Budget Credibility of Subnational Governments: Analyzing the Fiscal Forecasting Errors of 28 States in India

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Abstract

Budget credibility, the ability of governments to accurately forecast the macro-fiscal variables, is crucial for effective Public Financial Management (PFM). Fiscal marksmanship analysis captures the extent of errors in the budgetary forecasting. The fiscal rules can determine fiscal marksmanship, as effective fiscal consolidation procedure affects the fiscal behaviour of the states in conducting the budgetary forecasts. Against this backdrop, applying Theil's technique, we analyse the fiscal forecasting errors for 28 States (except Telangana) in India for the period 2011-12 to 2015-16. There is a heterogeneity in the magnitude of errors across subnational governments in India. The forecast errors in revenue receipts have been greater than revenue expenditure. Within revenue receipts, the errors are pronounced more significantly in grants component. Within expenditure budgets, the errors in capital spending are found greater than revenue spending in all the States. Partitioning the sources of errors, we identified that the errors were more broadly random than systematic bias, except for a few crucial macro-fiscal variables where improving the forecasting techniques can provide better estimates.

Keywords: forecast errors, fiscal policies, fiscal forecasting, political economy, fiscal marksmanship

JEL Classification Codes: H6, E62, C53.

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Budget credibility is integral to Public Financial Management (PFM). It is the ability of the governments to accurately forecast the macro-fiscal variables. Fiscal marksmanship captures the extent of errors in the budgetary forecasting. The fiscal rules can determine fiscal marksmanship as effective fiscal consolidation procedure affects the fiscal behaviour of the states. Even logical and well-written fiscal rules require justification, given that constraining a government's ability to practice fiscal policy has obvious disadvantages as well (Auerbach, 2017). Against this backdrop, we analyse the errors in the budget forecasts in India at the State level for the period 2011-12 to 2015-16. The FRBM (Fiscal Responsibility and Budget Management) stipulated that States should maintain a fiscal deficit to GDP threshold ratio of 3 per cent except for West Bengal, Kerala and Punjab (Fiscal Responsibility and Budget Management (FRBM) Committee Report, 2017). The FRBM compliance by the States has been rewarded by performance incentive grants by the central government. Therefore two issues are relevant here to analyse, (i) the credibility of budget forecasts and (ii) if there are any changes in fiscal behaviour of the States ex-post fiscal rules.

Technically, the revenue and expenditure forecasts are initially made in the annual *Budget Speech* by the Finance Minister as "*Budget Estimates*", and these forecasts are revised after a year which are published as "*Revised Estimates*". The Finance Accounts of the States with a lag of one or two years provide the "*Actual*" figures for audited revenue and expenditure. There is a high likelihood for huge deviations between these three stages.

We examine these deviations in macro-fiscal variables for 28 States (except Telangana) in India by employing a technique which estimates the magnitude and the sources of forecast errors. The paper is organized in 5 sections. Section 1 explains what forecast error is and why studying the forecast error is important. Section 2 reviews the fiscal marksmanship analysis. Section 3 explains the data sources and measurement issues. Section 4 presents the magnitude of errors using simple statistical tools. Section 5 carries out the application of the Theil's U techniques for the evaluation of fiscal marksmanship and identify the systemic and random components of forecast errors for all States in India. Section 6 concludes and draws policy implications.

I *What is forecast error and why analyzing forecast error is important?*

Any budget has three sets of numbers, the budget estimates for the current year, the revised estimates of the ensuing year and the actuals. The credibility of the budget depends on the quality of the budgetary estimates.

There can be various issues arising if the government estimates are inaccurate, which at times can have unintended/adverse macroeconomic consequences. In cases where the actual expenditure exceeds the budgeted, there would be an unanticipated need of financing the deficit. Conversely, if the actual expenditure is less than the budgeted, then there would be idle resources which can otherwise be put to productive use. Therefore, having accurate forecasts are quintessential for proper implementation of the budget.

Accurate fiscal forecasts are also important for fiscal management. For instance if a country wants to reduce fiscal deficit, one needs to rely on the accuracy of the budgetary estimates of its revenues and expenditures. Generally, the budgetary estimates will consist of errors i.e. the forecasts would deviate from the actual values. However, not all errors can be treated similarly. Primarily one can distinguish between systematic errors and random errors. The systematic errors can be improved upon by incorporating additional relevant variables or even factoring in the variations in the different variables involved. On the other hand, random errors are the errors which cannot be improved upon by improving upon the forecasting methodologies/techniques and is because of unanticipated and exogenous shock which out of control of the forecaster. Therefore, credible budgetary forecasts would have a higher proportion of random errors compared to systematic error. It is only when the estimates are credible that one can maintain a desired level of fiscal deficit.

The Theil's Index is used in the literature assess the extent of errors. To know the composition of errors we break down the error into systematic error and random error. If the systematic component of error is high, one can improve the forecasting by improving the forecasting method. This can be done adding more variables into the forecasting model or also by incorporating the fluctuations in the variables in the model. In case the random error is high, one cannot improve the forecasting further and the model used to estimate the error is a good model (Theil, H 1958).

Effective fiscal consolidation at subnational government levels requires a high degree of accuracy in forecasting tax revenue and in estimating public expenditure. Fiscal Marksmanship is an exercise to examine the degree of correspondence between the actual and forecasted revenue and expenditure which will aid in assessing the extent of errors and also the composition of errors. The fiscal marksmanship is significant because the revenue projections/forecasting determine the extent of borrowing requirements to finance the public expenditure. The public expenditure compression – the significant deviation between "what is budgeted" and "what is actually spent"- to meet the FRBM targets also have adverse macroeconomic consequences.

II A Review of Fiscal Marksmanship Analysis

The political economy of budget deficit and other macro-fiscal variables have started gaining attention since the nineties (Alesina, Alberto and Roberto Perotti, 1995; Blanchard Olivier, 1990). However, one of the earlier attempts on fiscal forecast errors was made by Allan (1965) in the case of Britain. According to Allan, the importance of fiscal marksmanship during that time was because that the margin for error was limited, given the tradeoff between inflation and full employment. In such a scenario, accurate predictions of budgetary estimates were important to meet the fiscal policy targets of having full employment without undesirably high inflation. Davis (1980), following up on Allan's study has taken a longer time series (from 1951 to 1978).

Auld (1970) has done a fiscal marksmanship exercise for Canada for the post war period (till 1968). Auld says that if the government is to finance its long range programmes, accurate predictions is important. Morrison (1986) has done a fiscal marksmanship exercise in the United States for the years 1950-1983. Cassidy, Glenn, Mark. S. Kamlet, and Daniel S. Nagin (1989) analysed the revenue forecast biases in the context of Europe. The expectations of macro-fiscal 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). Fiscal marksmanship is the accuracy of budgetary forecasting. Good fiscal marksmanship can be one important piece of available 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* (Davis 1980), where he noted that budget estimates have an important 'signal effect' on outside forecasters and analysts, with particular attention in recent years focused on the estimated borrowing requirement. If expectations are rational rather than adaptive, it is the estimate of taxes and public expenditure in any given budget - the ex-ante data, not the observed data that will be used by forward-looking private agents who base their decisions in whole or in part on fiscal variables (Morrison, 1986).

In the context of Eurozone, Stephan Andreas and Brück Tilman (2005) have estimated the political economy determinants of budget deficit forecast errors. Their findings show that political, electoral cycles and the institutional design of governments affects the quality of fiscal forecasts. Their findings against the backdrop of Stability and Growth Pact (SGP) suggest incentives for "unobservable fiscal effort" (Beetsma and Jensen 2004) of a malign nature, by eurozone governments (compared to other OECD governments) in reporting their budget deficits prior to elections. They explained the fiscal behaviour under three cycles- an electoral forecast cycle, partisan forecast cycle and an institutional cycle.[2] They applied panel econometric techniques to the analysis of forecast errors of both euro zone and non-euro zone OECD economies. Their findings suggest that the forecast errors are more with election cycles in euro zone countries.

Xisco Oliver Joan Rosselló (2016) in the context of Stability and Growth Pact, have examined the relationship between fiscal rules and budgetary forecasts by analyzing the significance of political and institutional variables in Eurozone. Their findings showed that level of public sector debt is crucial in explaining budgetary forecast errors. The electoral coincidence, political orientation of ruling parties, tax autonomy and per capita revenue are the other significant determinants of forecast errors. This study took the literature forward

[2] They emphasized that in an electoral forecast cycle, election date determines the nature of government spending and taxation plans, for instance, government may increase public expenditure and revise taxation plans prior to election date and manipulate the emerging budget deficit until after the elections. In a partisan forecast cycle, they have elaborated that a cyclical behaviour derives from different preferences of the political parties and their respective voters. The quality of budget deficit forecasts in such a cycle depends on the political orientation of a government, for instance, the left-wing (right-wing) governments pursue employment (price stability) at the expense of price stability (employment) which means that tax revenues are more (less) difficult to forecast. In an institutional forecast cycle, they elaborated that the institutions of governance create incentives for manipulating budget deficit forecasts, for instance, the deficit forecasts of a coalition or minority government and a single-party majority governments may not be the same. Artis, Michael J. and Massimilano Marcellino (2001) also analysed the forecast errors of OECD countries.

to subnational tiers of government in 15 European countries, unlike the earlier studies in the context of Eurozone which have confined their analysis on a macroeconomic perspective at the national government levels. The Stability and Growth Path therefore creates incentives for creative budgetary deficit forecasts prior to election cycles (Strauch et al 2004).

Luisa Giuriato, Alessandra Cepparulo and Matteo Barberi (2016) analysed the quality of fiscal forecasts of 13 EU countries by using annual forecast vintages, 1999-2013 against the backdrop of Stability and Convergence Programme. They found that if fiscal rules counter the executive's monopoly of fiscal forecasting, strengthening the legislature's formal powers negatively influences the fiscal forecast accuracy. Pina Álvaro and Nuno Venes (2011) analysed the budget balance forecasts prepared by 15 European countries in their "Excessive Deficit Procedure (EDP)"reportings. They found that growth surprises, fiscal institutions, elections cycle, forms of fiscal governance and numerical expenditure rules (unlike deficit and debt rules) affect the forecast errors.

There have been a number of fiscal marksmanship exercises in the case of India (Bhattacharya, and Kumari 1988). In one of the earlier attempts at analyzing budgetary estimates in India (for 1956-64), Paul and Rangarajan (1974) has done an analysis of two components of the capital expenditure of the state and union budget, namely construction and industrial development (the analysis was limited to these two because of the scope of the subject matter they were dealing with). In this study, the analysis of forecasting errors were based largely on graphs plotting the actual expenditure and the budget estimates. In their analysis, it is stated that while in both the components the budget estimates of the center was more accurate compared to the state. This difference was attributed to the different in efficiency in the budgetary process.

Asher (1978) has performed a more comprehensive fiscal marksmanship exercise for India for the period 1967-68 to 1975-76 for both the revised and budget estimates. The study showed that during that period, both the revenues and expenditures were consistently underestimated. However, it was observed that the extent of error for the expenditure side was larger.

Chakrabarty and Varghese (1982) have used data from 1970-71 to 1979-80. One of the major findings of that study was that both revenues and expenditure are underestimated.

Pattnaik (1990) has done a fiscal marksmanship exercise using the Theil's Index for the period 1951 to 1989. The study observes that the errors in the revised estimates are lower than the errors in the budget estimate (although there are large errors in both). It is stated that largely most of the errors in the estimates are systematic in nature for both the entire time period as well as sub time periods (the systematic errors were maximum for the period 1981 to 1989).

More recent studies on fiscal marksmanship in India have a different conclusion. A study done by K Nitin and Roy (2015) using data from 1990-91 to 2011-12 observes that the source of error in components such as tax revenue, non-tax revenue, interest payments, defense revenue expenditure, plan revenue expenditure and fiscal deficit were primarily due to random error (in the paper, if the proportion of the random error is more than any of the bias component or the error in variance). The rest of the components such as subsidy expenditure, non-plan revenue expenditure, capital expenditure and non-debt capital receipts had a higher systematic error (mean error and slope error). A very interesting point made in the paper is that while there is an attempt to have fiscal consolidation by controlling expenditure, the predictability of expenditure is quite low compared to revenue. In a similar study, Chakraborty and Sinha (2018) has done a fiscal marksmanship exercise for the period 1990-1991 to 2016-17 and have come up with a similar conclusion.

A trend which is observed based on the empirical literature is that from 1951 to 1990, the systematic component of the error was higher, from 1990 to 2016-17, the random component is higher compared to the systematic component. It is worth noting that, that these studies are based on data of the union government. Shrestha and Chakraborty (2019) is the only study that has examined the fiscal marksmanship in the context of a State in India. Their study focused on Kerala, and identified forecast errors with respect to tax revenue projections.

In the recent empirical literature, the fiscal forecast errors are analysed against the backdrop of fiscal rules. The political economy of fiscal forecasts at the subnational level depend on the tax autonomy and the nature of the intergovernmental fiscal transfer mechanism. The tax autonomy is heterogeneous across States. The intergovernmental fiscal transfers may be progressive if the transfer is designed to offset the inter-state fiscal disabilities.

In India, the Finance Bill 2018 has incorporated a few clauses (clauses 207–10) to amend FRBM Act, 2003, with special reference to eliminate the reference to "revenue balance" and using fiscal deficit as an operational parameter (Chakraborty and Chakraborty, 2018). Against these policy changes, it is pertinent to analyse the impact of fiscal rules on fiscal marksmanship of macro-fiscal variables in India. Buiter and Patel (2011) have analysed the fiscal rules in India, however the effect of fiscal rules on fiscal marksmanship in the context of India has not been analysed. As mentioned above, Nitin and Roy (2014) have analysed the normative fiscal assessments of the Finance Commission (FC) of India, and realization of fiscal policy with regard to Central Finances over the period 1990–2012.

The recent empirical literature on fiscal marksmanship is highly confined to the forecast errors of national governments in India (Chakraborty and Sinha, 2018, Nitin and Roy, 2014). There have been virtually no effort in doing a fiscal marksmanship exercise at the state level. In this paper, we attempt to do a fiscal marksmanship exercise at the state level from the year 2010-11 to 2015-16; analyzing the magnitude of the errors of the states and subsequently examining the nature of the errors. This is done in two ways: a) Firstly to check whether the errors are overestimates or under-estimates and b) To check the extent of systematic and random components in these fiscal forecast errors.

III Data and Measurement Issues

The data is organized from Finance Accounts of various States and CSO. The forecast error is defined as deviation between what is predicted (as Budget Estimates or Revised Estimate) and what is Actual. The summary statistics usually used to measure forecasting errors in the empirical literature are the following (González Cabanillas, Laura and Alessio Terzi, 2012).

III.1: The Mean Error

The mean error (ME) refers to the average difference between the forecast and the actual. The mean error has been calculated by taking the average of the difference between the Predicted values (of both BE and RE) and the actuals over the period 2011/12 to 2015/16. We have divided the mean error by the sum of actuals of the reference period for a meaningful inference from data. The Mean error is a crude measure of quality of forecast as positive and

negative errors can offset each other, thereby not giving us the exact magnitude of error. However, The ME is a pointer to a possible bias in the forecast.

III.2: The Root Mean Square Error

The root mean squared error (RMSE) is a measure of the relative size of the forecast error. In this paper, to calculate the RMSE the mean squared error is taken over the reference period after which the square root of the MSE is calculated. While this will give us the magnitude of error, it will not give any information on the direction of the error, i.e. whether the error is positive or negative. We have taken the RMSE as a proportion of the sum of actuals of the reference period. It takes reflects the fact that large forecast errors are more significant than small differences.

III.3: Theil's Inequality Coefficients (U)

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:

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

where

U_1 = inequality coefficient

P_t = Predicted value

A_t = Actual value

n = the number of years

This inequality coefficient ranges from zero to one. When $P_t = A_t$ for all observations (a perfect forecast), U_1 equals zero[3].

[3] 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.

The mean square prediction error (U_1) 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. The derivation of equation 4 is given in detail in Davis (1980).

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

In equation (2), 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 (2) 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 (2) 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 (2) measures the proportion of forecasting error due to random variation.

U_2 = $\dfrac{\sqrt{1/n\sum(P_t - A_t)^2}}{\sqrt{1/n\sum A_t^2}}$

This measure has an advantage that denominator does not contain P and the inequality coefficient does not depend on the forecast. In perfect forecast, U_2 equals to zero. U_2 does not have an upper bound.

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.

U_3 = $\sqrt{\dfrac{1/n\sum[Pt - at]^2}{1/n\sum[Pt]^2 + 1/n\sum[at]^2}}$

Where $a = A_t - A_{t-1}$

$P_t = P_t - A_{t-1}$

n= no: of years

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).

III.3: Magnitude of Forecasting Errors

Our analysis showed that in 28 States, the overestimation of revenue receipts amount to 1.18 percent of GSDP, with respect to the forecast deviation between Budget Estimates (BE) and Actuals. The same ratio however has slightly reduced to 1.03 per cent for Revised Estimates (RE) and Actuals. The underestimation (negative deviations of BE and Actuals) of revenue however is negligible (Table 1).

The State's own tax revenue alone showed 0.40 per cent overestimation as per cent of GSDP for all States with regard to forecast errors between BE and Actuals. The errors reduced to 0.22 per cent of GSDP for RE-Actuals. The State's own non-tax revenue was cumulatively overestimated to the range of 0.11 per cent while the Central transfers was overestimated to the range of 0.14 per cent of GSDP. It would be interesting to analyse the reasons of this forecast errors in central transfers to all states. The design of cess and surcharges is an additional dimension for the reduction in the divisible tax pool central transfers to the States. The cumulative forecast errors/deviation between BE and Actuals was relatively higher for grants than tax transfers to all States, at a range of 0.66 per cent for BE-Actuals (Table 1).

The cumulative overestimation of revenue expenditure of all States over the period 2011-12 to 2015-16 was 1.05 per cent of GSDP with respect to the forecast errors between BE and Actuals (Table 2) . Within the revenue expenditure, the overestimation of social services (0.53 % with respect to RE-Actuals) is the higher than economic services and general services. This is broadly giving an indication that against the backdrop of fiscal rules at subnational level, expenditure compression happens more with the social sector spending. The cumulative overestimation of general services is 0.34 per cent for BE-Actuals and lesser at 0.17 per cent for RE-Actuals.

Table 1: Deviation between BE/RE and Actuals in Revenue Receipts as Percent of GSDP, 2011-12 to 2015-16

	Revenue Receipts		States' Own Tax Revenue		State's Own Non Tax Revenue		Share in Central Taxes		Grants From Center	
	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals
Over-estimation as a % of All State GSDP	1.20%	1.05%	0.40%	0.22%	0.11%	0.08%	0.14%	0.12%	0.67%	0.66%
Under-estimation as a % of All State GSDP	0.00%	-0.08%	-0.04%	-0.07%	-0.04%	-0.03%	-0.02%	-0.02%	-0.02%	0.00%

Source: Finance Accounts of States and State Budget documents (various years)

Table 2: Deviation between BE/RE and Actuals in Revenue Expenditure: as % of GSDP, 2011/12-2015/16

	Revenue Expenditure(total)		Social Services		Economic Services		General Services	
	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals
Over-estimation as a % of All State GSDP	1.05%	1.29%	0.37%	0.53%	0.19%	0.39%	0.34%	0.17%
Under-estimation as a % of All State GSDP	-0.01%	-0.10%	-0.02%	-0.05%	-0.05%	-0.02%	-0.03%	-0.05%

Source: Finance Accounts of States and State Budget documents (various years)

Table 3: Deviation between BE/RE and Actuals in Capital Expenditure, as % of GSDP, 2011/12-2015/16

	Capital Expenditure (total)		Social Services		Economic Services		General Services	
	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals
Over-estimation as a % of All State GSDP	0.39%	0.38%	0.15%	0.14%	0.20%	0.19%	0.08%	0.06%
Under-estimation as a % of All State GSDP	-0.02%	-0.01%	0.00%	0.00%	-0.05%	-0.02%	0.00%	0.00%

Source: Finance Accounts of States and State Budget documents (various years)

The cumulative overestimation of capital expenditure over the period under analysis was to extent of 0.38 per cent of GSDP for both BE-Actuals and RE-Actuals (Table 3).

III.3.1: Mean Error (ME) and Root of Mean Error Square (RMSE)

Analyzing the mean error and root of mean squared error, we find that the values of MSE and RMSE (as a proportion of actuals) seems to be higher in the case of capital expenditure compared to revenue expenditure. This is true of almost all of states. Only in case of Haryana, Karnataka and Odisha, the MSE (as a proportion of actuals) is higher in revenue expenditure compared to capital expenditure (Table 4). Furthermore, only in Himachal, Karnataka, Kerala and Uttarakhand the RMSE as proportion of actuals is higher in case of revenue expenditure compared to capital expenditure. Secondly, the MSE and RMSE (as a proportion of actuals) is higher in case of non-tax revenue (including grants) compared to tax revenue (including tax transfers) at the all-state level. The all state ME as a proportion of actuals for total tax revenue is 0.0496 and the all-state ME for non-tax revenue as a proportion of actuals is 0.2049. Similarly in the case of RMSE, the all-state RMSE as a proportion of actuals for total tax revenue is 548.09 and the same for non-tax revenue is 1140.79. The main reason the ME and RMSE are higher for non-tax revenue is because the value of these two indicators are very high for the grants from the center. The RMSE as a proportion of actuals for grants from the center is 1157.62 and the RMSE for States own non tax revenue is only 372.02. Similarly, mean error of states own tax revenue is only 0.0544 whereas it is 0.282 for grants from the center.

Table 4: Mean Error (ME) and Root Mean Square Error (RMSE): Budget Estimates (BE) and Actuals

States	State Own Tax Revenue	Share in Central Taxes	States Own Non Tax Revenue	Grants from Center	Revenue Expenditure	Capital Expenditure	Revenue Deficit	Fiscal Deficit	Primary Deficit
Andhra Pradesh	0.04	0.04	-0.07	0.14	0.02	0.07	-0.45	-0.04	-0.11
	0.02	0.01	0.03	0.07	0.02	0.05	-0.17	-0.08	-0.16
Arunachal Pradesh	0.08	0.01	0.22	0.11	0.12	0.75	-0.07	3.19	13.61
	0.04	0.00	0.05	0.06	0.02	0.17	0.27	-0.91	-3.98
Assam	0.07	0.05	0.10	0.51	0.33	1.56	1.42	0.64	0.93
	0.02	0.01	0.03	0.12	0.05	0.24	-0.50	-0.23	-0.34
Bihar	0.07	0.04	0.27	0.37	0.27	0.34	-1.52	1.18	2.39
	0.02	0.01	0.10	0.08	0.05	0.07	0.46	-0.27	-0.55
Chhattisgarh	0.11	0.06	0.26	0.54	0.17	0.31	0.96	0.19	0.26
	0.02	0.01	0.03	0.10	0.03	0.05	0.38	-0.13	-0.20
Goa	0.03	0.03	0.02	0.61	0.09	0.67	-8.79	0.90	4.02
	0.01	0.01	0.01	0.10	0.02	0.10	2.19	-0.25	-1.07
Gujarat	0.00	0.07	0.04	0.35	0.04	0.06	0.23	0.00	0.00
	0.01	0.01	0.01	0.07	0.01	0.02	0.12	-0.03	-0.12
Haryana	0.06	0.04	0.07	0.54	0.11	0.04	0.06	0.26	0.49
	0.01	0.01	0.02	0.11	0.02	0.05	-0.05	-0.11	-0.21
Himachal Pradesh	-0.01	0.12	-0.02	0.08	0.07	0.07	0.87	0.02	0.77
	0.01	0.03	0.05	0.02	0.01	0.01	-0.23	-0.03	-0.35
Jammu and Kashmir	0.05	0.04	0.14	0.19	0.01	0.56	7.68	-0.05	-0.16
	0.01	0.01	0.05	0.03	0.01	0.10	1.38	-0.29	-0.89
Jharkhand	0.15	0.04	0.19	0.86	0.22	0.31	0.81	0.09	0.20
	0.03	0.01	0.04	0.18	0.04	0.07	0.25	-0.10	-0.21
Karnataka	-0.02	0.02	-0.06	0.34	0.25	-0.02	-0.43	0.03	0.06
	0.00	0.01	0.02	0.09	0.10	0.01	0.15	-0.03	-0.05
Kerala	0.06	0.04	0.05	0.24	0.16	0.18	0.60	0.43	0.92
	0.01	0.01	0.01	0.06	0.07	0.06	-0.36	-0.24	-0.50
Madhya Pradesh	0.01	0.05	0.02	0.29	0.10	0.07	-0.21	0.28	0.71
	0.01	0.01	0.01	0.08	0.02	0.02	0.04	-0.08	-0.20
Maharashtra	0.01	0.00	0.12	0.40	0.06	0.14	0.37	0.18	1.71
	0.00	0.00	0.02	0.08	0.01	0.02	-0.15	-0.07	-0.64
Manipur	0.08	0.04	0.30	0.15	0.15	0.33	-0.02	1.41	-4.61
	0.03	0.01	0.09	0.04	0.03	0.06	0.05	-0.32	1.05
Meghalaya	-0.02	0.06	0.17	0.66	0.28	0.47	1.50	-0.20	-0.44
	0.03	0.01	0.08	0.14	0.07	0.09	0.34	-0.17	-0.28

States	State Own Tax Revenue	Share in Central Taxes	States Own Non Tax Revenue	Grants from Center	Revenue Expenditure	Capital Expenditure	Revenue Deficit	Fiscal Deficit	Primary Deficit
Mizoram	-0.05	-0.01	0.09	0.15	0.14	0.40	-0.88	0.90	2.31
	0.01	0.01	0.04	0.03	0.03	0.08	0.54	-0.40	-0.97
Nagaland	-0.05	0.00	-0.11	0.09	0.14	0.29	-0.27	1.10	-20.32
	0.02	0.00	0.04	0.01	0.03	0.06	0.08	-0.32	5.69
Orissa	-0.01	0.02	-0.10	0.39	0.12	0.03	-0.40	0.80	2.71
	0.00	0.01	0.03	0.08	0.02	0.01	0.09	-0.22	-1.12
Punjab	0.09	0.03	0.51	0.37	0.08	0.77	-0.20	-0.49	-1.76
	0.02	0.01	0.12	0.10	0.02	0.17	-0.04	-0.18	-0.67
Rajasthan	0.02	0.00	0.01	0.17	0.06	0.12	2.16	0.18	0.31
	0.01	0.00	0.01	0.04	0.01	0.03	-0.63	-0.04	-0.07
Sikkim	-0.07	0.04	0.27	0.47	0.19	0.71	0.67	0.76	-127.83
	0.02	0.01	0.07	0.12	0.04	0.15	0.13	-0.29	34.27
Tamil Nadu	0.07	0.02	-0.02	0.10	0.05	0.14	-0.31	0.03	0.07
	0.02	0.01	0.02	0.02	0.01	0.03	-0.10	-0.02	-0.06
Tripura	0.04	0.03	0.03	0.15	0.11	0.30	0.06	1.26	-2.47
	0.02	0.01	0.03	0.03	0.02	0.05	0.04	-0.45	0.66
Uttar Pradesh	0.03	0.05	0.07	0.33	0.08	0.10	0.19	0.06	0.18
	0.01	0.01	0.03	0.09	0.01	0.02	0.08	-0.03	-0.08
Uttarakhand	-0.85	-0.48	-0.82	0.06	-0.60	-0.27	9.86	-0.74	-0.79
	0.15	0.09	0.16	0.01	0.11	0.06	1.84	-0.20	-0.26
West Bengal	0.02	0.04	0.22	0.13	0.02	0.34	-0.15	0.03	0.27
	0.01	0.01	0.11	0.04	0.01	0.06	-0.06	-0.03	-0.28

Note: the first figure is ME and the second figure is RMSE respectively.

Source: (Basic data), Finance Accounts of States and State Budget documents (various years)

Table 5: Mean Error (ME) and Root Mean Square Error (RMSE): Revised Estimates (BE) and Actuals

States	State Own Tax Revenue	Share in Central Taxes	States Own Non Tax Revenue	Grants from Center	Revenue Expenditure	Capital Expenditure	Revenue Deficit	Fiscal Deficit	Primary Deficit
Andhra Pradesh	0.01	0.01	-0.01	0.03	0	0.01	-0.09	-0.01	-0.02
	0.04	0.03	0.06	0.15	0.05	0.12	-0.4	-0.14	-0.27
Arunachal Pradesh	0.02	0	0.04	0.02	0.02	0.15	-0.01	0.64	2.72
	0.08	0	0.13	0.13	0.06	0.36	0.56	-2.03	-8.84
Assam	0.01	0.01	0.02	0.1	0.07	0.31	0.28	0.13	0.19
	0.05	0.03	0.07	0.26	0.17	0.79	-1.27	-0.3	-0.44
Bihar	0.01	0.01	0.05	0.07	0.05	0.07	-0.3	0.24	0.48
	0.05	0.02	0.22	0.18	0.13	0.17	1.07	-0.58	-1.18
Chhattisgarh	0.02	0.01	0.05	0.11	0.03	0.06	0.19	0.04	0.05
	0.07	0.03	0.16	0.27	0.09	0.15	0.81	-0.2	-0.31
Goa	0.01	0.01	0	0.12	0.02	0.13	-1.76	0.18	0.8
	0.02	0.02	0.02	0.34	0.04	0.32	4.7	-0.42	-1.84
Gujarat	0	0.01	0.01	0.07	0.01	0.01	0.05	0	0
	0.02	0.03	0.05	0.19	0.02	0.04	0.27	-0.04	-0.18
Haryana	0.01	0.01	0.01	0.11	0.02	0.01	0.01	0.05	0.1
	0.04	0.02	0.05	0.25	0.05	0.11	-0.1	-0.23	-0.45
Himachal Pradesh	0	0.02	0	0.02	0.01	0.01	0.17	0	0.15
	0.02	0.07	0.11	0.05	0.04	0.04	-0.66	-0.03	-0.74
Jammu and Kashmir	0.01	0.01	0.03	0.04	0	0.11	1.54	-0.01	-0.03
	0.03	0.02	0.12	0.1	0.01	0.28	3.68	-0.09	-0.23
Jharkhand	0.03	0.01	0.04	0.17	0.04	0.06	0.16	0.02	0.04
	0.09	0.02	0.09	0.41	0.1	0.15	0.56	-0.14	-0.29
Karnataka	0	0	-0.01	0.07	0.05	0	-0.09	0.01	0.01
	0.01	0.02	0.04	0.21	0.22	0.02	0.22	-0.02	-0.04
Kerala	0.01	0.01	0.01	0.05	0.03	0.04	0.12	0.09	0.18
	0.03	0.02	0.03	0.12	0.15	0.14	-0.81	-0.53	-1.12
Madhya Pradesh	0	0.01	0	0.06	0.02	0.01	-0.04	0.06	0.14
	0.02	0.03	0.04	0.17	0.05	0.05	0.17	-0.15	-0.4
Maharashtra	0	0	0.02	0.08	0.01	0.03	0.07	0.04	0.34
	0.01	0	0.05	0.2	0.03	0.08	-0.31	-0.1	-0.96
Manipur	0.02	0.01	0.06	0.03	0.03	0.07	0	0.28	-0.92
	0.07	0.03	0.2	0.08	0.07	0.15	0.12	-0.71	2.3
Meghalaya	0	0.01	0.03	0.13	0.06	0.09	0.3	-0.04	-0.09
	0.07	0.03	0.18	0.33	0.16	0.23	0.77	-0.25	-0.55
Mizoram	-0.01	0	0.02	0.03	0.03	0.08	-0.18	0.18	0.46
	0.04	0.02	0.09	0.08	0.07	0.2	1.14	-0.56	-1.44
Nagaland	-0.01	0	-0.02	0.02	0.03	0.06	-0.05	0.22	-4.06
	0.04	0	0.09	0.05	0.08	0.15	0.18	-0.52	9.73
Orissa	0	0	-0.02	0.08	0.02	0.01	-0.08	0.16	0.54
	0.01	0.02	0.06	0.19	0.06	0.03	0.18	-0.37	-1.67
Punjab	0.09	0.03	0.51	0.37	0.08	0.77	-0.2	-0.49	-1.76
	0.04	0.03	0.28	0.21	0.04	0.37	-0.1	-0.41	-1.49
Rajasthan	0	0	0	0.03	0.01	0.02	0.43	0.04	0.06
	0.02	0	0.02	0.09	0.03	0.06	-1.29	-0.08	-0.14
Sikkim	-0.01	0.01	0.05	0.09	0.04	0.14	0.13	0.15	-25.57
	0.05	0.03	0.15	0.22	0.09	0.32	0.31	-0.37	62.99

States	State Own Tax Revenue	Share in Central Taxes	States Own Non Tax Revenue	Grants from Center	Revenue Expenditure	Capital Expenditure	Revenue Deficit	Fiscal Deficit	Primary Deficit
Tamil Nadu	0.01	0	0	0.02	0.01	0.03	-0.06	0.01	0.01
	0.04	0.01	0.04	0.07	0.02	0.07	-0.27	-0.03	-0.07
Tripura	0.01	0.01	0.01	0.03	0.02	0.06	0.01	0.25	-0.49
	0.04	0.03	0.06	0.08	0.06	0.14	0.12	-0.65	1.33
Uttar Pradesh	0.01	0.01	0.01	0.07	0.02	0.02	0.04	0.01	0.04
	0.02	0.03	0.06	0.18	0.04	0.06	0.2	-0.06	-0.15
Uttarakhand	-0.17	-0.1	-0.16	0.01	-0.12	-0.05	1.97	-0.15	-0.16
	0.39	0.22	0.37	0.03	0.28	0.14	6.34	-0.38	-0.55
West Bengal	0	0.01	0.04	0.03	0	0.07	-0.03	0.01	0.05
	0.02	0.03	0.19	0.09	0.01	0.16	-0.14	-0.07	-0.6

Note: the first figure is MSE and the second figure is RMSE respectively.

Source: (Basic data), Finance Accounts of States and State Budget documents (various years)

III.3.2: Forecasting Errors: Overestimate or Underestimate?

One of limitations of RMSE is that we cannot find the sign of the error, i.e. whether the error was positive or negative. We attempt to calculate fiscal marksmanship indices in this section which would help us assess whether the budgetary estimates are overestimates or underestimates. This ratio would give us information on whether the BE (RE) is an underestimate or an overestimate. If the values of the ratio is above 1, this indicates that on average, the indicator has been overestimated. Conversely, if the value is below 1 it can be said that it is an underestimate. In case of BE, it can be observed that most of the categories are overestimated in both the revenue and the expenditure side.

Table 6: Descriptive Statistics of Fiscal Marksmanship Ratio: Revenue and its Components (BE/ Actuals)

	Total Revenue Receipt	Tax Revenue	States Own Tax Revenue	Share in Central Taxes	Non Tax Revenue	States Own Tax Revenue	Grants From Center
Median	1.115	1.029	1.003	1.056	1.210	1.120	1.332
Mean	1.118	1.039	1.097	1.038	1.241	1.156	1.325
Max	1.360	1.223	1.072	1.166	1.698	2.191	2.121
Min	1.012	0.916	0.952	0.866	0.839	0.828	0.803
Standard Deviation	0.087	0.056	0.077	0.053	0.199	0.280	0.269

Source: (Basic data), Finance Accounts of States and State Budget documents (various years)

On the total revenue receipt, all the states have the overall revenue overestimated ranging from a maximum value of 1.36 (Meghalaya) and a minimum value of 1.01 (Rajasthan).

The median value of total revenue receipt is 1.12 (Table 6). Correspondingly, both the tax revenue and non-tax revenue are generally overestimated. However, there are a few states where there has been underestimation of tax revenue and non-tax revenue. Tax Revenue was underestimated in Karnataka and Orissa, and Non Tax Revenues were underestimated in Tamil Nadu and Rajasthan. An interesting observation from the data is that the standard deviation of this index for the non-tax revenues (for both the components states own non-tax revenue and grants from the center) were considerably higher than the tax revenues. In the table 6, the standard deviation for tax revenue is 0.053, whereas the standard deviation of non-tax revenue is 0.199. This shows that the ratio of BE and actuals are relatively more spread compared to tax revenues. An observation which is worth noting is that the higher standard deviation of the ratio of BE and actuals for non-tax revenue compared to tax revenue complements the fact that the ME and the RMSE also had similar trend. Coupling the results from the previous and this section, one can conclude that while the BEs are generally overestimated for both tax revenues and non-tax revenues, the errors are generally higher for non-tax revenues compared to tax revenues.

Table 7: Descriptive Statistics of Fiscal Marksmanship Ratio: Revenue Expenditure

	Revenue Expenditure	Social Services	Economic Services	Non Developmental Expenditure
Median	1.072	1.074	1.069	1.040
Mean	1.094	1.086	1.117	1.055
Max	1.279	1.432	1.715	1.319
Min	0.950	0.866	0.895	0.920
Standard Deviation	0.084	0.122	0.174	0.088

Source: (Basic data), Finance Accounts of States and State Budget documents (various years)

When we consider the expenditure side, we can observe that it is generally the case that both revenue expenditure and capital expenditure have been overestimated. In case of revenue expenditure all of the states except Nagaland and Assam have underestimates. In case of capital expenditure, all the states besides Karnataka, Uttar Pradesh and Himachal Pradesh have overestimates. However, one trend that can observed is the range and standard deviation of capital expenditure is much higher compared to revenue expenditure (both overall and component wise). The maximum and the minimum of the revenue expenditure is 1.279 and 0.95 respectively for revenue expenditure (Table 7). This range is considerably lower

compared to the maximum and minimum of this index for capital expenditure which is 2.476 and 0.956 respectively (Table 8).

Table 8: Descriptive Statistics of Fiscal Marksmanship Ratio: Capital Expenditure

	Capital Expenditure	Social Services	Economic Services	Non Developmental Expenditure
Median	1.269	1.306	1.185	1.368
Mean	1.335	1.446	1.197	1.941
Max	2.476	3.305	2.113	9.879
Min	0.956	0.659	0.570	0.800
Standard Deviation	0.359	0.555	0.330	1.765

Source: (Basic data), Finance Accounts of States and State Budget documents (various years)

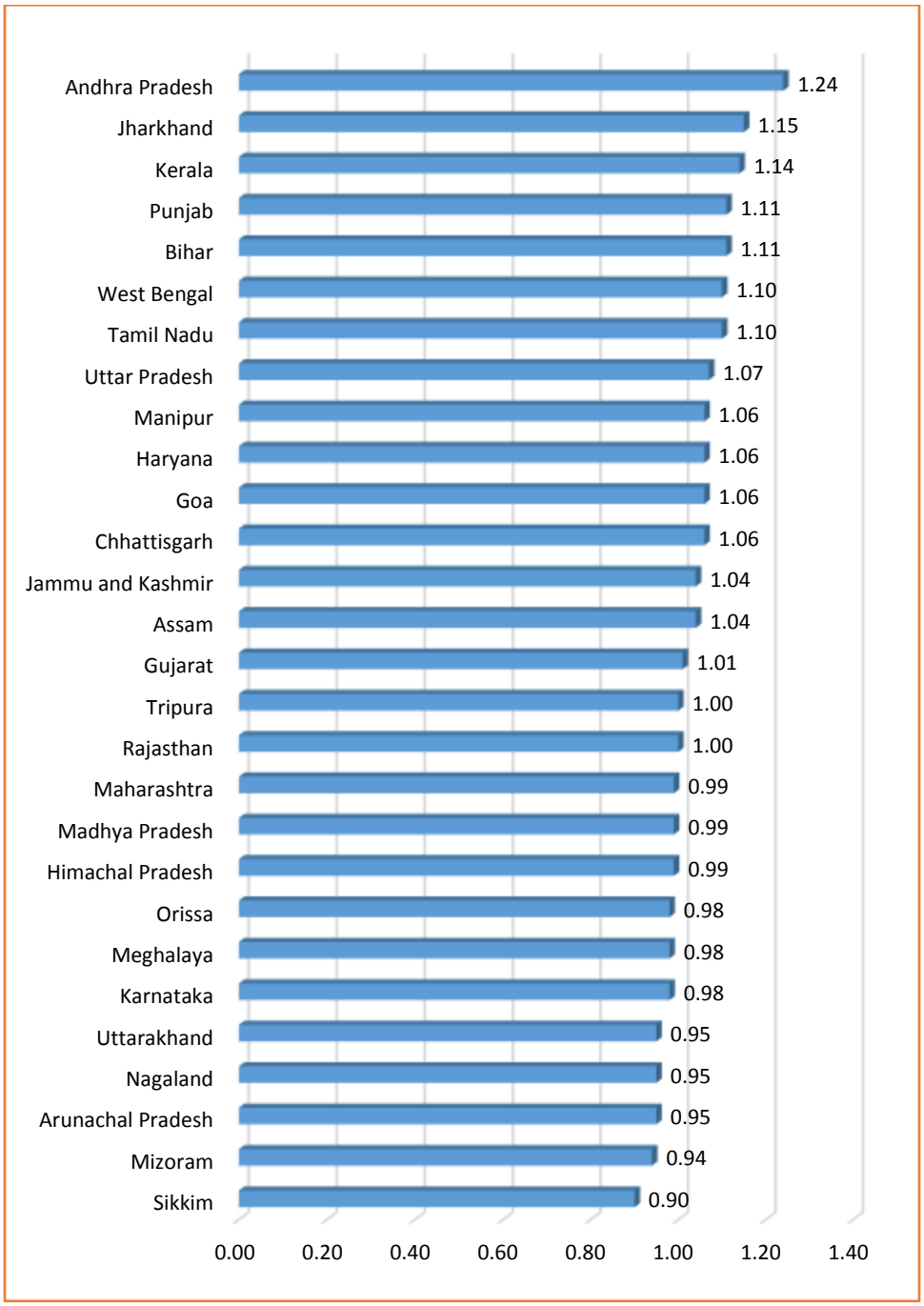
The standard deviation for capital expenditure is 0.359 which is around fourfold higher than the standard deviation of revenue expenditure (Table 8). It was observed in the previous section that the MSE and RMSE are higher for capital expenditure compared to revenue expenditure. Since most of the states had overestimates of both the revenue and capital expenditure it can be concluded that the forecasting errors in capital expenditure tends to be higher compared to revenue expenditure.

III.4: State-wise Fiscal marksmanship Ratios of Macro-fiscal variables

For fiscal marksmanship ratios, we have divided the BE by the Actual values and taken the average for the year 2011-12 to 2015-16. Therefore, if the values in the figures 1-5 is above 1, this indicates that on average, the indicator has been overestimated. Conversely, if the value is below 1 it can be said that it is underestimated. In case of BE, it can be observed that most of the categories are overestimated in both the revenue and the expenditure side. It can be observed that both the mean and median are over 1, indicating most of them are overestimated. When we observe the state wise trend, most of the categories have more than 20 states have an overestimate. One can observe a similar trend in the case RE. On average both the revenue and expenditure have been overestimated. In most of the categories there have been overestimate in over 20 states. It is worth noting that while most of the categories have overestimates, in case of revenue deficit, fiscal deficit and primary deficit merely 11, 18 and 16 states had underestimates. This is a trend similar to the BE. The fiscal marksmanship

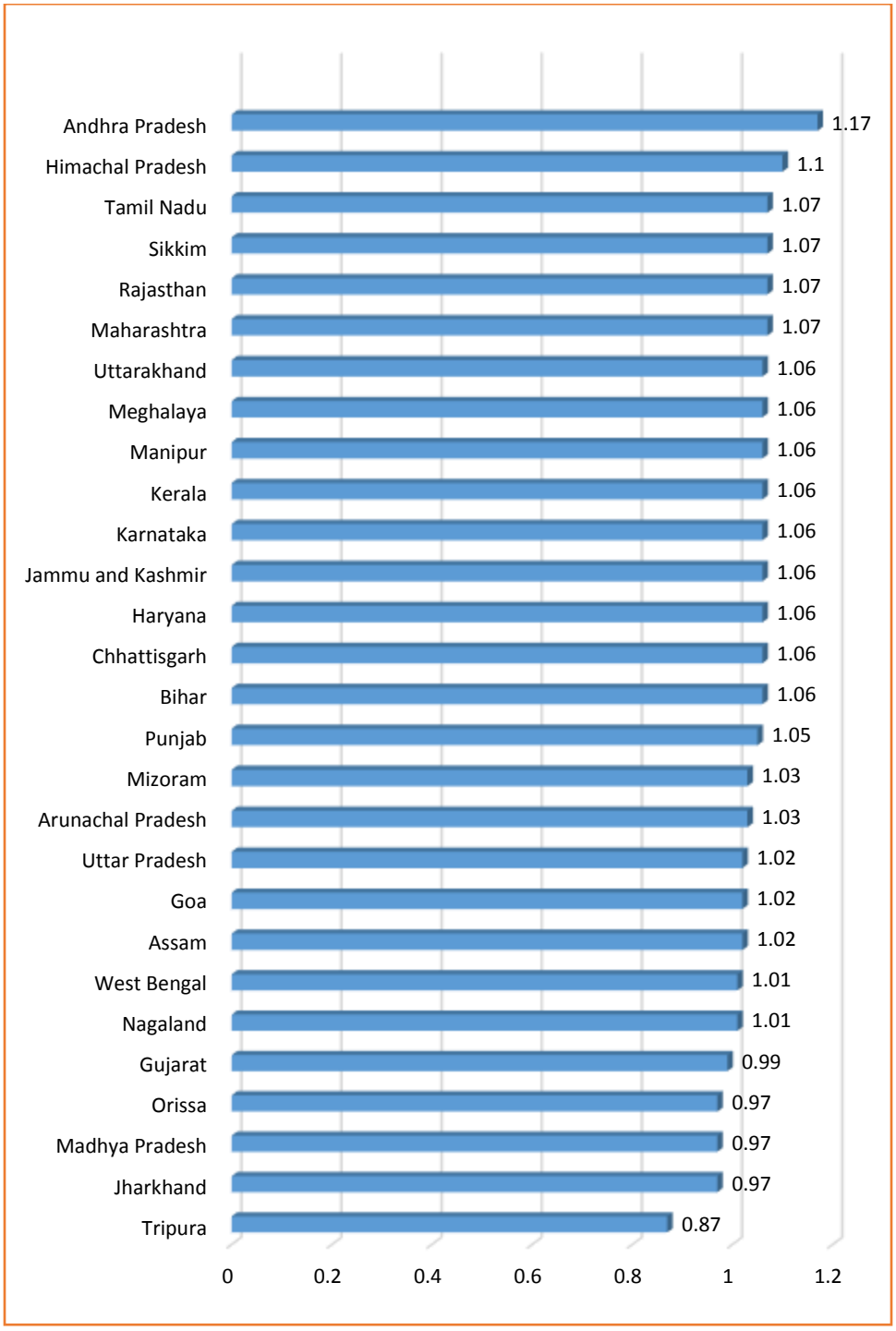
ratios suggest that forecast errors in grants is greater than other macro-fiscal variables (figure 3).

Figure 1: Fiscal Marksmanship Ratio of Own Tax revenue



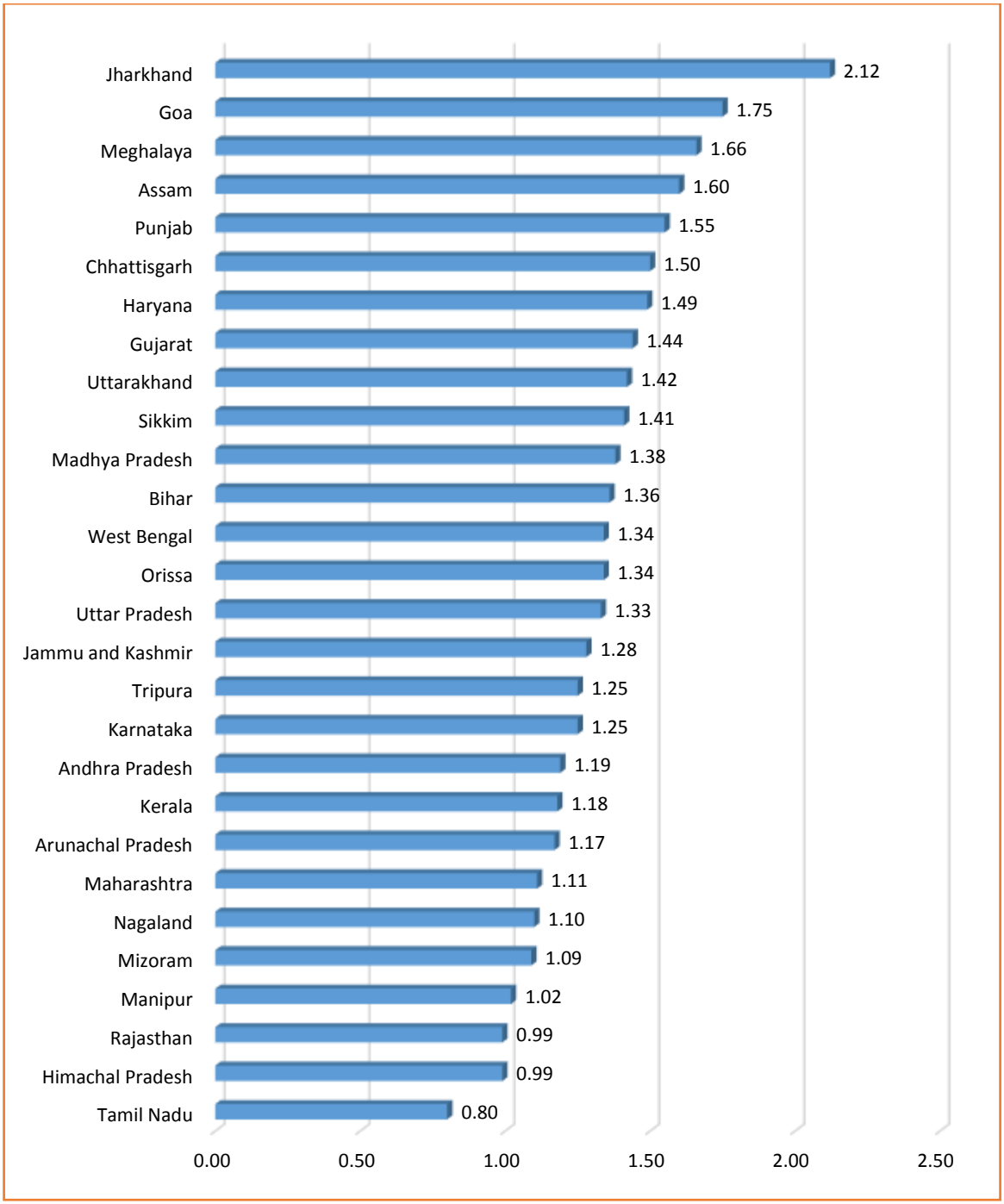
Source: Finance Accounts of States and State Budget documents (various years)

Figure 2: Fiscal Marksmanship Ratio of Tax Transfer



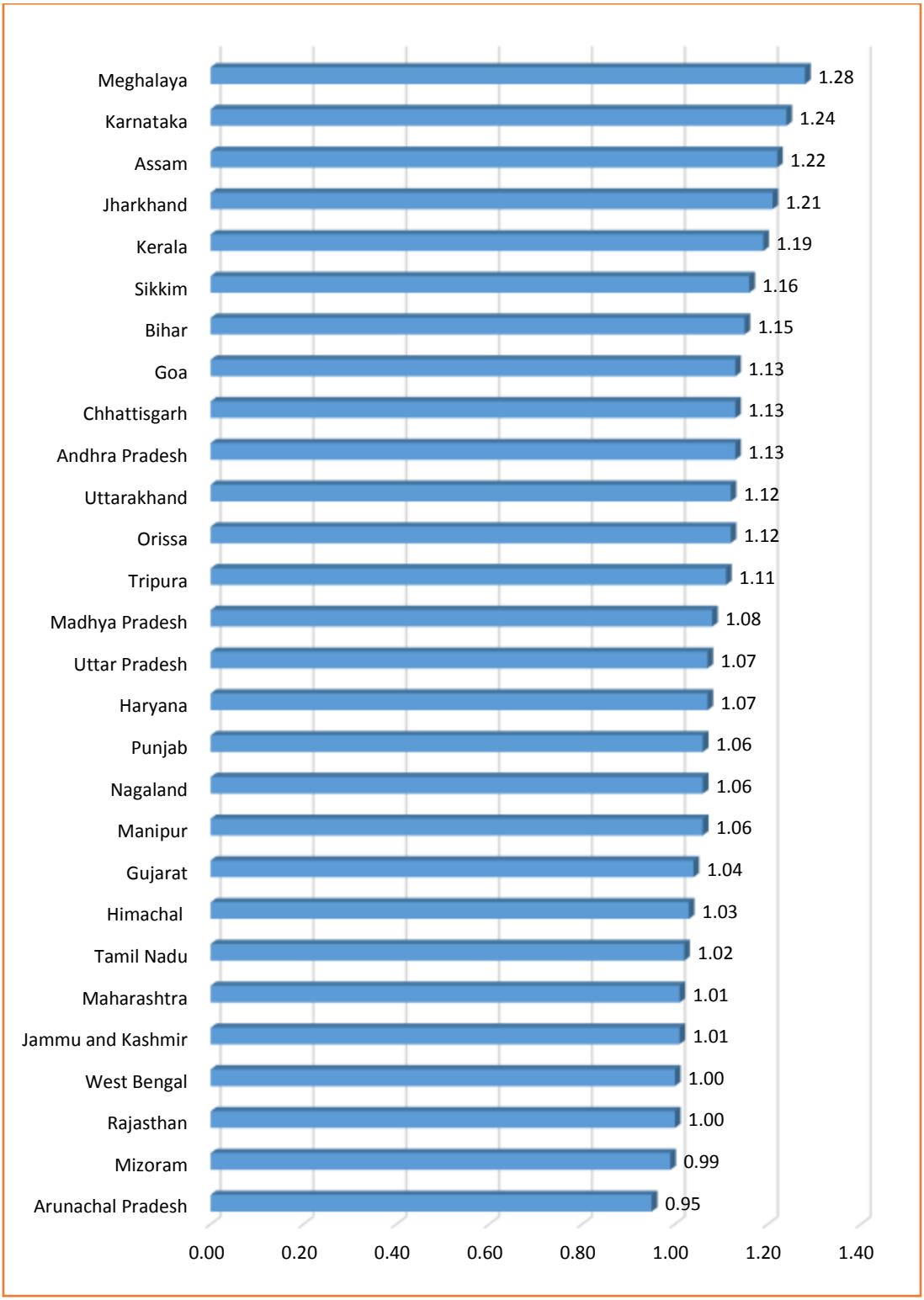
Source: Finance Accounts of States and State Budget documents (various years)

Figure 3: Fiscal Marksmanship Ratio of Grants



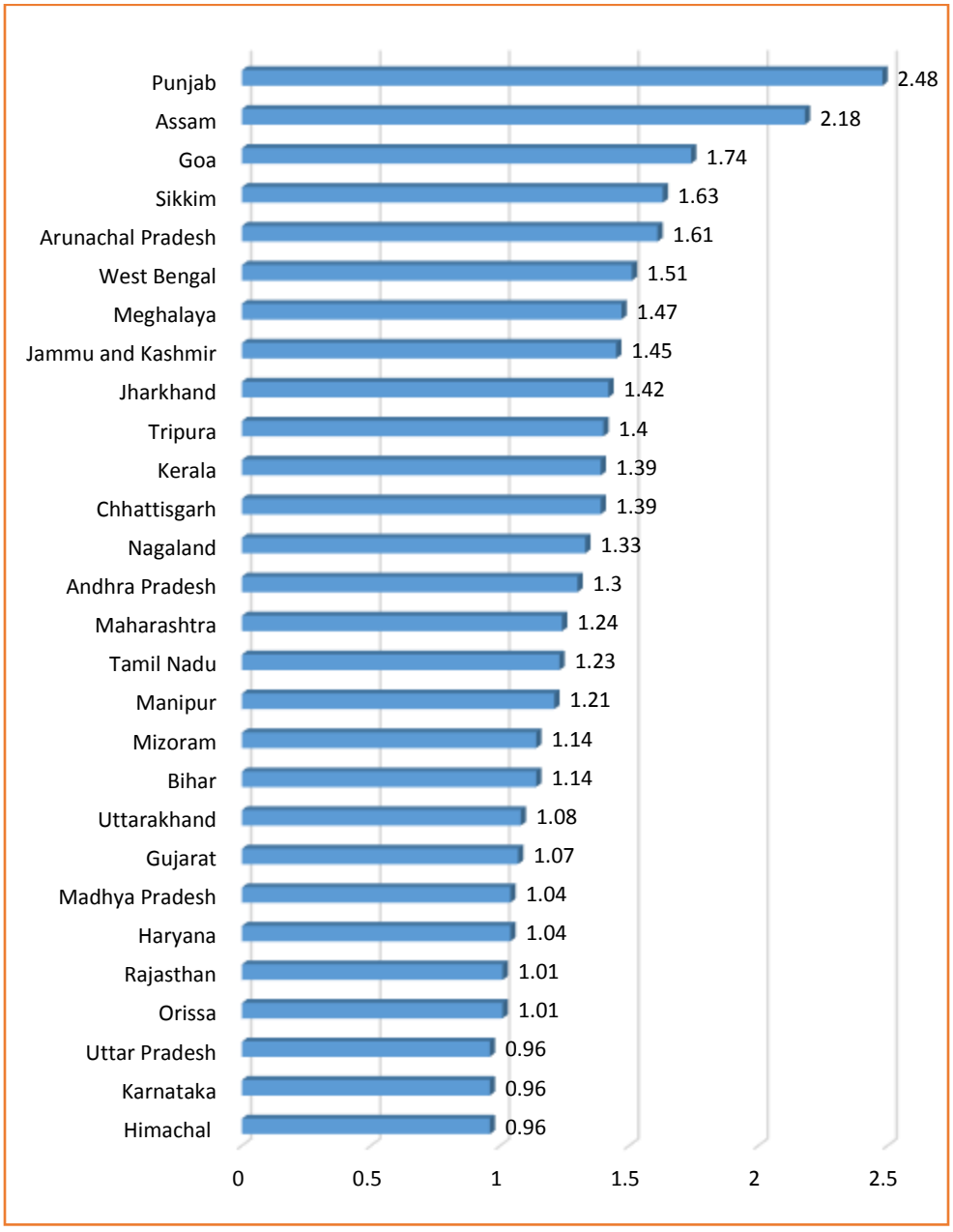
Source: Finance Accounts of States and State Budget documents (various years)

Figure 4: Fiscal Marksmanship Ratio of Revenue Expenditure



Source: Finance Accounts of States and State Budget documents (various years)

Figure 5: Fiscal Marksmanship Ratio of Capital Expenditure



Source: Finance Accounts of States and State Budget documents (various years)

IV. Analyzing the Forecast Errors using Theil's U

The U_1 of the Theil's index has a lower limit of 0 (which is the case of perfect forecast) and an upper limit of 1 (which is the highest forecasting error). We will state some of the observations on the forecasting errors and elaborate on it using some basic statistical indicators.

IV.1: The forecasting errors in most of the macro-fiscal indicators in most of states are generally low in both the revised and the budget estimate, to below 0.20 in a range of 0-1, with zero being perfect forecast and one , the imperfect forecast.

In the case of Budget Estimate, the average forecasting error in most of the revenue and expenditure are below 0.20. Furthermore, almost all of the variables (except the revenue deficit) is positively skewed (since median < mean). This means that a lot of the observations are clustered in to the left side of the interval of U_1 (i.e. 0 and 1), and most of them are below 0.20. One can observe that on average, both revenue and expenditure variables have low forecasting errors. We observe that the all-state average for total revenue receipt is 0.09. The all State average forecast error for the tax revenue is 0.074, and for non-tax revenue is 0.15. In case of the expenditure variables, the all India average is 0.08 for revenue expenditure and 0.177 for capital expenditure.

When we look at the error in estimating the fiscal deficit, the U_1 for fiscal deficit on average is 0.302. The states which have fiscal deficit forecast errors greater than 0.5 are only four, viz., Arunachal Pradesh (0.818), Assam (0.554), Mizoram (0.617) and Punjab (0.866). In case of revenue deficit, the value of U_1 was higher at 0.432. Seven States are with U_1 higher than 0.5, viz., Andhra Pradesh (0.672), Assam (0.94), Goa (0.59), Jammu and Kashmir (0.861), Kerala (0.532), Uttar Pradesh (0.669) and West Bengal (0.636).

A very similar observation can be made regarding the revised estimates (Tables 9 and 10). The average forecasting error in most of the revenue and expenditure are below 0.20. Similar to BE, all the variables are positively skewed. It is worth noting that in most of the major revenue and expenditure variables RE is better forecasted than BE (on average) (tables 9 and 10). For all the macro-fiscal variables among the states, the value of U_1 in RE is lower than BE.

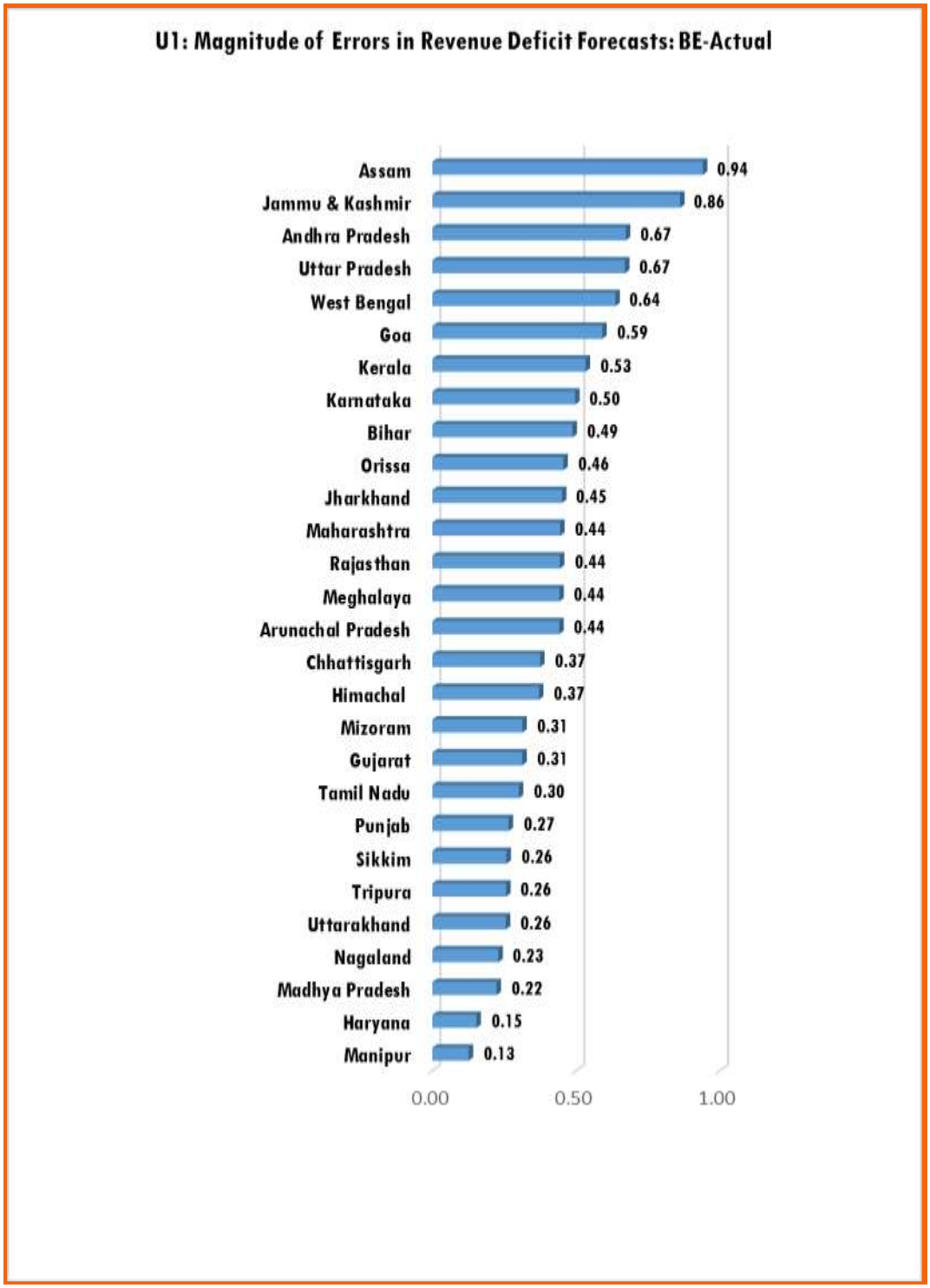
IV.2: States having magnitude of errors above 0.30 threshold are as low as four in case of expenditure and 10 in case of revenue receipts

Applying the Theil's U, we have estimated the errors between the BE and the Actuals; and the RE and the Actuals. As mentioned above, the range of U_1 is between zero and one, the value zero of U_1 equals to perfect forecast. Figures 6 to 11 depict the magnitude of errors of macro-fiscal variables of subnational governments in India. The Maximum-Minimum range of U_1 for BE-Actuals revealed that the range of errors in revenue receipts is the higher than that of revenue expenditure and capital expenditure (Max for 0.83 in case of Arunachal Pradesh to minimum for 0.07 in case of Uttarakhand, figure 9).The U_1 magnitude of forecasts for the revenue receipts also revealed that around 10 States have magnitude of error greater than 0.30, viz, Arunachal Pradesh 90.83), Tripura (0.63), Punjab (0.63), Tamil Nadu (0.53), Nagaland (0.53), Mizoram (0.52), Assam (0.51), Jammu and Kashmir (0.47), Goa (0.45) and Uttar Pradesh (0.34).

On the contrary, the magnitude of errors above 0.30 threshold in case of revenue expenditure are noted for only 4 States, viz., Jammu and Kashmir (0.50), Punjab and Assam(0.37) and Arunachal Pradesh (0.30) (Figure 10). In case of capital expenditure also, magnitude of error is highest in case of Jammu and Kashmir at 0.48, followed by Punjab (0.39), Assam (0.37), Goa (0.311) and Arunachal Pradesh (0.25). The minimum error in capital expenditure forecast is noted for Karnataka at 0.034 (figure 11).

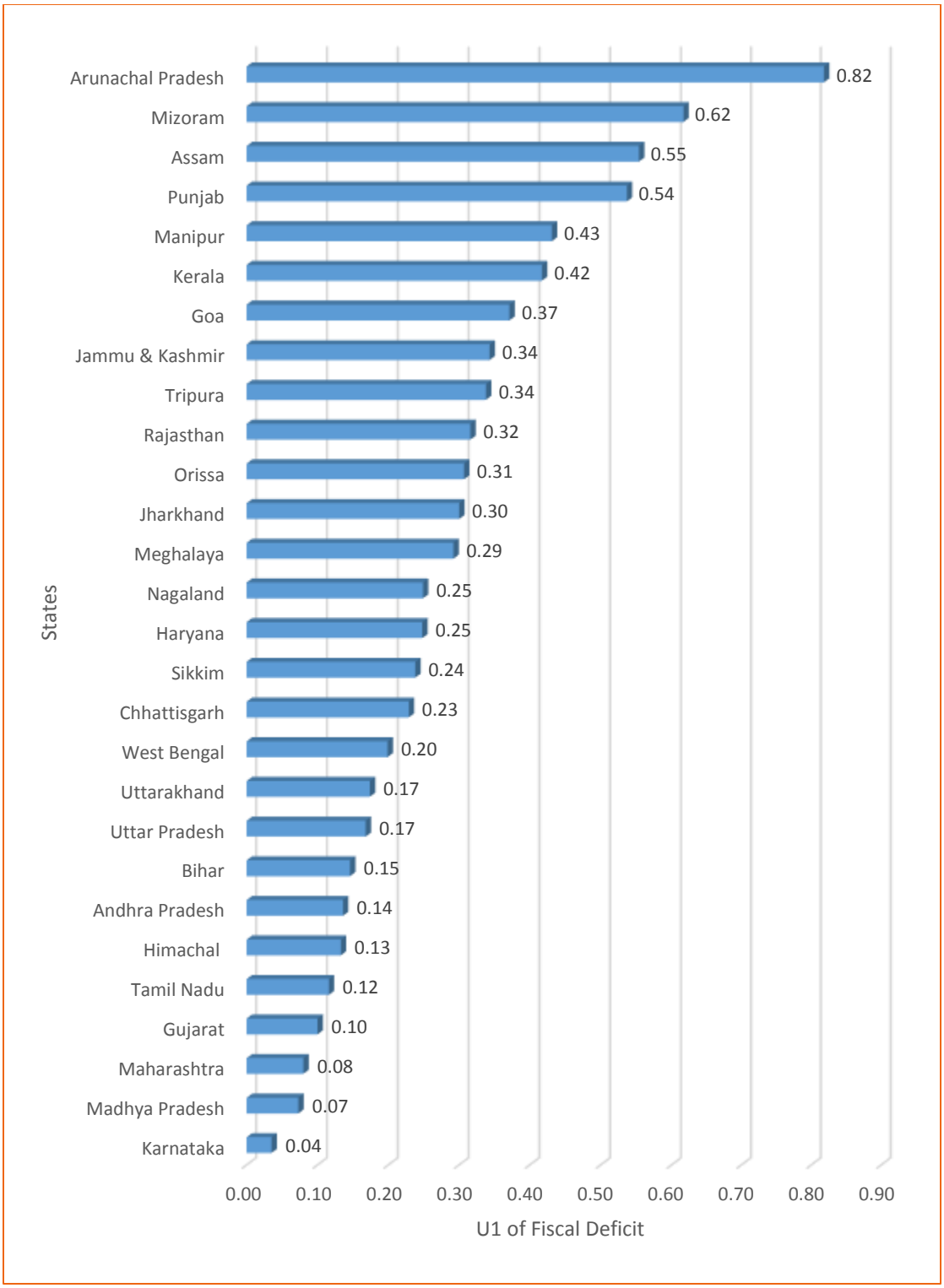
Looking at the end of the tail, around 16 states have magnitude of error lower than 0.15 threshold in case of revenue expenditure (figure 10); on the contrary the lower end of the tail is scarce for revenue receipts with only 8 state have revenue receipts forecast errors less than 0.15 threshold(figure 9). The lower end of forecast errors in capital expenditure, below 0.15 threshold was noted for 15 States.

Figure 6: U_1 for Revenue Deficit: Magnitude of Errors (BE-Actual), 2011-12 to 2015-16



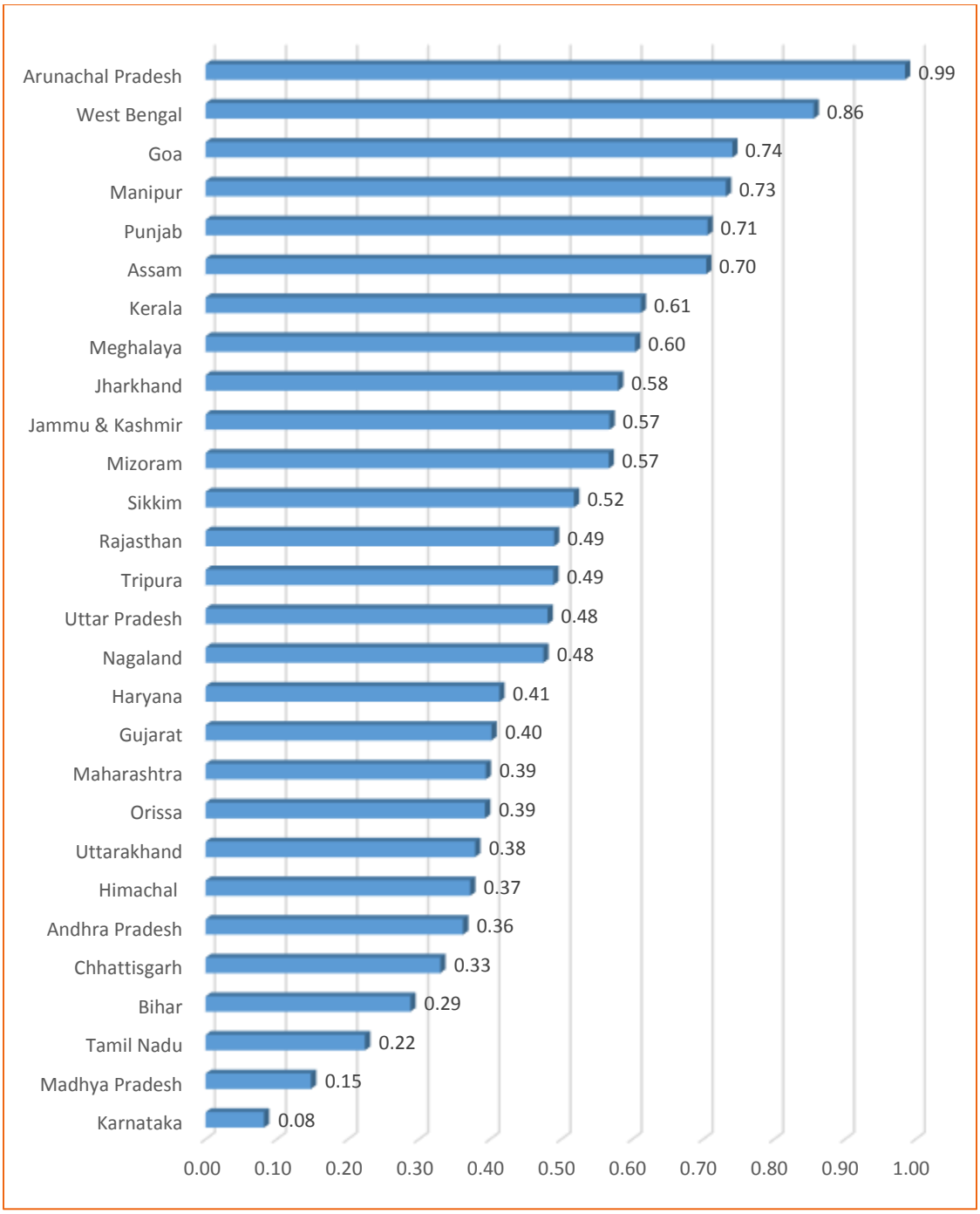
Source: Finance Accounts of States and State Budget documents (various years)

Figure 7: U_1 for Fiscal Deficit: Magnitude of Errors (BE-Actual), 2011-12 to 2015-16



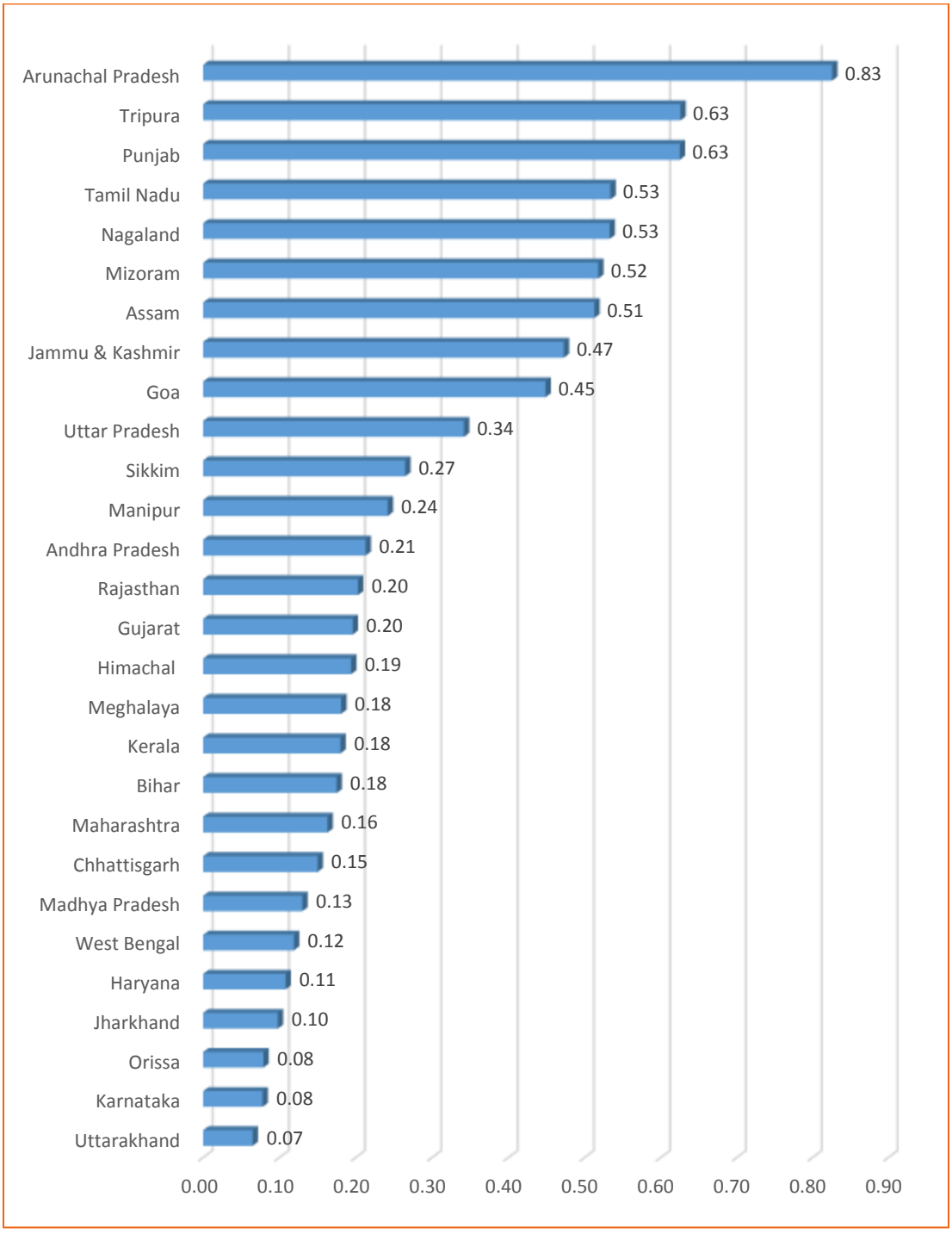
Source: Finance Accounts of States and State Budget documents (various years)

Figure 8: U_1 for Primary Deficit: Magnitude of Errors (BE-Actual), 2011-12 to 2015-16



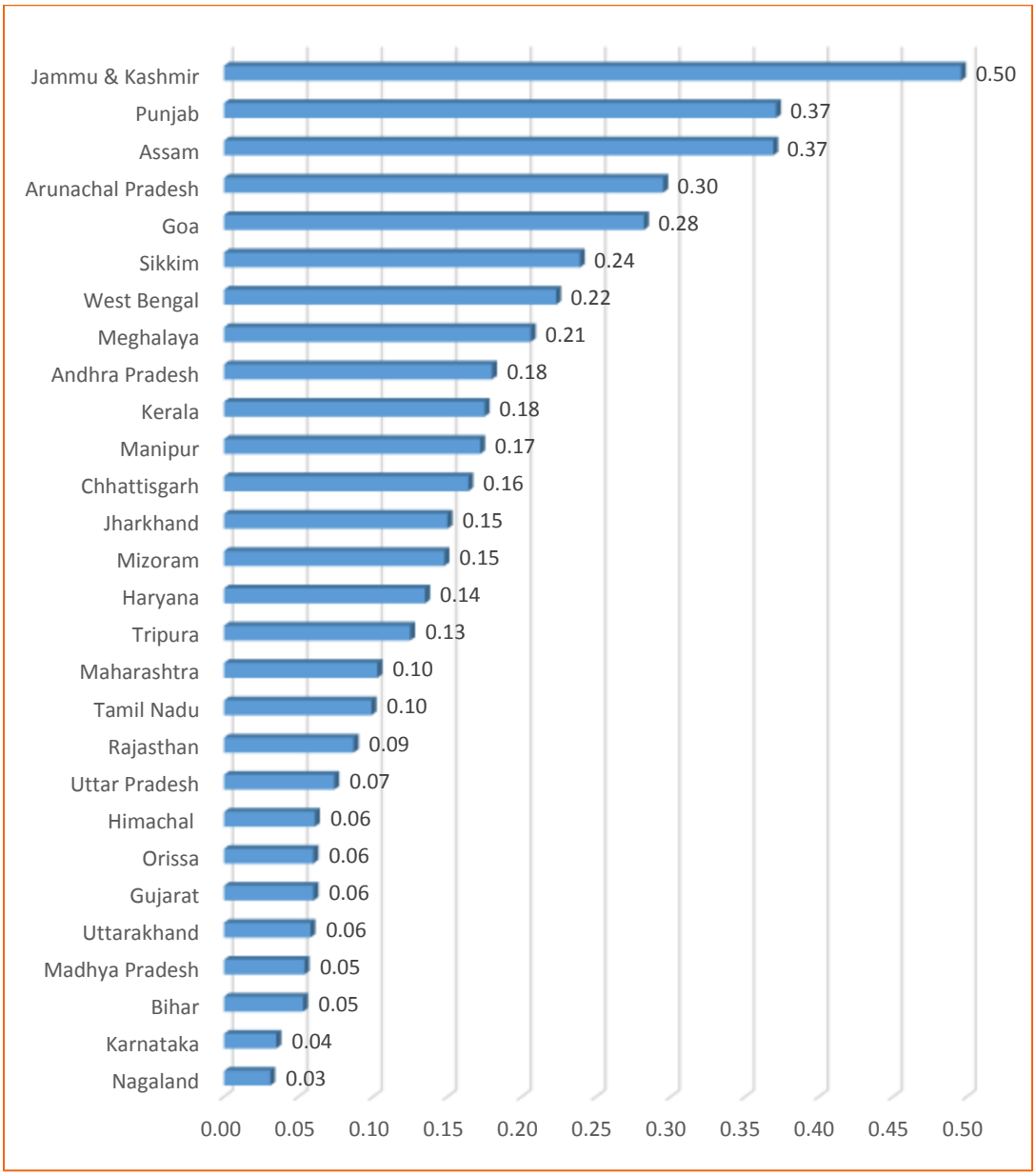
Source: Finance Accounts of States and State Budget documents (various years)

Figure 9: U_1 for Revenue Receipts: Magnitude of Errors (BE-Actual), 2011-12 to 2015-16



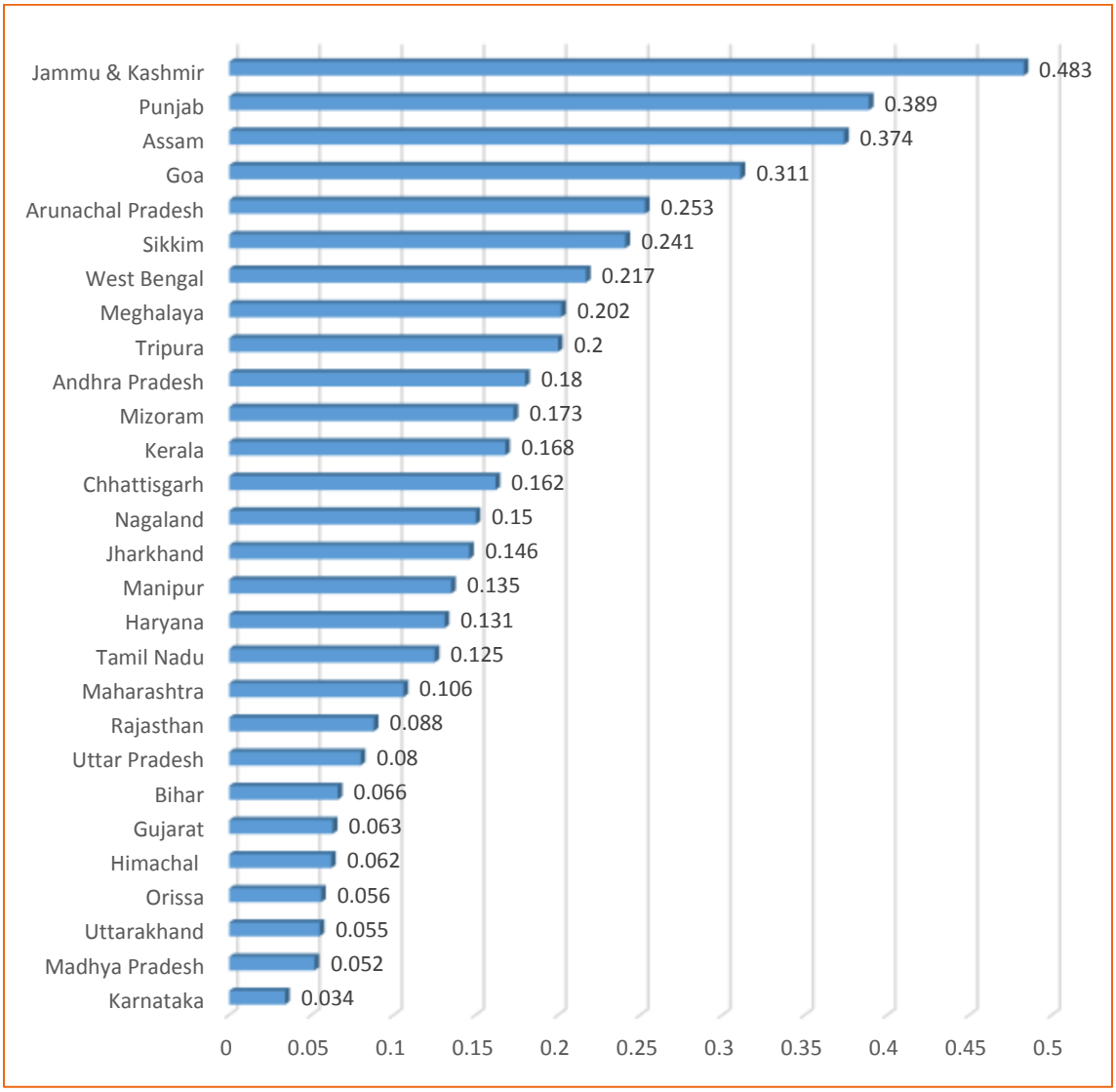
Source: Finance Accounts of States and State Budget documents (various years)

Figure 10: U_1 for Revenue Expenditure: Magnitude of Errors (BE-Actual), 2011-12 to 2015-16



Source: Finance Accounts of States and State Budget documents (various years)

Figure 11: U_1 for Capital Expenditure: Magnitude of Errors (BE-Actual), 2011-12 to 2015-16



Source: Finance Accounts of States and State Budget documents (various years)

Table 9: Magnitude of Errors in Public Expenditure: Revenue and Capital – Comparison of BE-Actuals and RE-Actuals

	Revenue Expenditure		Capital expenditure	
	BE-Actuals	**RE-Actuals**	**BE-Actuals**	**RE-Actuals**
Andhra Pradesh	0.072	0.051	0.180	0.053
Arunachal Pradesh	0.063	0.058	0.253	0.289
Assam	0.108	0.155	0.374	0.435
Bihar	0.077	0.119	0.066	0.127
Chhattisgarh	0.077	0.087	0.162	0.134
Goa	0.068	0.049	0.311	0.259
Gujarat	0.031	0.022	0.063	0.036
Haryana	0.039	0.047	0.131	0.096
Himachal	0.027	0.041	0.062	0.042
Jammu and Kashmir	0.118	0.098	0.483	0.447
Jharkhand	0.084	0.090	0.146	0.117
Karnataka	0.168	0.170	0.034	0.042
Kerala	0.152	0.126	0.168	0.115
Madhya Pradesh	0.038	0.047	0.052	0.039
Maharashtra	0.020	0.039	0.106	0.077
Manipur	0.056	0.072	0.135	0.127
Meghalaya	0.150	0.145	0.202	0.198
Mizoram	0.030	0.080	0.173	0.229
Nagaland	0.056	0.072	0.150	0.129
Orissa	0.064	0.059	0.056	0.024
Punjab	0.029	0.046	0.389	0.257
Rajasthan	0.018	0.028	0.088	0.058
Sikkim	0.089	0.091	0.241	0.271
Tamil Nadu	0.026	0.024	0.125	0.074
Tripura	0.059	0.056	0.200	0.129
Uttarakhand	0.039	0.034	0.055	0.052
Uttar Pradesh	0.082	0.055	0.080	0.105
West Bengal	0.016	0.015	0.217	0.144

Source: Finance Accounts of States and State Budget documents (various years)

IV.3: Disaggregating the Revenue Receipts

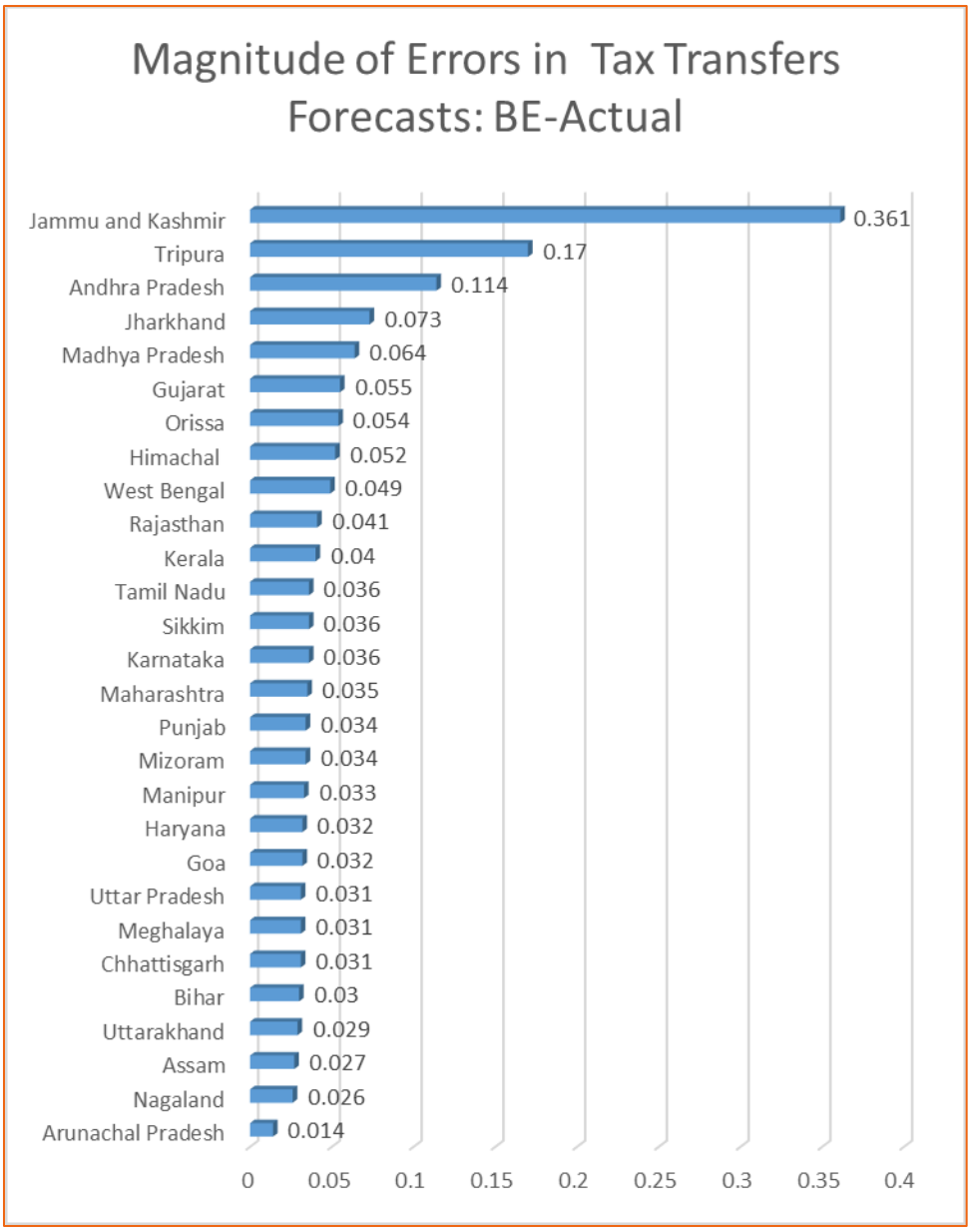
A pertinent question is, why is it that the forecasting errors are much higher in the revenue receipts in case of 10 states above 0.30 threshold as compared to capital expenditure (only 4 states) and revenue expenditure (only 4 states)? Which component of revenue receipts showed erratic range in forecasts – own tax revenue, tax transfers or grants from centre?

The disaggregated analysis of revenue receipts showed that magnitude of errors in grants is relatively higher than the forecast errors in own tax revenue and share in central taxes. If we take a relative threshold of magnitude of errors at 0.10 , the number of states having forecast errors above 0.10 in case of own tax revenue (figure 12) and tax transfers (figure 13) are only three states, while the number of states having forecast errors above 0.10 in case of grants is as high as 23 States (figure 14). The three states showing forecast error magnitude above 0.10 in case of own tax revenue are Jammu and Kashmir (0.361), Andhra Pradesh (0.157) and Assam (0.101). In case of tax transfers, the three states that have shown forecast errors magnitude above 0.10 are Jammu &Kashmir (0.361), Tripura (0.17) and Andhra Pradesh (0.114). As high as 23 states have shown forecast errors in grants greater than 0.10, except for Maharashtra (0.088), Nagaland (0.069), Mizoram (0.06), Manipur (0.058) and Himachal Pradesh (0.034) (figure 14).

Figure 12: Own tax revenue: Magnitude of Errors (BE-Actual), 2011-12 to 2015-16

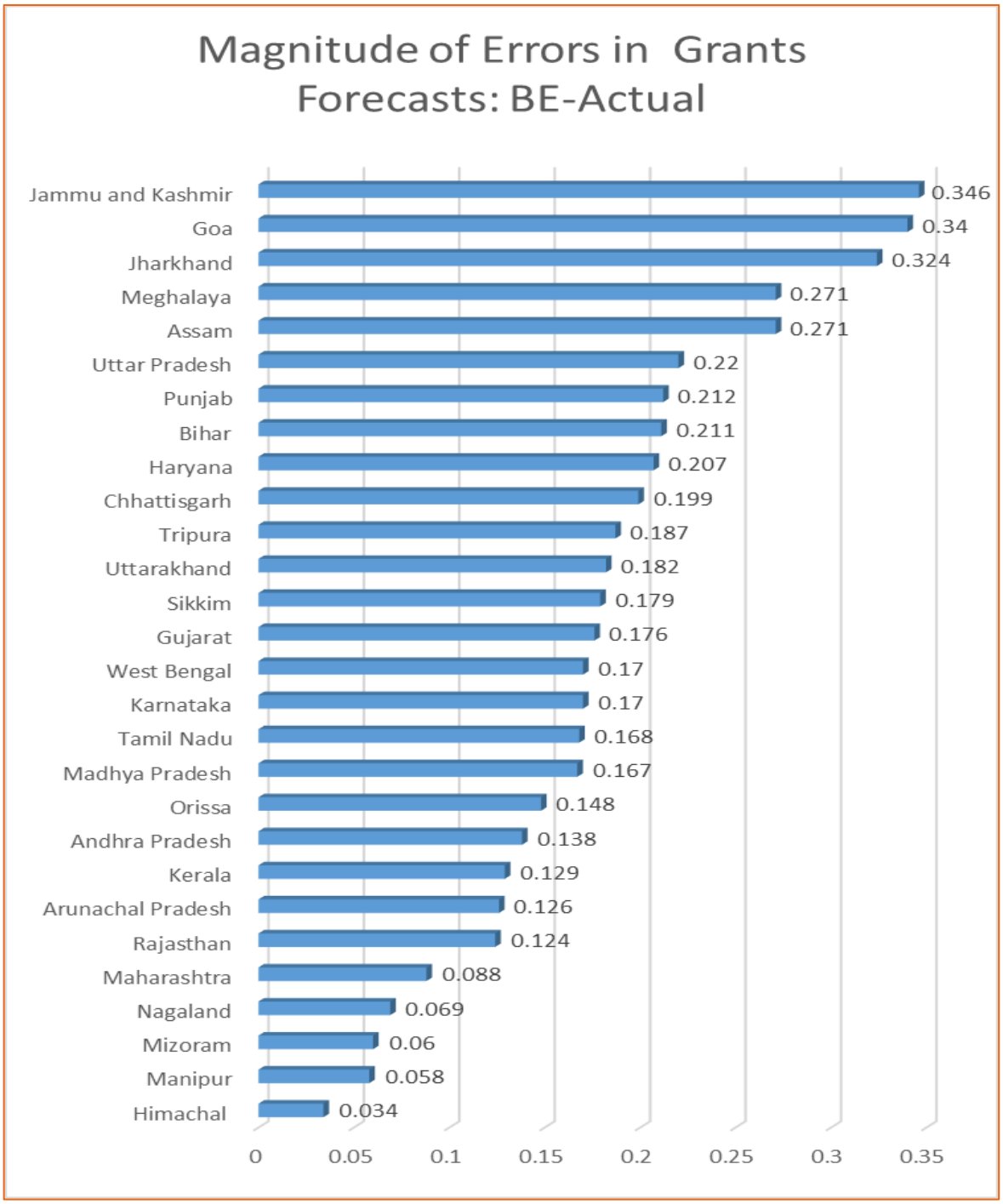
Source: Finance Accounts of States and State Budget documents (various years)

Figure 13: Tax Transfers: Magnitude of Errors (BE-Actual), 2011-12 to 2015-16



Source: Finance Accounts of States and State Budget documents (various years)

Figure 14: Grants: Magnitude of Errors (BE-Actual), 2011-12 to 2015-16



Source: Finance Accounts of States and State Budget documents (various years)

Table 10: Magnitude of Errors: Comparison of BE-Actuals with RE-Actuals for Revenue and its Components

	Revenue receipts		Own Tax Revenue		Tax Transfers		Own Non-Tax Revenue		Grants	
	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals
Andhra Pradesh	0.121	0.043	0.157	0.018	0.114	0.002	0.099	0.018	0.138	0.162
Arunachal Pradesh	0.076	0.090	0.072	0.012	0.014	0.004	0.149	0.111	0.126	0.137
Assam	0.124	0.095	0.101	0.032	0.027	0.033	0.155	0.056	0.271	0.247
Bihar	0.082	0.073	0.089	0.028	0.030	0.020	0.338	0.171	0.211	0.220
Chhattisgarh	0.090	0.094	0.065	0.054	0.031	0.025	0.152	0.146	0.199	0.200
Goa	0.060	0.027	0.046	0.018	0.032	0.016	0.078	0.030	0.340	0.298
Gujarat	0.043	0.047	0.039	0.072	0.055	0.026	0.067	0.046	0.176	0.147
Haryana	0.055	0.038	0.056	0.027	0.032	0.035	0.121	0.065	0.207	0.199
Himachal	0.054	0.054	0.035	0.141	0.052	0.059	0.130	0.112	0.034	0.041
Jammu and Kashmir	0.271	0.266	0.290	0.315	0.361	0.353	0.188	0.237	0.346	0.317
Jharkhand	0.120	0.116	0.097	0.205	0.073	0.021	0.133	0.184	0.324	0.277
Karnataka	0.064	0.081	0.014	0.095	0.036	0.013	0.045	0.067	0.170	0.165
Kerala	0.054	0.063	0.073	0.085	0.040	0.017	0.065	0.028	0.129	0.119
Madhya Pradesh	0.161	0.145	0.036	0.221	0.064	0.024	0.122	0.048	0.167	0.135
Maharashtra	0.051	0.040	0.026	0.069	0.035	0.001	0.161	0.078	0.088	0.181
Manipur	0.134	0.098	0.066	0.654	0.033	0.028	0.222	0.179	0.058	0.078
Meghalaya	0.177	0.183	0.082	0.305	0.031	0.030	0.175	0.169	0.271	0.261
Mizoram	0.095	0.115	0.088	0.532	0.034	0.023	0.116	0.103	0.060	0.089
Nagaland	0.084	0.111	0.038	0.709	0.026	0.003	0.104	0.128	0.069	0.045
Orissa	0.088	0.117	0.021	0.221	0.054	0.016	0.121	0.075	0.148	0.158
Punjab	0.080	0.067	0.054	0.070	0.034	0.023	0.254	0.170	0.212	0.176
Rajasthan	0.052	0.084	0.062	0.146	0.041	0.004	0.116	0.025	0.124	0.086
Sikkim	0.066	0.061	0.066	0.547	0.036	0.026	0.145	0.121	0.179	0.245
Tamil Nadu	0.061	0.053	0.064	0.071	0.036	0.014	0.072	0.050	0.168	0.053
Tripura	0.091	0.071	0.041	0.255	0.170	0.027	0.130	0.067	0.187	0.078
Uttarakhand	0.044	0.041	0.057	0.020	0.029	0.031	0.073	0.056	0.182	0.206

	Revenue receipts		Own Tax Revenue		Tax Transfers		Own Non-Tax Revenue		Grants	
	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals
Uttar Pradesh	0.067	0.097	0.040	0.142	0.031	0.022	0.249	0.175	0.220	0.216
West Bengal	0.122	0.141	0.057	0.223	0.049	0.025	0.270	0.200	0.170	0.116

Source: Finance Accounts of States and State Budget documents (various years)

Table 11: Magnitude of Errors: Comparison of BE-Actuals with RE-Actuals for Revenue Deficit, Fiscal Deficit and Primary Deficit

	Revenue Deficit		Fiscal Deficit		Primary Deficit	
	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals	BE-Actuals	RE-Actuals
Andhra Pradesh	0.672	0.640	0.136	0.073	0.362	0.240
Arunachal Pradesh	0.441	0.441	0.818	0.643	0.985	0.718
Assam	0.940	0.462	0.554	0.293	0.704	0.341
Bihar	0.487	0.589	0.146	0.347	0.288	0.499
Chhattisgarh	0.374	0.336	0.229	0.248	0.330	0.359
Goa	0.590	0.551	0.371	0.364	0.741	0.736
Gujarat	0.312	0.229	0.100	0.056	0.402	0.221
Haryana	0.153	0.116	0.248	0.150	0.413	0.220
Himachal	0.370	0.428	0.133	0.054	0.372	0.376
Jammu and Kashmir	0.861	0.885	0.343	0.387	0.568	0.653
Jharkhand	0.450	0.413	0.300	0.163	0.580	0.273
Karnataka	0.496	0.302	0.035	0.051	0.082	0.103
Kerala	0.532	0.501	0.417	0.376	0.612	0.572
Madhya Pradesh	0.223	0.204	0.073	0.108	0.148	0.173
Maharashtra	0.444	0.603	0.080	0.116	0.394	0.390
Manipur	0.126	0.115	0.431	0.329	0.732	0.477
Meghalaya	0.441	0.434	0.292	0.283	0.604	0.595
Mizoram	0.312	0.438	0.617	0.446	0.567	0.513
Nagaland	0.229	0.332	0.249	0.430	0.475	0.812

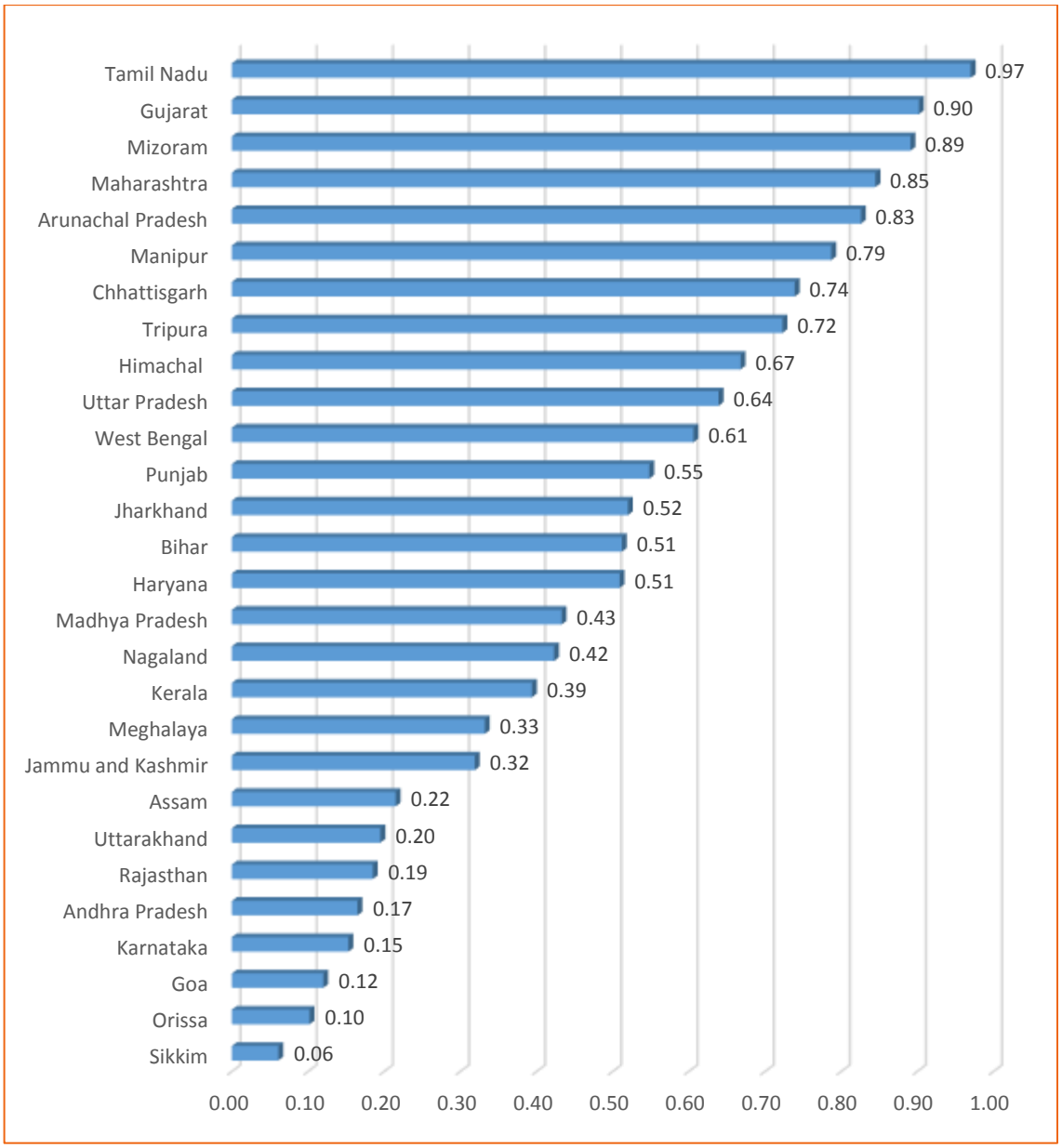
	Revenue Deficit		Fiscal Deficit		Primary Deficit	
	BE-Actuals	**RE-Actuals**	**BE-Actuals**	**RE-Actuals**	**BE-Actuals**	**RE-Actuals**
Orissa	0.455	0.251	0.307	0.236	0.393	0.269
Punjab	0.265	0.148	0.537	0.189	0.706	0.251
Rajasthan	0.443	0.123	0.316	0.055	0.490	0.075
Sikkim	0.257	0.256	0.238	0.260	0.518	0.516
Tamil Nadu	0.300	0.138	0.116	0.039	0.224	0.068
Tripura	0.256	0.125	0.338	0.307	0.489	0.482
Uttarakhand	0.255	0.154	0.174	0.051	0.379	0.104
Uttar Pradesh	0.669	0.644	0.168	0.155	0.481	0.387
West Bengal	0.636	0.166	0.199	0.067	0.856	0.399

Source: Finance Accounts of States and State Budget documents (various years)

VI.2: Decomposition of Forecast Errors

We have decomposed the error between systematic and unsystematic error. Systematic error is the sum of mean error and the slope error. The systematic error can be improved by using better forecasting techniques. The partitioning of sources of State-specific forecast errors are given in Appendix 1. Within BE-Actuals partitioning, more than 20 States showed that the source of errors was systemic for capital expenditure.

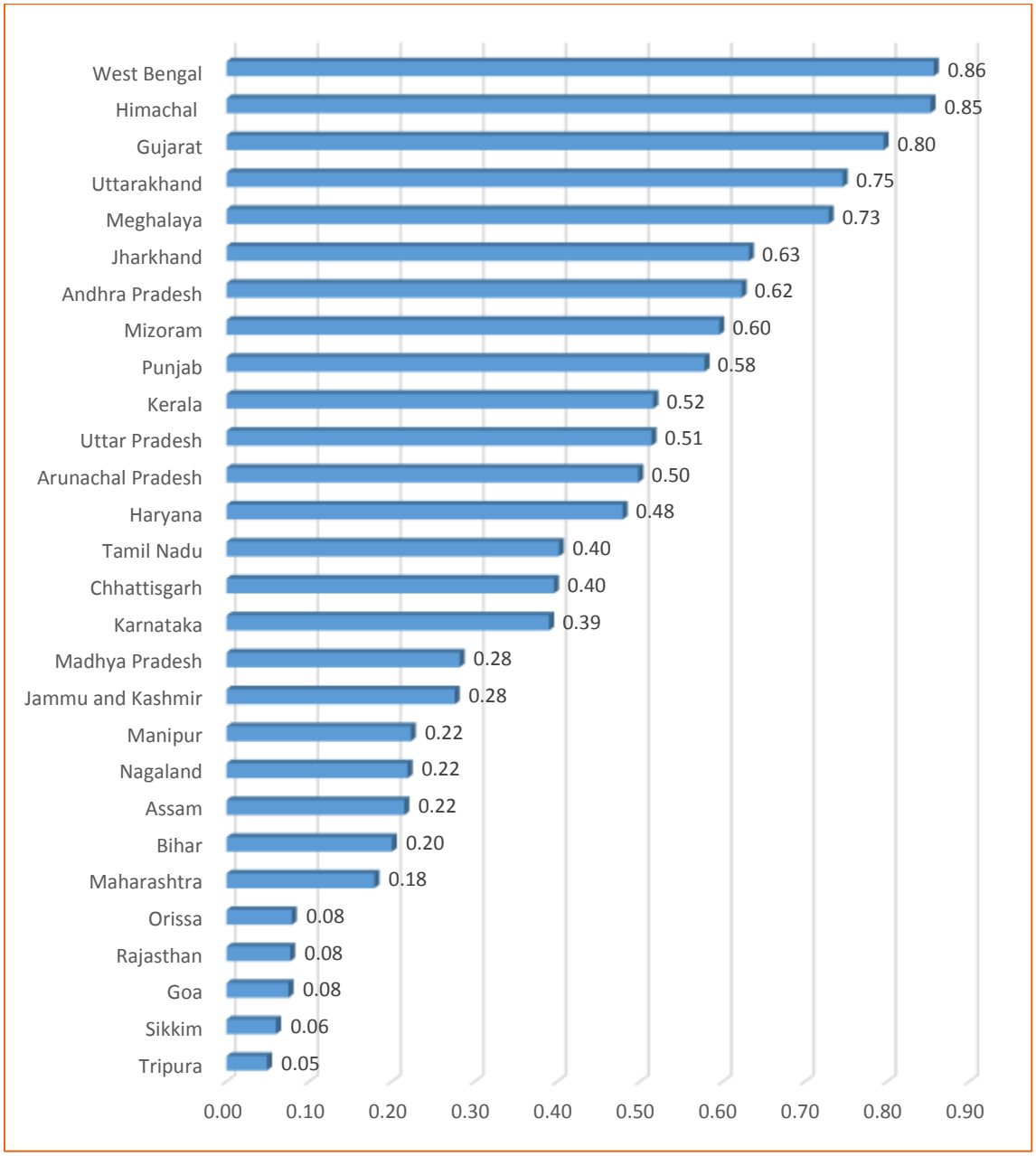
Figure 15: Randomness of Errors in Revenue Deficit (BE-Actual), 2011-12 to 2015-16



Source: Finance Accounts of States and State Budget documents (various years)

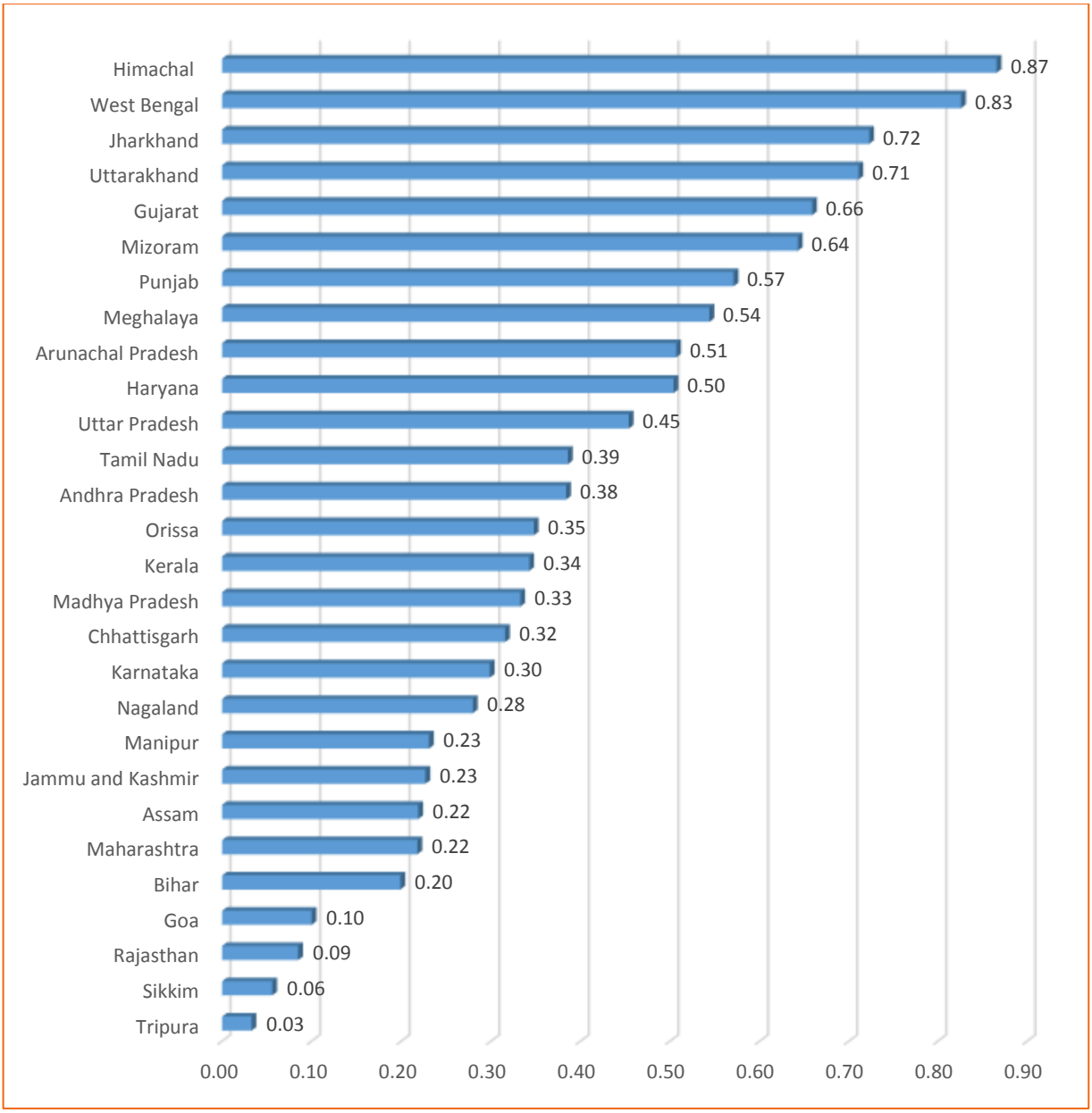
One can observe that merely 7 and 5 states in the budget estimates and revised estimates respectively of the *capital expenditure* have the random error more than 0.5. The average of the random errors of the budget estimate and the revised estimate is 0.31 and 0.24. Both the above observations tells us that the errors in capital expenditure are more because of systematic bias rather than being random.

Figure 16: Randomness of Errors in Fiscal Deficit (BE-Actual), 2011-12 to 2015-16



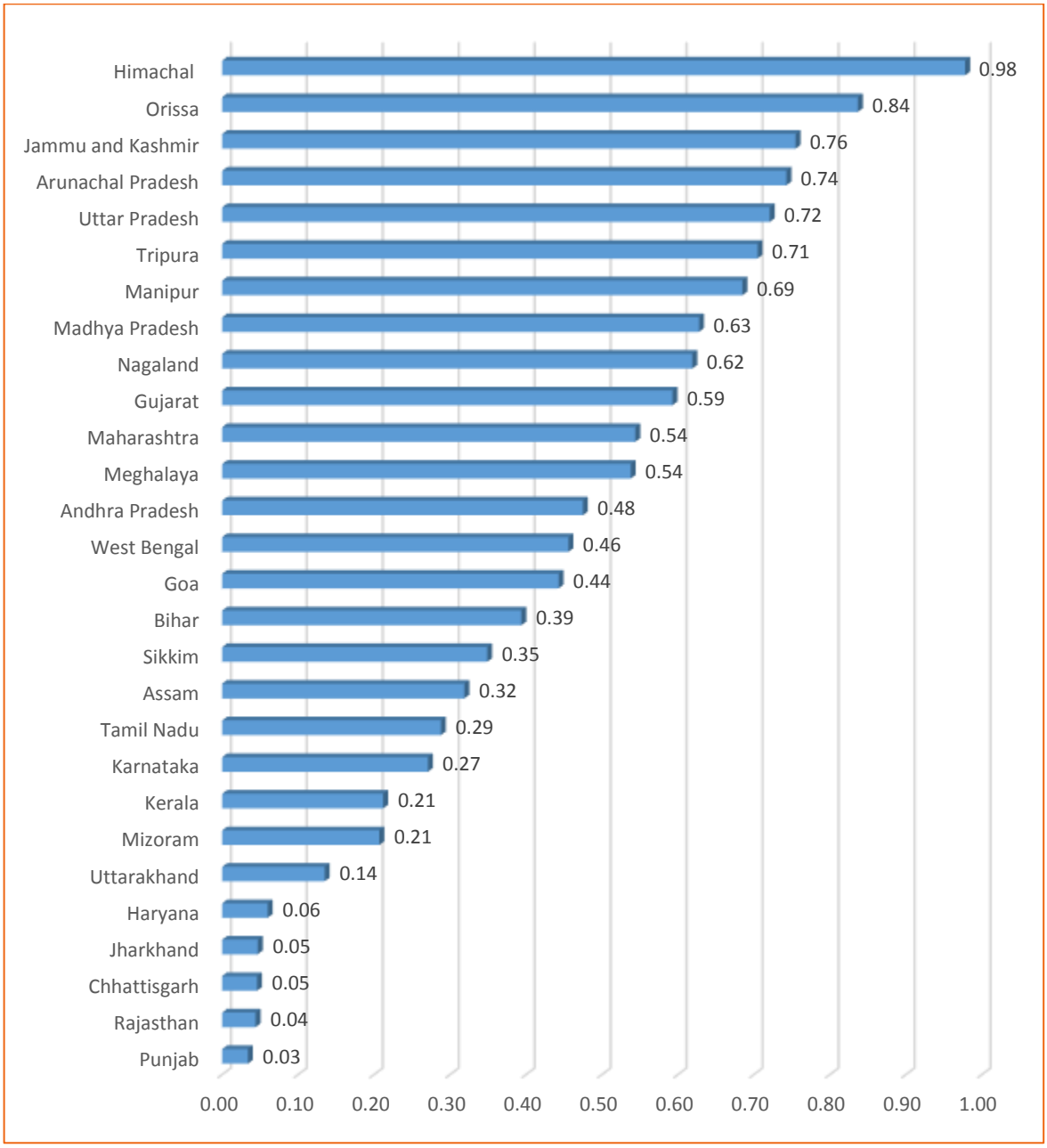
Source: Finance Accounts of States and State Budget documents (various years)

Figure 17: **Randomness of Errors in Primary Deficit (BE-Actual), 2011-12 to 2015-16**



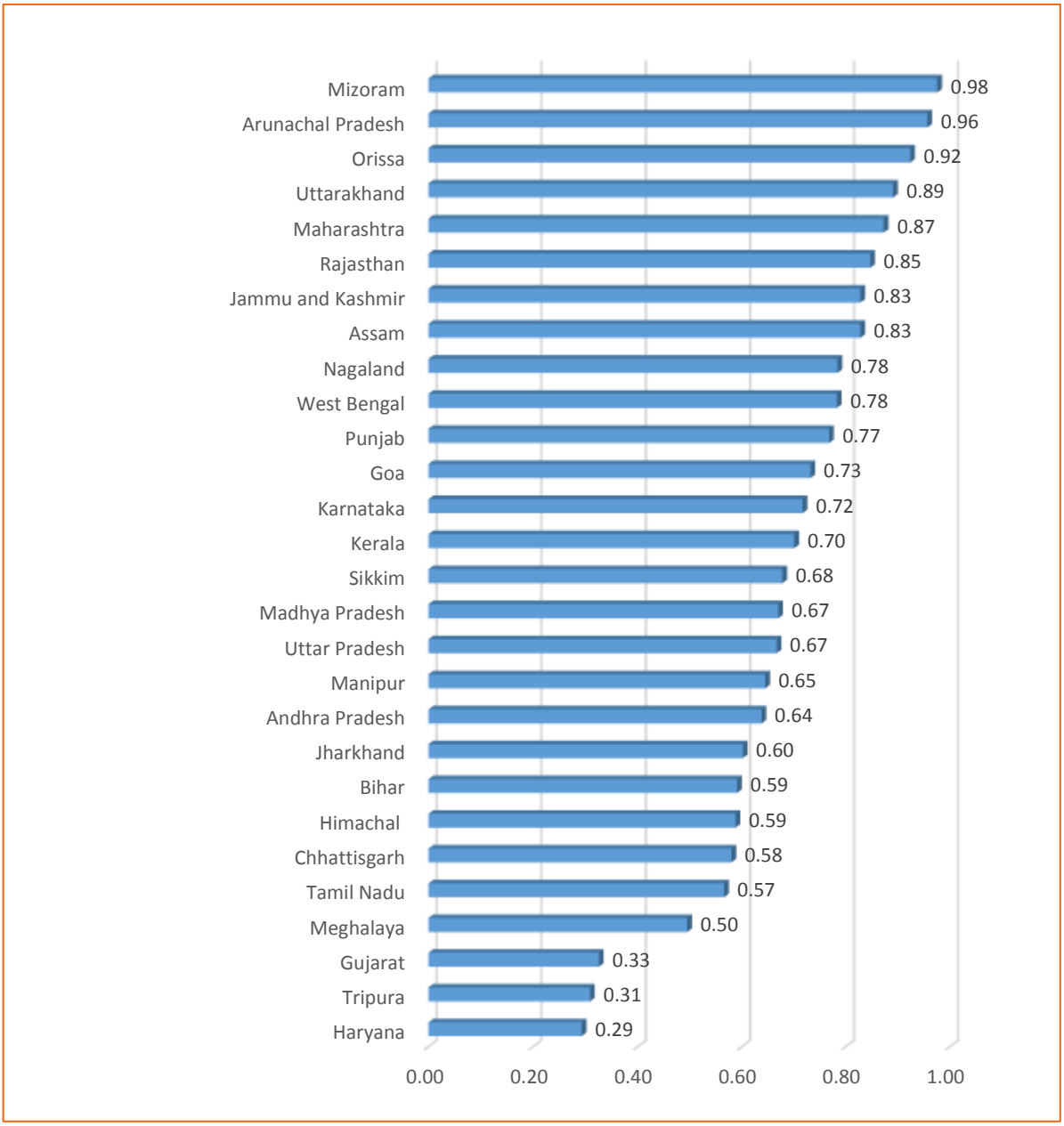
Source: Finance Accounts of States and State Budget documents (various years)

Figure 18: Randomness of Errors in Own Tax Revenue (BE-Actual), 2011-12 to 2015-16



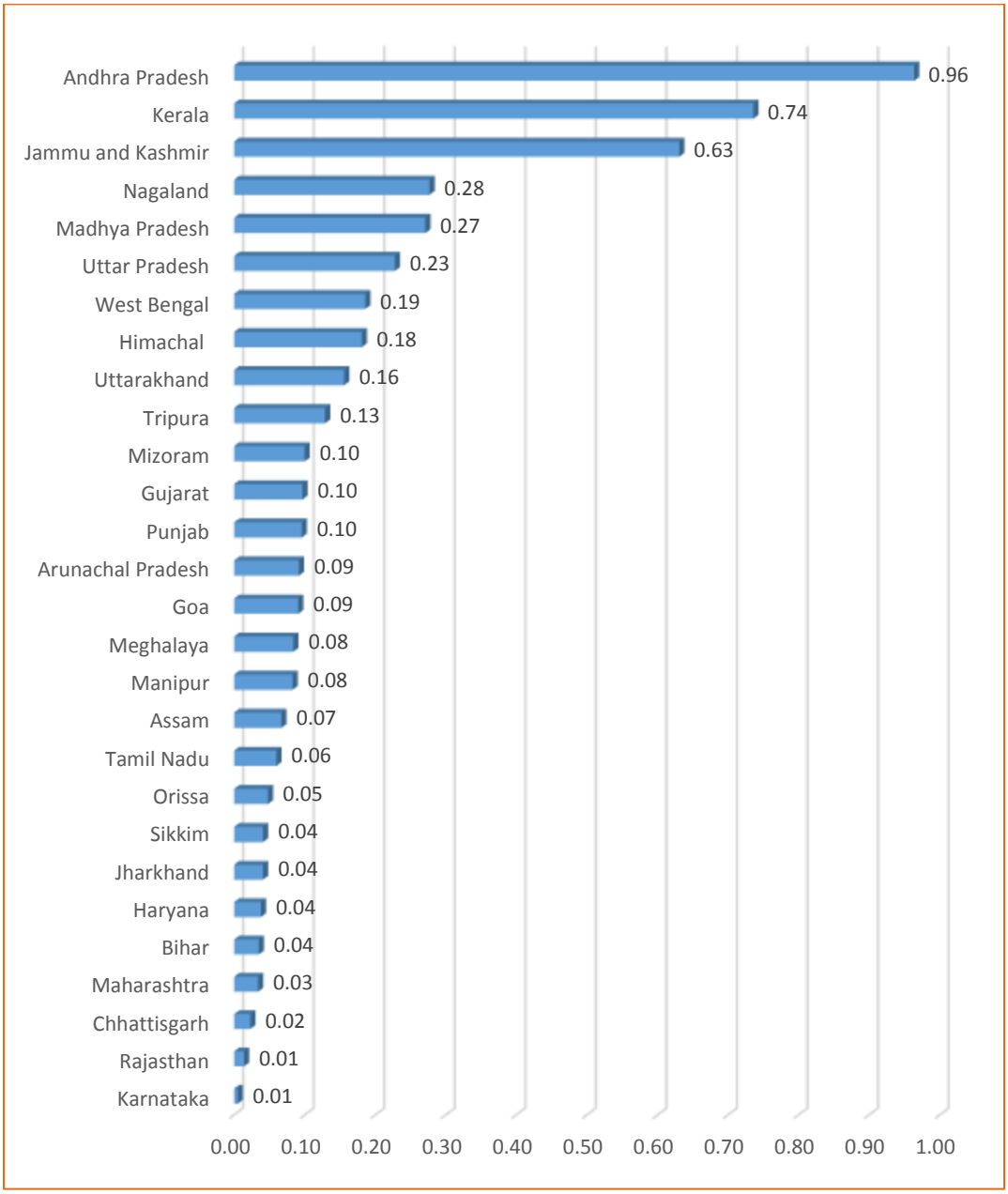
Source: Finance Accounts of States and State Budget documents (various years)

Figure 19: Randomness of Errors in Tax Transfers (BE-Actual), 2011-12 to 2015-16



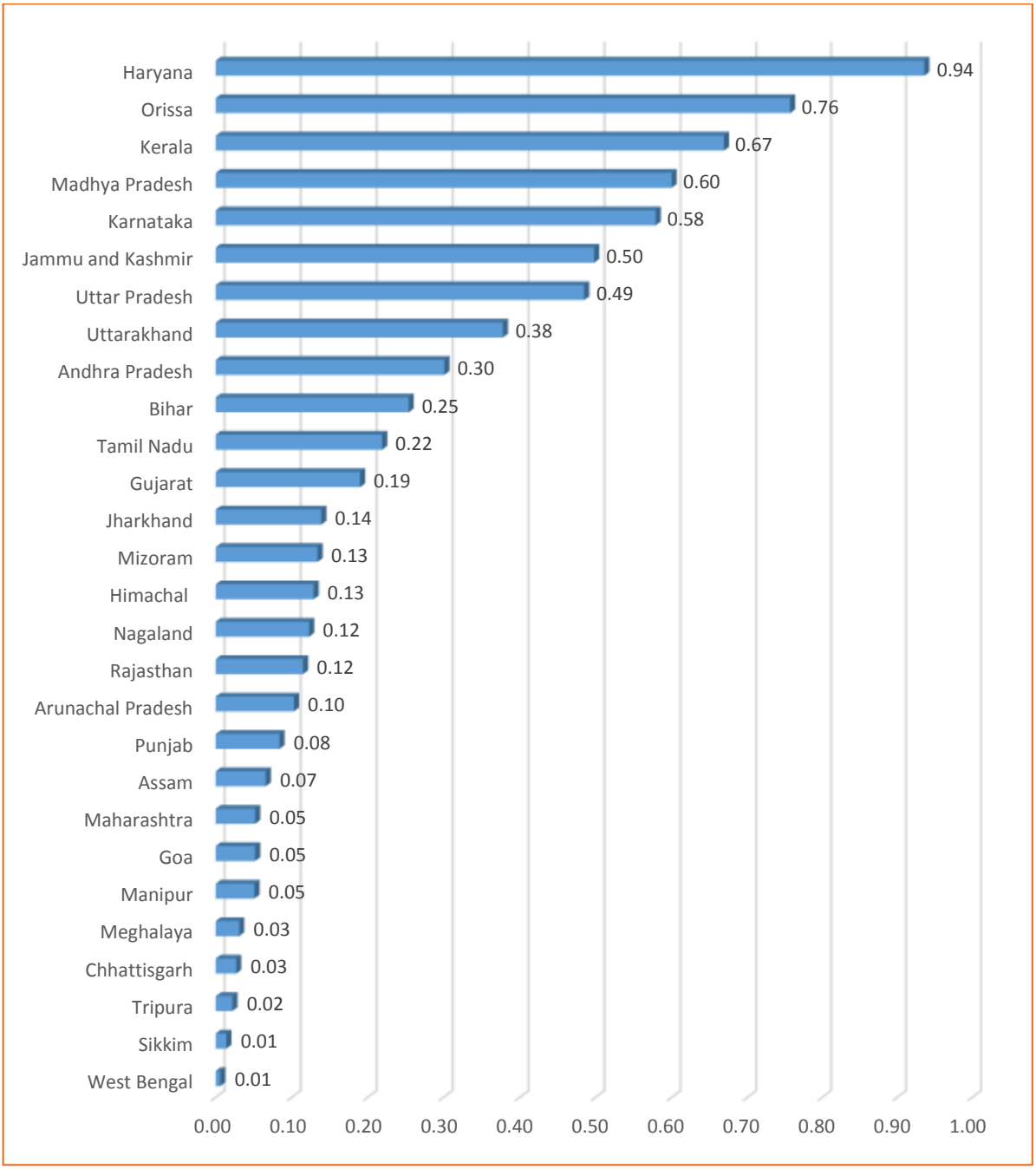
Source: Finance Accounts of States and State Budget documents (various years)

Figure 20: Randomness of Errors in Revenue Expenditure (BE-Actual), 2011-12 to 2015-16



Source: Finance Accounts of States and State Budget documents (various years)

Figure 21: Randomness of Errors in Capital Expenditure (BE-Actual), 2011-12 to 2015-16



Source: Finance Accounts of States and State Budget documents (various years)

In case of BE, it can be observed that in most of the categories, more than half of the states have random error of over 50 per cent of total error. In Appendix tables on the sources of errors, it is observed that in case of all of the revenue and expenditure variables (except

share in central taxes where 4 states have systematic error of over 50%), the former trend persists.

While there have been negligible improvements from the BE to the RE , that is, on average the number of states having systematic error of more than 50 per cent have changed marginally across the different categories of revenues and expenditure, the larger trend of the BE seems to persist. For instance, in categories such as tax revenue, state's own tax revenue, share in central taxes, state's own non tax revenue, revenue expenditure, revenue deficit and primary deficit, the number of states having systematic error of over fifty percent of total error has decreased. For the rest of the categories, the same has increased. However in both cases, the change has been only marginal.

V. Conclusion

Applying Theil's U technique, we tried to analyse the errors of fiscal forecasts of subnational governments in India. The fiscal marksmanship analysis showed that the forecast errors in revenue receipts has been greater than revenue expenditure. Within revenue receipts, the forecast errors in grants is the highest. Within the public expenditure, the errors of capital expenditure forecasts showed greater deviations than revenue expenditure. The analysis shows that in more than 20 States, the sources of error for systemic than random in case of a few macro-fiscal variables, with negligible improvements from BE to RE.

Appendix 1: State-wise Partitioning the Errors

Table 1: REVENUE DEFICIT: Sources of Forecast Errors (BE-ACTUALS & RE_ACTUALS)

	BE-Actuals			RE-Actuals		
	Sources of Error			Sources of Error		
	Bias	Variance	Random	Bias	Variance	Random
Andhra Pradesh	0.375	0.267	0.358	0.264	0.570	0.165
Arunachal Pradesh	0.437	0.006	0.556	0.007	0.166	0.826
Assam	0.193	0.013	0.794	0.461	0.324	0.215
Bihar	0.394	0.089	0.517	0.437	0.051	0.512
Chhattisgarh	0.247	0.250	0.503	0.035	0.226	0.739
Goa	0.206	0.249	0.544	0.723	0.157	0.120
Gujarat	0.001	0.105	0.895	0.013	0.085	0.902
Haryana	0.587	0.206	0.207	0.000	0.491	0.509
Himachal	0.294	0.001	0.705	0.163	0.170	0.668
Jammu and Kashmir	0.448	0.384	0.167	0.333	0.348	0.319
Jharkhand	0.707	0.001	0.292	0.366	0.114	0.520
Karnataka	0.432	0.524	0.044	0.600	0.246	0.153
Kerala	0.056	0.711	0.233	0.073	0.534	0.394
Madhya Pradesh	0.396	0.115	0.489	0.444	0.123	0.433
Maharashtra	0.385	0.393	0.222	0.025	0.129	0.845
Manipur	0.000	0.018	0.982	0.018	0.308	0.787
Meghalaya	0.767	0.022	0.210	0.668	0.000	0.332
Mizoram	0.626	0.208	0.166	0.108	0.001	0.891
Nagaland	0.498	0.327	0.175	0.343	0.235	0.423
Orissa	0.892	0.023	0.085	0.897	0.001	0.102
Punjab	0.710	0.185	0.105	0.080	0.371	0.548
Rajasthan	0.270	0.516	0.214	0.500	0.315	0.185
Sikkim	0.893	0.000	0.106	0.937	0.002	0.061
Tamil Nadu	0.258	0.005	0.738	0.029	0.001	0.970
Tripura	0.063	0.673	0.265	0.042	0.234	0.723
Uttarakhand	0.176	0.260	0.564	0.154	0.651	0.195
Uttar Pradesh	0.076	0.619	0.305	0.286	0.075	0.639
West Bengal	0.873	0.001	0.127	0.389	0.005	0.606

Source: Finance Accounts of States and State Budget documents (various years)

Table 2: FISCAL DEFICIT: Sources of Forecast Errors (BE-ACTUALS & RE_ACTUALS)

	BE-Actuals			RE-Actuals		
	Sources of Error			Sources of Error		
	Bias	Variance	Random	Bias	Variance	Random
Andhra Pradesh	0.077	0.309	0.613	0.076	0.302	0.623
Arunachal Pradesh	0.018	0.256	0.726	0.430	0.072	0.498
Assam	0.008	0.147	0.846	0.780	0.005	0.215
Bihar	0.061	0.503	0.437	0.785	0.015	0.200
Chhattisgarh	0.313	0.116	0.571	0.398	0.206	0.396
Goa	0.830	0.068	0.102	0.848	0.077	0.075
Gujarat	0.341	0.003	0.656	0.132	0.073	0.796
Haryana	0.021	0.490	0.490	0.143	0.378	0.479
Himachal	0.173	0.000	0.827	0.105	0.042	0.853
Jammu and Kashmir	0.450	0.474	0.076	0.184	0.540	0.276
Jharkhand	0.172	0.724	0.104	0.015	0.354	0.632
Karnataka	0.025	0.555	0.420	0.006	0.603	0.390
Kerala	0.084	0.562	0.354	0.077	0.407	0.516
Madhya Pradesh	0.280	0.465	0.255	0.701	0.017	0.282
Maharashtra	0.090	0.566	0.344	0.690	0.132	0.179
Manipur	0.302	0.366	0.332	0.787	0.022	0.223
Meghalaya	0.139	0.133	0.729	0.093	0.178	0.729
Mizoram	0.181	0.688	0.131	0.385	0.019	0.596
Nagaland	0.134	0.152	0.714	0.707	0.075	0.219
Orissa	0.845	0.001	0.154	0.921	0.000	0.079
Punjab	0.362	0.110	0.527	0.097	0.326	0.578
Rajasthan	0.183	0.301	0.517	0.921	0.002	0.077
Sikkim	0.462	0.094	0.444	0.860	0.080	0.060
Tamil Nadu	0.153	0.539	0.307	0.336	0.262	0.402
Tripura	0.772	0.153	0.075	0.759	0.192	0.049
Uttarakhand	0.243	0.317	0.440	0.254	0.000	0.746
Uttar Pradesh	0.002	0.375	0.623	0.016	0.470	0.514
West Bengal	0.744	0.052	0.204	0.007	0.136	0.857

Source: Finance Accounts of States and State Budget documents (various years)

Table 3: PRIMARY DEFICIT: Sources of Forecast Errors (BE-ACTUALS & RE_ACTUALS)

	BE-Actuals			RE-Actuals		
	Sources of Error			Sources of Error		
	Bias	Variance	Random	Bias	Variance	Random
Andhra Pradesh	0.224	0.510	0.266	0.112	0.504	0.384
Arunachal Pradesh	0.024	0.320	0.655	0.430	0.063	0.507
Assam	0.009	0.137	0.854	0.777	0.003	0.219
Bihar	0.123	0.524	0.352	0.778	0.024	0.199
Chhattisgarh	0.303	0.218	0.479	0.373	0.311	0.316
Goa	0.853	0.017	0.129	0.867	0.033	0.100
Gujarat	0.309	0.087	0.604	0.116	0.225	0.659
Haryana	0.032	0.497	0.471	0.142	0.353	0.504
Himachal	0.124	0.025	0.851	0.047	0.087	0.866
Jammu and Kashmir	0.381	0.552	0.067	0.180	0.594	0.227
Jharkhand	0.166	0.644	0.189	0.016	0.261	0.723
Karnataka	0.200	0.379	0.420	0.008	0.693	0.299
Kerala	0.084	0.693	0.223	0.080	0.578	0.343
Madhya Pradesh	0.118	0.584	0.299	0.666	0.001	0.333
Maharashtra	0.072	0.545	0.383	0.692	0.090	0.218
Manipur	0.337	0.341	0.322	0.787	0.015	0.231
Meghalaya	0.142	0.304	0.554	0.099	0.357	0.544
Mizoram	0.283	0.569	0.148	0.351	0.006	0.643
Nagaland	0.028	0.019	0.954	0.714	0.007	0.280
Orissa	0.632	0.005	0.363	0.637	0.015	0.348
Punjab	0.360	0.078	0.562	0.098	0.331	0.571
Rajasthan	0.183	0.363	0.454	0.915	0.000	0.085
Sikkim	0.437	0.119	0.444	0.851	0.093	0.056
Tamil Nadu	0.170	0.590	0.241	0.313	0.301	0.386
Tripura	0.795	0.130	0.075	0.689	0.279	0.033
Uttarakhand	0.231	0.389	0.380	0.288	0.000	0.711
Uttar Pradesh	0.017	0.399	0.584	0.025	0.521	0.454
West Bengal	0.761	0.001	0.239	0.002	0.172	0.826

Source: Finance Accounts of States and State Budget documents (various years)

Table 4: REVENUE RECEIPTS: Sources of Forecast Errors (BE-ACTUALS & RE_ACTUALS)

	BE-Actuals			RE-Actuals		
	Sources of Error			Sources of Error		
	Bias	Variance	Random	Bias	Variance	Random
Andhra Pradesh	0.478	0.191	0.331	0.365	0.375	0.260
Arunachal Pradesh	0.482	0.004	0.513	0.286	0.078	0.635
Assam	0.750	0.217	0.033	0.847	0.023	0.130
Bihar	0.773	0.081	0.146	0.657	0.187	0.156
Chhattisgarh	0.672	0.219	0.109	0.637	0.287	0.075
Goa	0.772	0.068	0.160	0.721	0.051	0.229
Gujarat	0.022	0.008	0.970	0.061	0.131	0.807
Haryana	0.874	0.032	0.094	0.785	0.033	0.181
Himachal	0.071	0.283	0.647	0.087	0.510	0.404
Jammu and Kashmir	0.403	0.100	0.497	0.092	0.050	0.859
Jharkhand	0.344	0.061	0.595	0.080	0.083	0.836
Karnataka	0.073	0.151	0.776	0.144	0.273	0.582
Kerala	0.380	0.001	0.619	0.004	0.290	0.706
Madhya Pradesh	0.904	0.032	0.065	0.217	0.062	0.721
Maharashtra	0.962	0.000	0.038	0.041	0.092	0.867
Manipur	0.711	0.024	0.265	0.491	0.016	0.493
Meghalaya	0.718	0.162	0.120	0.272	0.308	0.421
Mizoram	0.007	0.015	0.977	0.027	0.501	0.472
Nagaland	0.764	0.139	0.098	0.610	0.202	0.188
Orissa	0.078	0.013	0.909	0.136	0.155	0.709
Punjab	0.394	0.142	0.463	0.143	0.284	0.573
Rajasthan	0.050	0.016	0.935	0.181	0.195	0.624
Sikkim	0.006	0.650	0.343	0.017	0.427	0.556
Tamil Nadu	0.895	0.020	0.085	0.078	0.038	0.884
Tripura	0.363	0.599	0.038	0.016	0.022	0.961
Uttarakhand	0.762	0.194	0.044	0.640	0.139	0.221
Uttar Pradesh	0.651	0.124	0.225	0.072	0.003	0.925
West Bengal	0.795	0.112	0.092	0.373	0.301	0.326

Source: Finance Accounts of States and State Budget documents (various years)

Table 5: OWN TAX REVENUE: Sources of Forecast Errors (BE-ACTUALS & RE_ACTUALS)

	BE-Actuals			RE-Actuals		
	Sources of Error			Sources of Error		
	Bias	Variance	Random	Bias	Variance	Random
Andhra Pradesh	0.434	0.054	0.513	0.335	0.190	0.475
Arunachal Pradesh	0.102	0.401	0.497	0.135	0.122	0.743
Assam	0.182	0.781	0.037	0.205	0.476	0.319
Bihar	0.513	0.411	0.076	0.424	0.182	0.394
Chhattisgarh	0.364	0.588	0.049	0.422	0.531	0.046
Goa	0.663	0.210	0.128	0.500	0.057	0.443
Gujarat	0.120	0.796	0.084	0.004	0.402	0.593
Haryana	0.558	0.374	0.068	0.625	0.315	0.060
Himachal	0.001	0.000	0.998	0.021	0.001	0.978
Jammu and Kashmir	0.212	0.028	0.760	0.205	0.040	0.755
Jharkhand	0.664	0.295	0.041	0.574	0.379	0.047
Karnataka	0.285	0.576	0.139	0.729	0.000	0.271
Kerala	0.796	0.123	0.081	0.691	0.098	0.212
Madhya Pradesh	0.006	0.891	0.103	0.000	0.371	0.628
Maharashtra	0.000	0.719	0.280	0.067	0.389	0.544
Manipur	0.164	0.702	0.135	0.184	0.228	0.685
Meghalaya	0.014	0.458	0.529	0.053	0.408	0.538
Mizoram	0.391	0.326	0.283	0.346	0.447	0.207
Nagaland	0.272	0.434	0.294	0.365	0.016	0.619
Orissa	0.068	0.001	0.931	0.163	0.000	0.837
Punjab	0.864	0.048	0.088	0.873	0.092	0.034
Rajasthan	0.084	0.859	0.058	0.162	0.795	0.044
Sikkim	0.649	0.007	0.344	0.534	0.117	0.349
Tamil Nadu	0.434	0.385	0.181	0.601	0.111	0.288
Tripura	0.001	0.368	0.631	0.146	0.150	0.705
Uttarakhand	0.589	0.383	0.028	0.421	0.444	0.135
Uttar Pradesh	0.019	0.879	0.102	0.115	0.164	0.721
West Bengal	0.693	0.063	0.244	0.438	0.106	0.456

Source: Finance Accounts of States and State Budget documents (various years)

Table 6: TAX TRANSFERS: Sources of Forecast Errors (BE-ACTUALS & RE_ACTUALS)

	BE-Actuals			RE-Actuals		
	Sources of Error			Sources of Error		
	Bias	Variance	Random	Bias	Variance	Random
Andhra Pradesh	0.230	0.002	0.768	0.362	0.000	0.638
Arunachal Pradesh	0.435	0.286	0.279	0.039	0.004	0.957
Assam	0.001	0.251	0.748	0.055	0.117	0.828
Bihar	0.387	0.004	0.609	0.391	0.017	0.591
Chhattisgarh	0.391	0.036	0.572	0.420	0.000	0.580
Goa	0.001	0.094	0.905	0.109	0.159	0.732
Gujarat	0.006	0.124	0.871	0.653	0.022	0.326
Haryana	0.142	0.288	0.571	0.491	0.216	0.293
Himachal	0.458	0.001	0.541	0.402	0.009	0.588
Jammu and Kashmir	0.223	0.000	0.777	0.171	0.002	0.828
Jharkhand	0.047	0.220	0.732	0.119	0.279	0.602
Karnataka	0.092	0.146	0.762	0.261	0.022	0.717
Kerala	0.079	0.084	0.837	0.279	0.020	0.701
Madhya Pradesh	0.075	0.215	0.710	0.321	0.009	0.670
Maharashtra	0.175	0.257	0.568	0.037	0.090	0.873
Manipur	0.707	0.004	0.288	0.332	0.115	0.645
Meghalaya	0.727	0.004	0.269	0.434	0.071	0.495
Mizoram	0.000	0.142	0.857	0.018	0.006	0.976
Nagaland	0.018	0.243	0.739	0.143	0.073	0.784
Orissa	0.112	0.182	0.706	0.048	0.028	0.924
Punjab	0.090	0.461	0.449	0.213	0.018	0.768
Rajasthan	0.215	0.173	0.612	0.143	0.010	0.847
Sikkim	0.651	0.002	0.346	0.317	0.005	0.678
Tamil Nadu	0.263	0.202	0.535	0.423	0.012	0.566
Tripura	0.164	0.532	0.304	0.168	0.523	0.309
Uttarakhand	0.023	0.224	0.753	0.057	0.052	0.891
Uttar Pradesh	0.169	0.305	0.526	0.332	0.001	0.667
West Bengal	0.006	0.469	0.525	0.214	0.003	0.783

Source: Finance Accounts of States and State Budget documents (various years)

Table 7: OWN NON-TAX REVENUE: Sources of Forecast Errors (BE-ACTUALS & RE_ACTUALS)

	BE-Actuals			RE-Actuals		
	Sources of Error			Sources of Error		
	Bias	Variance	Random	Bias	Variance	Random
Andhra Pradesh	0.098	0.000	0.901	0.201	0.057	0.743
Arunachal Pradesh	0.186	0.337	0.477	0.431	0.029	0.540
Assam	0.620	0.157	0.223	0.375	0.000	0.625
Bihar	0.796	0.013	0.191	0.268	0.051	0.681
Chhattisgarh	0.652	0.268	0.080	0.546	0.351	0.103
Goa	0.526	0.014	0.459	0.027	0.417	0.556
Gujarat	0.047	0.060	0.893	0.240	0.335	0.425
Haryana	0.446	0.363	0.191	0.503	0.179	0.318
Himachal	0.007	0.070	0.923	0.018	0.042	0.940
Jammu and Kashmir	0.207	0.017	0.776	0.320	0.055	0.625
Jharkhand	0.429	0.316	0.255	0.453	0.375	0.172
Karnataka	0.274	0.573	0.153	0.000	0.582	0.418
Kerala	0.001	0.490	0.509	0.763	0.069	0.169
Madhya Pradesh	0.009	0.166	0.824	0.189	0.016	0.795
Maharashtra	0.522	0.340	0.138	0.719	0.072	0.209
Manipur	0.923	0.063	0.014	0.536	0.118	0.404
Meghalaya	0.188	0.000	0.811	0.121	0.013	0.866
Mizoram	0.038	0.601	0.362	0.016	0.573	0.411
Nagaland	0.726	0.163	0.110	0.431	0.016	0.552
Orissa	0.204	0.549	0.247	0.388	0.314	0.298
Punjab	0.127	0.073	0.801	0.651	0.019	0.331
Rajasthan	0.010	0.414	0.576	0.067	0.281	0.651
Sikkim	0.661	0.195	0.144	0.561	0.045	0.394
Tamil Nadu	0.390	0.030	0.580	0.007	0.077	0.916
Tripura	0.016	0.329	0.655	0.025	0.245	0.730
Uttarakhand	0.261	0.435	0.304	0.224	0.237	0.540
Uttar Pradesh	0.405	0.231	0.364	0.297	0.056	0.647
West Bengal	0.344	0.056	0.600	0.150	0.050	0.800

Source: Finance Accounts of States and State Budget documents (various years)

Table 8: GRANTS: Sources of Forecast Errors (BE-ACTUALS & RE_ACTUALS)

	BE-Actuals			RE-Actuals		
	Sources of Error			Sources of Error		
	Bias	Variance	Random	Bias	Variance	Random
Andhra Pradesh	0.329	0.242	0.429	0.310	0.159	0.532
Arunachal Pradesh	0.375	0.091	0.534	0.243	0.234	0.523
Assam	0.830	0.084	0.085	0.804	0.026	0.170
Bihar	0.622	0.166	0.212	0.619	0.248	0.133
Chhattisgarh	0.766	0.159	0.074	0.739	0.197	0.064
Goa	0.755	0.000	0.245	0.671	0.000	0.328
Gujarat	0.627	0.037	0.336	0.646	0.121	0.233
Haryana	0.834	0.024	0.143	0.913	0.001	0.086
Himachal	0.026	0.024	0.950	0.417	0.047	0.536
Jammu and Kashmir	0.453	0.031	0.516	0.332	0.017	0.651
Jharkhand	0.893	0.011	0.096	0.778	0.084	0.139
Karnataka	0.179	0.013	0.808	0.339	0.036	0.625
Kerala	0.494	0.010	0.496	0.749	0.010	0.241
Madhya Pradesh	0.508	0.151	0.341	0.537	0.086	0.378
Maharashtra	0.393	0.008	0.600	0.784	0.208	0.009
Manipur	0.026	0.000	0.974	0.571	0.370	0.068
Meghalaya	0.783	0.210	0.008	0.692	0.298	0.010
Mizoram	0.660	0.301	0.039	0.722	0.000	0.278
Nagaland	0.698	0.082	0.220	0.678	0.002	0.320
Orissa	0.764	0.153	0.083	0.847	0.065	0.089
Punjab	0.903	0.008	0.089	0.586	0.018	0.397
Rajasthan	0.041	0.000	0.959	0.809	0.152	0.039
Sikkim	0.835	0.006	0.159	0.416	0.011	0.072
Tamil Nadu	0.060	0.011	0.929	0.414	0.399	0.187
Tripura	0.331	0.344	0.325	0.671	0.228	0.101
Uttarakhand	0.678	0.280	0.042	0.316	0.267	0.026
Uttar Pradesh	0.769	0.194	0.037	0.693	0.205	0.102
West Bengal	0.683	0.044	0.273	0.517	0.042	0.442

Source: Finance Accounts of States and State Budget documents (various years)

Table 9: REVENUE EXPENDITURE: Sources of Forecast Errors (BE-ACTUALS & RE_ACTUALS)

	BE-Actuals			RE-Actuals		
	Sources of Error			Sources of Error		
	Bias	Variance	Random	Bias	Variance	Random
Andhra Pradesh	0.467	0.260	0.273	0.035	0.001	0.964
Arunachal Pradesh	0.152	0.708	0.140	0.684	0.224	0.092
Assam	0.877	0.100	0.023	0.847	0.086	0.067
Bihar	0.793	0.100	0.107	0.837	0.128	0.035
Chhattisgarh	0.678	0.285	0.037	0.735	0.242	0.023
Goa	0.881	0.079	0.040	0.847	0.062	0.091
Gujarat	0.612	0.255	0.132	0.608	0.295	0.097
Haryana	0.829	0.088	0.083	0.952	0.010	0.038
Himachal	0.465	0.174	0.361	0.386	0.433	0.181
Jammu and Kashmir	0.195	0.177	0.629	0.166	0.203	0.631
Jharkhand	0.902	0.002	0.095	0.902	0.056	0.041
Karnataka	0.004	0.001	0.011	0.000	0.004	0.005
Kerala	0.226	0.174	0.600	0.206	0.057	0.736
Madhya Pradesh	0.594	0.074	0.331	0.630	0.099	0.271
Maharashtra	0.179	0.584	0.236	0.745	0.221	0.034
Manipur	0.240	0.006	0.754	0.739	0.189	0.083
Meghalaya	0.640	0.289	0.071	0.540	0.377	0.084
Mizoram	0.002	0.631	0.367	0.730	0.170	0.100
Nagaland	0.375	0.405	0.221	0.594	0.129	0.277
Orissa	0.762	0.174	0.064	0.867	0.086	0.048
Punjab	0.961	0.001	0.038	0.842	0.062	0.096
Rajasthan	0.030	0.500	0.470	0.856	0.131	0.014
Sikkim	0.720	0.193	0.087	0.791	0.167	0.041
Tamil Nadu	0.263	0.411	0.326	0.830	0.110	0.060
Tripura	0.781	0.147	0.072	0.771	0.100	0.129
Uttarakhand	0.659	0.034	0.307	0.787	0.057	0.156
Uttar Pradesh	0.695	0.220	0.085	0.770	0.002	0.228
West Bengal	0.116	0.384	0.499	0.811	0.004	0.186

Source: Finance Accounts of States and State Budget documents (various years)

Table 10: CAPITAL EXPENDITURE: Sources of Forecast Errors (BE-ACTUALS & RE_ACTUALS)

	BE-Actuals			RE-Actuals		
	Sources of Error			Sources of Error		
	Bias	Variance	Random	Bias	Variance	Random
Andhra Pradesh	0.357	0.236	0.407	0.053	0.646	0.301
Arunachal Pradesh	0.828	0.006	0.166	0.893	0.004	0.103
Assam	0.813	0.112	0.075	0.767	0.167	0.066
Bihar	0.756	0.003	0.241	0.738	0.009	0.254
Chhattisgarh	0.894	0.073	0.033	0.851	0.122	0.027
Goa	0.806	0.152	0.042	0.807	0.141	0.052
Gujarat	0.481	0.199	0.321	0.638	0.172	0.190
Haryana	0.105	0.008	0.887	0.018	0.046	0.936
Himachal	0.196	0.005	0.800	0.554	0.317	0.129
Jammu and Kashmir	0.443	0.035	0.522	0.461	0.041	0.498
Jharkhand	0.728	0.205	0.067	0.791	0.070	0.139
Karnataka	0.484	0.036	0.480	0.330	0.092	0.579
Kerala	0.409	0.000	0.591	0.094	0.237	0.669
Madhya Pradesh	0.317	0.532	0.152	0.315	0.085	0.600
Maharashtra	0.980	0.001	0.019	0.696	0.252	0.052
Manipur	0.463	0.256	0.281	0.906	0.050	0.051
Meghalaya	0.854	0.127	0.019	0.777	0.192	0.031
Mizoram	0.260	0.376	0.364	0.657	0.209	0.134
Nagaland	0.918	0.004	0.079	0.722	0.154	0.123
Orissa	0.024	0.910	0.065	0.064	0.179	0.757
Punjab	0.797	0.001	0.202	0.909	0.007	0.084
Rajasthan	0.167	0.061	0.772	0.872	0.013	0.115
Sikkim	0.959	0.023	0.018	0.969	0.017	0.014
Tamil Nadu	0.525	0.135	0.340	0.735	0.046	0.219
Tripura	0.595	0.374	0.032	0.910	0.069	0.022
Uttarakhand	0.027	0.047	0.926	0.529	0.094	0.378
Uttar Pradesh	0.314	0.005	0.681	0.482	0.033	0.485
West Bengal	0.864	0.041	0.095	0.854	0.140	0.006

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