.0	75742.0	-6518.0	-8.6
1994-95	92797.0	92297.0	-500.0	-0.5
1995-96	106022.0	111224.0	5202.0	4.7
1996-97	121637.0	128762.0	7125.0	5.5
1997-98	139559.0	139221.0	-338.0	-0.2
1998-99	159299.0	143797.0	-15502.0	-10.8
1999-00	180894.0	171752.0	-9142.0	-5.3
2000-01	198226.0	188603.0	-9623.0	-5.1
2001-02	230961.0	187060.0	-43901.0	-23.5
2002-03	269185.0	216266.0	-52919.0	-24.5
2003-04	313833.0	254348.0	-59485.0	-23.4
2004-05	366002.0	304958.0	-61044.0	-20.0
2005-06	343703.0	366151.0	22448.0	6.1
2006-07	393140.0	473512.0	80372.0	17.0
2007-08	450597.0	585410.0	134813.0	23.0

Source (Basic Data): Budget Documents and Reports of the Finance Commission.

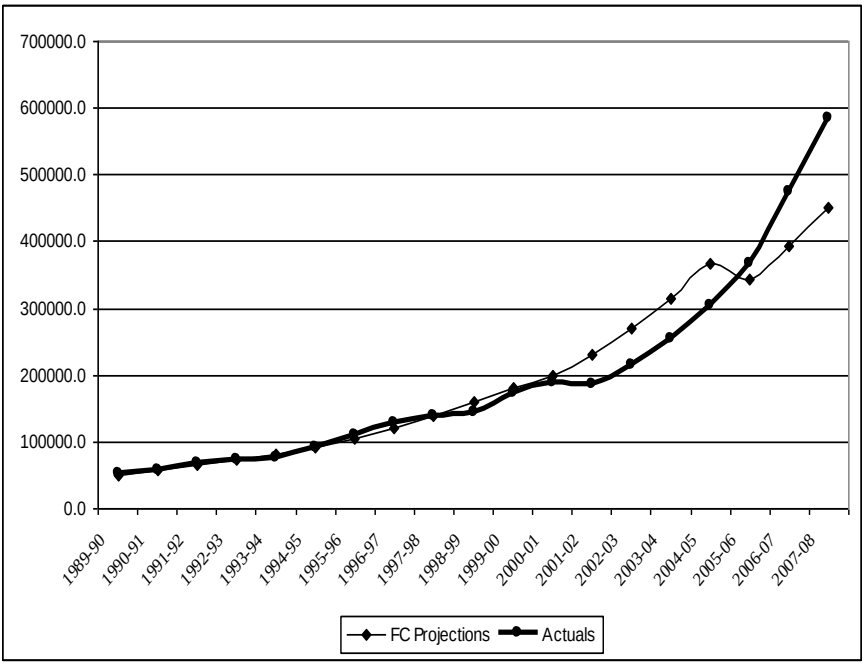

Chart 10: Total Central Tax Revenues: FC Forecasts and Actuals

The percentage errors (Chart 11) for the Ninth Finance Commission period were limited in the range of 0.4 percent to (-) 6.8 percent with signs changing within the forecast period. In the case of the Tenth Finance Commission, the errors range between (-) 10.8 percent to 5.5 percent with errors changing sign within the forecast period. For the Eleventh Finance Commission period, for all the years, there is an overestimation and errors range between (–) 5.1 to (–) 24.5 percent. For the Twelfth Finance Commission also, the errors range between 6.1 to 23 percent for the three years considered here although these are cases of underestimation.

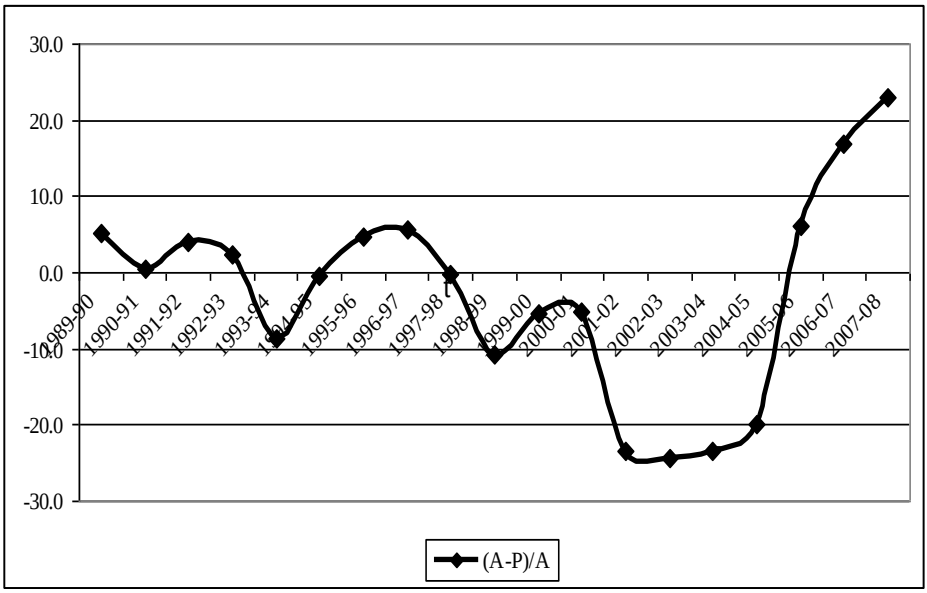

Chart 11: Total Central Tax Revenues: Percentage Error

Table 10: Total Central Tax Revenues: Forecast Errors - Summary Measures

Forecast Evaluation Measures	Ninth (Second Report)	Tenth	Eleventh	Twelfth (3 Years)
RMSQ	3253.7	8964.7	49163.3	91538.9
Theil Inequality Coefficient	0.044	0.064	0.210	0.189
Decomposition of Theil Inequality Coefficient				
Bias	0.022	0.080	0.853	0.749
Slope	0.211	0.653	0.105	0.250
Covariance	0.7668	0.2675	0.0422	0.0009
Sum	1.000	1.000	1.000	1.000

Source (Basic Data): Budget Documents and Reports of the Finance Commission.

As indicated by Table 10, the error of bias was the largest for the Eleventh and Twelfth Finance commission whereas the slope error was the largest for the Tenth Finance Commission and the covariance error was the largest for the Ninth Finance Commission.

Table 11: Analysis of Difference between Actual and Assumed Growth Rates and Buoyancies in Finance Commission Projections

Years	GDP Growth Rate Assumed by Commission	Growth Rate of Total Tax Revenue in Projections	Implicit Buoyancy of Tax Revenue	Actual GDP Growth Rate	Growth Rate of Actual Central Tax Revenue	Implicit Buoyancy
	(percent per annum)		(units)	(percent per annum)		(units)
1990-91	11.0	17.05	1.55	16.80	11.51	0.68
1991-92	11.0	12.75	1.16	14.94	16.99	1.14
1992-93	11.0	12.77	1.16	14.95	10.80	0.72
1993-94	11.0	12.79	1.16	15.04	1.48	0.10
1994-95	11.0	12.81	1.16	17.32	21.86	1.26
Average	**11.00**	**13.64**	**1.24**	**15.81**	**12.53**	**0.78**
1995-96	12.5	15.32	1.23	17.33	20.51	1.18
1996-97	12.0	14.73	1.23	15.67	15.77	1.01
1997-98	12.0	14.73	1.23	10.77	8.12	0.75
1998-99	11.5	14.14	1.23	14.67	3.29	0.22
1999-00	11.0	13.56	1.23	11.47	19.44	1.70
Average	**11.80**	**14.50**	**1.23**	**13.98**	**13.43**	**0.97**
2000-01	13.0	16.62	1.28	7.70	9.81	1.27
2001-02	13.0	16.51	1.27	8.50	-0.82	-0.10
2002-03	13.0	16.55	1.27	7.76	15.61	2.01
2003-04	13.0	16.59	1.28	12.51	17.61	1.41
2004-05	13.0	16.62	1.28	13.06	19.90	1.52
Average	**13.00**	**16.58**	**1.28**	**9.91**	**12.42**	**1.22**
2005-06	12.0	20.07	1.67	14.51	20.07	1.38
2006-07	12.0	29.32	2.44	15.79	29.32	1.86
Average	**12.00**	**24.69**	**2.06**	**15.15**	**24.69**	**1.62**

Source (Basic Data): Finance Commission Reports and Central Budget Documents.

Note: For the first year of the forecasts of the Finance Commissions, we have taken the base year figures as estimated by the Finance Commissions rather than the forecast for the last year.

In Table 11, we undertake an analysis as to whether the source of error was mis-prediction of growth rate of tax revenues or mis prediction of tax buoyancy. This analysis has been done for only the total central tax revenues. It can be seen that for the Ninth Finance Commission, it was the GDP growth rate that was under-projected and the buoyancy was over-predicted by a large margin. In the case of Tenth Finance Commission, the nature of the error is the same although the differences are less. In the case of Eleventh Finance Commission, the underestimation arose primarily because the actual growth rate turned out to be much lower than what was assumed. In the early part of the decade, the Indian economy experienced low growth rates as well as low inflation rates.

The assumed buoyancy for the Eleventh Finance Commission period comes very close to the actual buoyancy. In the case of Twelfth Finance Commission, the growth rate is underestimated. None of the Finance Commissions are able to pick up the volatility in GDP growth rates and also the volatility in tax buoyancies. They tend to assume constant or nearly constant growth rates as well as constant buoyancies. While this may be done, it is important to clearly identify whether the recommendation period will have years containing a large part of either a boom or a trough in respect of the growth of GDP.

3. Comparison of State's Own Tax Revenue Assessment with Actuals: Selected

In this section, we look at the comparison of Finance Commission's assessments of own tax revenues of selected states and the corresponding actuals. For this analysis, we have selected four states, viz., Andhra Pradesh, Gujarat, Orissa, and Assam. These represent middle-, high-, low-income and special category states, respectively. It may be noted that the assessment of own tax revenue by a Finance Commission may not be taken as a forecast. Instead it should be taken as containing normative or prescriptive elements indicating what the

concerned state is expected to raise in terms of own tax revenues following certain norms rather that what it is likely to raise. The departures of assessed amounts compared to the corresponding actual may be interpreted as underperformance or better than prescribed performance as the case may be.

Table 12: Andhra Pradesh Own Tax Revenue: Finance Commission Projections and Actuals

(Rs. crore)

	FC Projections	Actuals	A-P	(A-P)/A (%)
1989-90	2465.4	2384.1	-81.2	-3.4
1990-91	2707.4	2647.2	-60.2	-2.3
1991-92	2973.3	3055.0	81.7	2.7
1992-93	3265.2	3388.7	123.5	3.6
1993-94	3585.8	3832.9	247.1	6.4
1994-95	3937.9	4227.4	289.6	6.9
1995-96	4232.3	4120.4	-111.9	-2.7
1996-97	4793.2	4881.8	88.6	1.8
1997-98	5432.6	7113.5	1680.9	23.6
1998-99	6131.4	7961.4	1830.0	23.0
1999-00	6889.7	9008.6	2119.0	23.5
2000-01	11028.0	10551.9	-476.1	-4.5
2001-02	13112.3	11550.6	-1561.7	-13.5
2002-03	15590.5	12617.6	-2972.9	-23.6
2003-04	18537.1	13805.9	-4731.2	-34.3
2004-05	22040.6	16254.5	-5786.1	-35.6
2005-06	19543.0	19207.4	-335.6	-1.7
2006-07	22123.0	23926.2	1803.2	7.5
2007-08	25043.0	31401.6	6358.6	20.2

Source (Basic Data): Budget Documents and Reports of the Finance Commission.

a. Andhra Pradesh

In the case of Andhra Pradesh the comparison of Finance Commission projections with actuals indicates an interesting difference between the approaches of different Finance Commissions. While the Ninth, Tenth and Twelfth Finance Commissions had assessed own tax revenues of Andhra Pradesh at less than their actual tax effort. The Eleventh Finance

Commission had prescribed tax performance much higher than what Andhra Pradesh was able to achieve. This pattern is summarised in Table 12 and Chart 12.

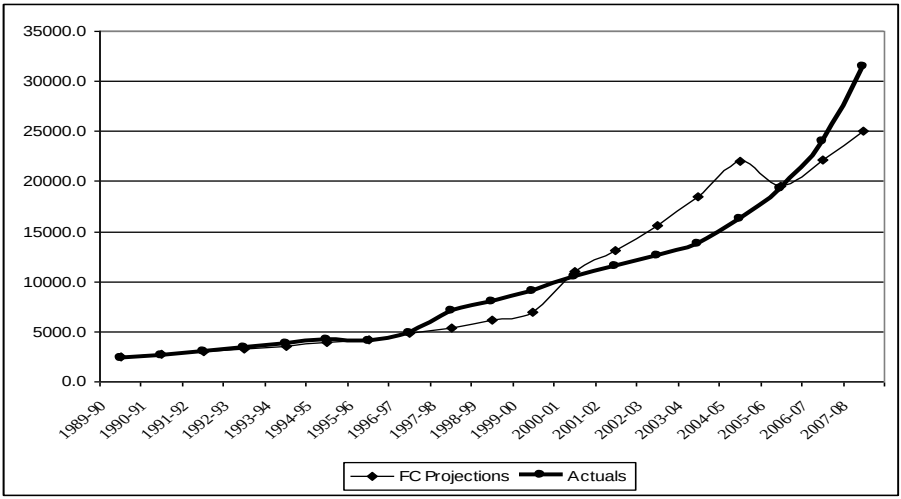

Chart 12: Own Tax Revenue: Finance Commission Projections and Actuals: Andhra Pradesh

As indicated in Table 13 and Chart 13 the pattern of differences in the Finance Commission assessment and the corresponding actual for Gujarat is similar to that of Andhra Pradesh in as much as except the Eleventh Finance Commission, the projection by Finance Commission was lower than the corresponding actual indicating that the Ninth, Tenth and Twelfth Finance Commissions did not take into account the higher than average tax effort of Gujarat also. This is in line with what would be expected if the equalization principle is applied because in these cases the extra revenue arising from the application of more than average tax effort was not taken into account while considering the issue of determining grants. In the case of Eleventh Finance Commission much higher tax effort was expected from these examples of middle and high income states.

Table 13: Gujarat Own Tax Revenue: Finance Commission Projections and Actuals

(Rs. crore)

	FC Projections	Actuals	A-P	(A-P)/A (%)
1989-90	1876.5	2159.7	283.2	13.1
1990-91	2088.9	2399.8	311.0	13.0
1991-92	2325.2	2893.4	568.2	19.6
1992-93	2588.3	3456.5	868.3	25.1
1993-94	2881.1	3941.7	1060.6	26.9
1994-95	3207.1	4742.9	1535.7	32.4
1995-96	5125.8	5322.9	197.1	3.7
1996-97	5809.1	6066.0	256.8	4.2
1997-98	6589.8	6590.5	0.7	0.0
1998-99	7446.7	7615.2	168.5	2.2
1999-00	8380.8	8161.7	-219.1	-2.7
2000-01	10481.9	9046.8	-1435.1	-15.9
2001-02	12463.0	9236.8	-3226.1	-34.9
2002-03	14818.5	9520.5	-5298.0	-55.6
2003-04	17619.1	11173.4	-6445.7	-57.7
2004-05	20949.2	12957.6	-7991.6	-61.7
2005-06	13896.5	15697.9	1801.4	11.5
2006-07	16208.9	18464.6	2255.7	12.2
2007-08	18906.0	21472.5	2566.5	12.0

Source (Basic Data): Budget Documents and Reports of the Finance Commission.

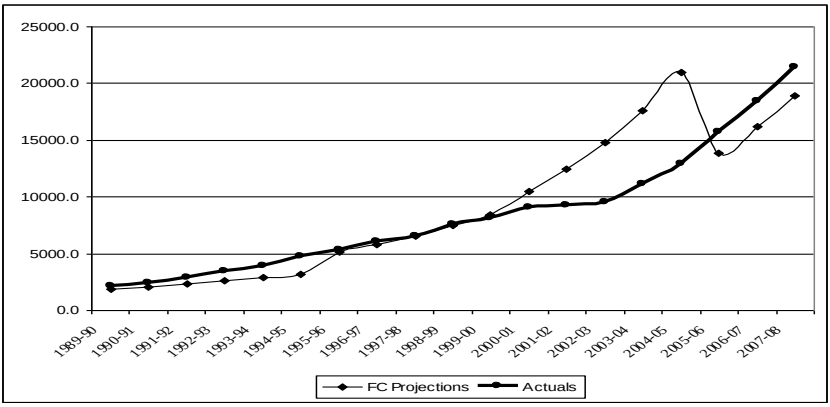

Chart 13: Gujarat Own Tax Revenue: Finance Commission Projections and Actuals

In the case of Orissa much lower than actual tax revenue was expected by the Ninth, Eleventh and Twelfth Finance Commissions. It is only the Tenth Finance Commission that required Orissa to raise its tax effort. In terms of relative departures of projections from actuals the minimum deviation was in the case of the Eleventh Finance Commission (refer Table 14 and Chart 14).

Table 14: Orissa Own Tax Revenue: Finance Commission Projections and Actuals

(Rs. crore)

	FC Projections	Actuals	A-P	(A-P)/A (%)
1989-90	399.5	524.8	125.3	23.9
1990-91	450.7	668.8	218.1	32.6
1991-92	508.5	673.6	165.1	24.5
1992-93	573.7	761.9	188.2	24.7
1993-94	647.3	859.9	212.6	24.7
1994-95	730.2	922.6	192.4	20.9
1995-96	1270.4	1127.2	-143.2	-12.7
1996-97	1418.0	1342.0	-76.0	-5.7
1997-98	1586.8	1421.7	-165.1	-11.6
1998-99	1772.0	1487.1	-284.8	-19.2
1999-00	1973.7	1704.1	-269.6	-15.8
2000-01	2012.2	2184.0	171.8	7.9
2001-02	2302.0	2466.9	164.9	6.7
2002-03	2633.5	2871.8	238.4	8.3
2003-04	3012.7	3301.7	289.0	8.8
2004-05	3446.5	4176.6	730.1	17.5
2005-06	4358.2	5002.3	644.1	12.9
2006-07	4933.5	6065.1	1131.6	18.7
2007-08	5584.7	6792.9	1208.2	17.8

Source (Basic Data): Budget Documents and Reports of the Finance Commission.

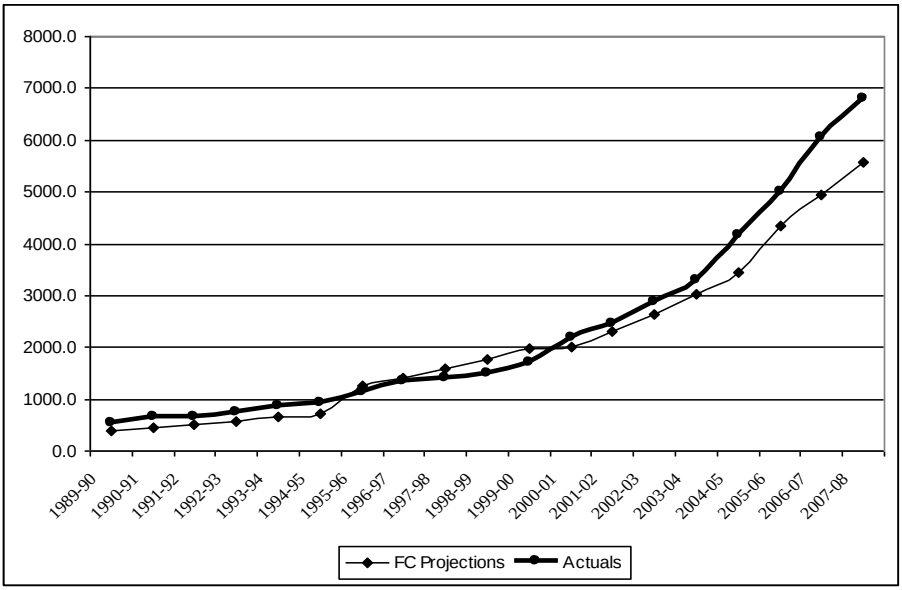

Chart 14: Orissa Own Tax Revenue: Finance Commission Projections and Actuals

In the case of Assam the year wise amounts for the assessed tax under the normative exercise of the Ninth Finance Commission are not available because these were applied only to fourteen major general category states. A comparison between Tenth, Eleventh and Twelfth Finance Commissions indicates that while the Tenth Finance Commission expected Assam to raise its tax effort, the Eleventh Finance Commission assessed the tax revenue at amounts lower than what the state was actually able to achieve. In the case of the Twelfth Finance Commission for the first two years of the award period the difference between actual and assessed tax revenues in relative terms is quite small.

Table 15: Assam Own Tax Revenue: Finance Commission Projections and Actuals

(Rs. crore)

	FC Projections	Actuals	A-P	(A-P)/A (%)
1995-96	794.3	702.5	-91.9	-13.1
1996-97	891.8	766.9	-124.9	-16.3
1997-98	1002.9	881.9	-121.0	-13.7
1998-99	1125.0	982.6	-142.4	-14.5
1999-00	1258.0	1224.8	-33.3	-2.7
2000-01	1269.5	1409.7	140.2	9.9
2001-02	1437.1	1556.9	119.9	7.7
2002-03	1626.8	1934.5	307.7	15.9
2003-04	1841.5	2070.3	228.8	11.1
2004-05	2084.6	2713.3	628.7	23.2
2005-06	3125.5	3232.2	106.8	3.3
2006-07	3538.0	3483.3	-54.7	-1.6
2007-08	4005.0	3511.8	-493.3	-14.0

Source (Basic Data): Budget Documents and Reports of the Finance Commission.

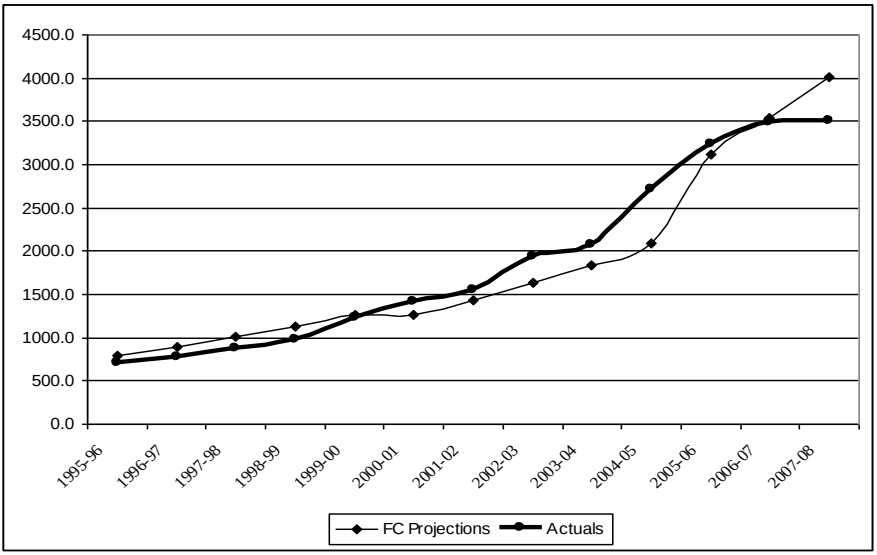

Chart 15: Assam Own Tax Revenue: Finance Commission

4. Conclusions

Finance Commissions in India require to make their recommendations for a period of five years based on information about central and state fiscal aggregates that are generally dated. Between the last year of the recommendation period and the last year for which accounts data are available, the gap could be seven to eight years. The Finance Commissions have to make forecasts for various fiscal aggregates and then determine grants that are specified in absolute amounts. In this paper, we have looked at the nature of forecast error in the forecast of central revenues and assessment of own tax revenues for four selected states for Ninth to Twelfth Finance commissions. It turns out that most of the Finance Commission have underestimated the central revenues but some have overestimated these.

Some of the findings are highlighted below:

1. For income tax, for the period 1989-90 to 2007-08, revenues were underestimated for 15 out of nineteen years. The percentage error ranged from (-) 28.1 percent to 43.2 percent. The four years of overestimation are all in the recommendation period of the Eleventh Finance Commission.
2. In the case of the Union excise duties, the revenues were overestimated by all Commissions. For 18 out of 19 years analyzed here, there was overestimation. The error of overestimation ranges from (-) 1.3 to (-) 32.3 percent.
3. In the case of corporation tax, there was under-estimation except for 4 years under the Eleventh Finance Commission.
4. In the case of customs duties, there was over estimation in 12 out of 19 years.
5. For total central taxes revenues, for 10 years there is under-estimation and for 9 years there is over-estimation. The errors range from (-) 24.5 to 23.0 percent.

6. The extent of percentage error increases, as we move towards the later years in a Commission's recommendation period.
7. An analysis of errors indicates that almost always the systematic error of bias (mis-prediction of means) accounts for a relatively large part of the prediction error.
8. A comparison between assessed own tax revenues and corresponding actual for the period covered by Ninth to Twelfth Finance Commission for four selected states viz., Andhra Pradesh, Gujarat, Orissa and Assam highlights some difference between the approaches followed by different Commissions. In particular, there are similarities between the approaches of the Ninth, Tenth and Twelfth Finance Commissions in the way middle and higher income states were assessed. In contrast the Eleventh Finance Commission required that they raise tax revenues much higher than what they were able to achieve.

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