

**Why Tax Effort Falls Short of Capacity in Indian States: A Stochastic  
Frontier Approach\***

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## **Abstract**

*Taxation is an important tool to enhance the economic development and to finance the expenditure responsibilities of a government. This paper attempts to measure the tax capacity and tax effort of 14 major Indian states from 1992-92 to 2010-11 using Stochastic Frontier Analysis. The use of tax capacity frontier helps to identify those states which are operating near their tax capacity and states which are away from tax frontier. The results indicate presence of large variation in tax effort index across states and which seems to be increasing over time. Econometric analysis suggests that economic and structural variables have significant impact on the tax capacity. While per-capita gross state domestic product has positive effect on states' own tax revenue, relative size of agriculture sector of a state has adverse effect on its own tax revenue. The evidence on tax efficiency suggests that the higher inter-governmental transfers tend to reduce tax efficiency. Outstanding liabilities and expenditure on debt repayment also indicate adverse effect on tax efficiency, but the adverse effect of the latter is lesser than the former. Enactment of Fiscal Responsibility and Budget Management Act seems to have improved the tax efficiency which has been further strengthened by the better law and order inside states. Higher political competition inside a state, represented by effective number of parties, has favourable effect on the tax efficiency of a state. Implications are drawn for policy.*

**Keywords: tax capacity, tax effort, stochastic frontier analysis, fiscal federalism**

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## 1. Introduction

India with 29 states and 6 union territories possesses a federal structure which specifies three characteristics for different tiers of governments: division of functional responsibilities, assignment of autonomous revenue sources and system of inter-governmental fiscal transfers (Bagchi, 2003). Exclusive powers of central and state governments are specified in Union list and State list respectively. The subjects like defence, macroeconomic stability, money and banking, international trade etc. are assigned to the central government in union list. The functions entrusted to the state governments are those of maintaining public order, agriculture sector, public health and sanitation, water supply, and irrigation etc. The powers falling in common jurisdiction are specified under concurrent list and these include education, transportation and social insurance etc. (Rao and Singh, 2007; Bagchi, 2003). Similar to the expenditure function of the governments, the revenue sources are also divided. Central government is assigned with taxes which have broad and mobile bases like tax on income and wealth from non-agriculture sources, corporation tax, custom duties etc. Taxes within jurisdiction of state governments include tax on income and wealth from agriculture sector, sales tax, certain excise duties etc. Apart from the taxation power of states, constitution made recommendations for additional revenue sources to states as well, which includes sharing the proceeds of centrally levied taxes and providing grants from Consolidated Fund of India. These transfers help states to bridge the gap between expenditure and their own revenue. The idea behind these transfers is to achieve uniformity in public services and the tax rates all over the country along with avoiding tax evasion and the high cost of decentralized collection.

The distribution of tax assignments between centre and states ensures fiscal autonomy to states up to some extent and makes for an effective federal structure. It is based on the principle of separation which indicates that the tax assignments between centre and state governments are mutually exclusive (Rao and Singh, 2007). Taxation, among all revenue sources<sup>1</sup> is an important tool to finance the expenditure responsibilities for state governments. Large differences in the expenditure pattern at the sub-national level (Rao et. al., 1999; Bagchi, 2003) calls for a study of the revenue sources of states. Concepts related to revenue sources of the government are revenue capacity and tax capacity. Revenue capacity/potential

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<sup>1</sup> Other revenue sources of states are: Inter-governmental transfers such as share in central taxes, grants, and loans from the central government; loans from the market; interest receipts; dividends etc.

is a broader term which includes total tax and non-tax revenue capacity of different fiscal entities. It refers to the maximum revenue a government can generate given its economic, social, administrative, demographic and other characteristics.

The object of this study is to analyse the revenue sources of the state governments in general, and their own tax collection in particular. As states impose certain kind of taxes and retain that revenue hence it is important to study their own tax capacity/potential<sup>2</sup> along with actual tax collection. Stochastic Frontier Analysis (SFA) is used to estimate own tax capacity at the sub-national level for the period of 1992-93 to 2010-11, which is further used to compute tax effort. Tax capacity similar to revenue capacity, refers to the maximum potential tax revenue a government can generate. Tax effort on the other hand is the comparison of actual tax collection and tax capacity. This in simple terms can be defined as the ability to raise tax revenue which can further be realized by imposing different kinds of tax policies. More specifically we investigate the determinants of own tax revenue of state governments.

Alfirman (2003) suggest that unlike output frontier where specific inputs i.e. capital and labour determine the output, the tax frontier is not subjected to specific inputs. As underlying relationship of tax revenue and its input factors is not very clear, implication of several factors has been analysed on tax capacity. Guided by the literature, a comprehensive data set has been used which covers economic, social, demographic, governance, and political aspects of states. These variables will help to identify factors to increase tax collection of less performing states.

There are few Indian studies on the determinants of tax collection. The use of better panel data methodology while incorporating several aspects of state economies is missing so far in estimation of tax capacity. This study fills this gap by providing improved estimates of tax capacity and tax effort using SFA. Construction of tax frontier at sub-national level will enable us to identify states performing near tax frontier i.e. collecting taxes near their tax capacity, and states which are far below their tax capacity. Based on these estimates all states are ranked from low tax effort to high tax effort. Low tax effort signifies that a state has not utilized its tax capacity fully relative to other states and vice-versa.

We aim to answer the following questions:

- (i) What is the role of economic structure on the tax capacity?

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<sup>2</sup>The terms *Tax Capacity* and *Tax Potential* have been used interchangeably.

- (ii) What is the relative tax effort index of states?
- (iii) Do federal transfers have any adverse effect on tax effort?
- (iv) How has Fiscal Responsibility and Budget Management Act (FRBMA) affected tax effort?
- (v) How does the political environment of a state affect its tax effort?

Our results indicate that economic and structural variables significantly affect the tax capacity of states. While per-capita Gross State Domestic Product (GSDP) has positive and significant association with tax collection of states, the agriculture sector with lesser contribution in aggregate tax revenue (Table, 1) reduces tax collection. Federal transfers adversely affect states' tax efficiency. Total outstanding liabilities and debt repayment of states also put adverse effect on the tax efficiency whereas the effect of the latter is lesser than the former. On the other hand, larger expenditure responsibility and better governance index of a state have favourable effect on the tax efficiency which has further improved with enactment of FRBMA. As far as political variables are concerned, the results show that effective number of parties which indicates the political competition inside a state has favourable effect on its tax efficiency.

The structure of this paper is organised as follows. Section 2 presents the brief overview of various revenue sources of the states such as: their own tax revenue, federal transfers, debt and FRBMA. Section 3 documents the literature review and methodological developments, where the methodology of SFA is explained. Section 4 gives the detail of all the variables. In section 5 the political economy of federal transfers is studied. Section 6 represents the computation of tax capacity and tax effort. Section 7 presents the concluding remarks.

## **2. Federal Structure in Indian Economy**

In this section we give brief introduction about important features of Indian federal structure. First, we give brief overview of share of each tax in total tax revenue, which is followed by contribution of federal transfers and debt. Also brief description of enactment of FRBMA is given.

### **2.1 Major Taxes**

Table (1) presents total revenue and the relative share of its various components in total revenue. These components consist of states' own tax revenue; transfers from central government and various ministries; borrowing; and other revenue sources. Own tax revenue



of the all states formed 39.3% of their total revenue<sup>3</sup> in 2010-11 (Table 1). Figure (1) shows the spread of own tax revenue relative to GSDP for individual states. While average level of tax to GSDP ratio has remained more or less same over the years, its variation has declined in 2010-11 as compared to 1991-92 as indicated by lower spreads. Large part of the total tax revenue of all the states taken together comes from sales tax category. It constituted 19.5% of total revenue in 1991-92, which increased to 23.8% in 2010-11 (Table 1). No other tax category contributes as much as sales tax. Contribution of all other individual taxes is less than 6% in the total revenue. Taxes that come in this category in descending order are Tax on Property & Capital Transactions, State Excise Tax, and Vehicle Tax etc. The first two taxes combined with sales tax cover nearly 85% of states' total own tax revenue. All the remaining taxes are minor taxes based on their share in states' total revenue.

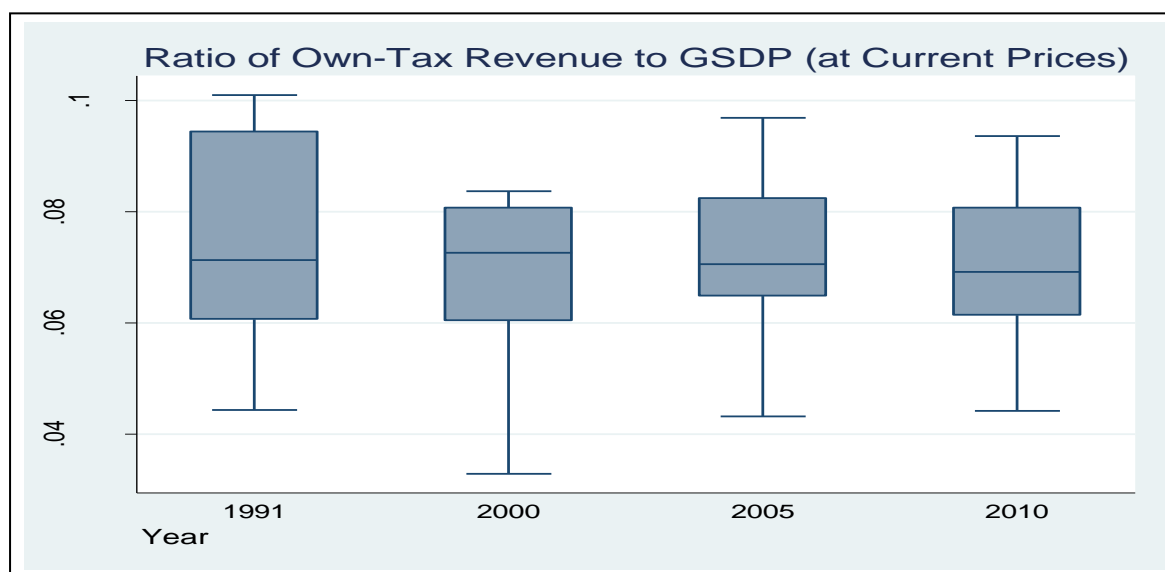
**Table 1: Various Sources of Revenue: All States (1991-91 to 2010-11)**

| Revenue Components: All States               | (% of Total Revenue) |      |      |
|--|----------------------|------|------|
|  | 1991                 | 2001 | 2010 |
| <b>1. Own Tax Revenue</b>                    | 33.2                 | 33.7 | 39.3 |
| (i) Sales Tax                                | 19.5                 | 20.0 | 23.8 |
| (ii) State Excise                            | 5.0                  | 4.5  | 5.0  |
| (iii) Tax on Property & Cap. Transaction     | 3.1                  | 3.5  | 5.2  |
| (iv) Vehicle Tax                             | 1.7                  | 2.0  | 2.1  |
| (v) Tax on duties on Electricity             | 1.5                  | 1.3  | 1.5  |
| (vi) Tax on Goods and Passengers             | 1.1                  | 1.0  | 1.0  |
| (vii) Tax on Profession, Trades and Callings | 0.4                  | 0.8  | 0.3  |
| (viii) Agriculture Income Tax                | 0.2                  | 0.02 | 0.00 |
| (ix) Entertainment Tax                       | 0.3                  | 0.2  | 0.1  |
| <b>2. Total Transfers</b>                    | 41.9                 | 32.6 | 33.4 |
| (i) Transfers from Central Taxes             | 15.6                 | 14.3 | 18.7 |
| (ii) Grants                                  | 14.1                 | 11.7 | 13.9 |
| (a) Plan Grants                              | 11.1                 | 8.0  | 9.8  |
| (b) Non-Plan Grants                          | 3.0                  | 3.7  | 4.2  |
| (iii) Loans From Centre                      | 12.1                 | 6.7  | 0.8  |
| <b>3. Internal Loans</b>                     | 4.7                  | 18.3 | 14.5 |
| (i) Market Loans                             | 3.1                  | 5.2  | 8.9  |
| <b>4. Other Sources</b>                      | 20.2                 | 15.4 | 12.8 |

Note: Computed by dividing the tax components by aggregate receipts of States.  
Source: RBI (2004, 2010, 2012)

<sup>3</sup> Total revenue includes revenue receipts and capital receipts of state governments.

**Figure 1: Variation in Own Tax Revenue Relative to GSDP: All States (1991-92 to 2010-11)**



Computed by dividing the Own tax revenue by GSDP (at current prices).  
Source: RBI (2004, 2010, 2012)

## 2.2 Federal Transfers

Federal transfers are shared with States through many channels, i.e. (a) Finance Commission (FC) that distributes the divisible taxes and provides grants-in-aid; (b) Planning Commission (PC) that makes transfers in the form of state plans; (c) various Individual Ministries. Since expenditure of States exceeds their tax revenue, inter-governmental transfers make an important and significant part of their total revenue (Table 1). Their contribution in total revenue has come down to 33.4% in 2010-11 from 42% in 1991-92. So dependence of all states on central transfers has declined over time.

Transfers made through FC serve two purposes. First, they address the issue of vertical imbalance<sup>4</sup> and help sub-national governments with inadequate revenues meet their expenditure liabilities and perform functional responsibilities. Second, they address the issue of horizontal imbalance<sup>5</sup> by an attempt to remove disparities in revenue capacity of state and local bodies. The horizontal distribution of resources is based on some criteria which have been subjected to change over various FCs (Appendix, A1).

On the other hand a well-designed formula was adopted by PC during formulation of fourth five year plan for devolution of inter-governmental transfers in a rational manner without

<sup>4</sup>Vertical distribution refers to the revenue sharing between different layers of government i.e. a part of revenue collected by central government from certain taxes is shared with states.

<sup>5</sup>Horizontal distribution refers to distribution of transfers across states i.e. determining each states' share in the total recommended share of central taxes.

discretion. This was known as Gadgil formula, after the name of the then deputy chairman of PC (Ramalingom and Kurup, 1991). This formula was constructed with inclusion of several factors: population, per-capita income of a state, tax effort defined as ratio of per-capita tax receipts to per-capita income, special problems of specific states etc. Population was assigned the highest weight of 60%. Gadgil formula has also been modified over time by changing the relative weights assigned to different components as well as with inclusion of new factors (Appendix, A2). Factors like fiscal discipline, deviation of income from mean income, distance of income from highest income were also incorporated into the formula. Tax effort has been included as one component of devolution formula adopted by both PC and FC (Appendix A1, A2).

There is large variation in transfers received by individual states (Table2). Among non-special category states, in 2010-11, Bihar and Orissa received the largest proportion of transfers. Bihar shows an increasing dependence on central transfers whereas the share of Orissa has come down from 1991-92 to 2010-11. A declining trend is also observed in case of Uttar Pradesh, Rajasthan and West Bengal. States least dependent on transfers are high income States, mainly Punjab, Haryana and Gujarat.

The inter-governmental transfers are major source of revenue for all the special category states. Nagaland received the highest funds in 2010 followed by Manipur. On the other hand Himachal Pradesh and Uttaranchal had received lowest funds.

Among components of transfers, share in central taxes constitute the highest proportion followed by the share of grants. Proportion of transfers in the form of central loans is the lowest component (Table 1).

***(a) Fiscal Responsibility and Budget Management Act (FRBMA)***

Although macroeconomic stability is one of the responsibilities assigned to central government, but coordination between central and state governments is required to ensure overall financial sustainability and stability. The process of bringing fiscal restructuring and consolidated reforms in state and central finances was initiated with 11<sup>th</sup> FC, for first time, when it was recommended to review the finances of centre and state governments and to suggest ways to restructuring of public finances to restore the budgetary balance and macroeconomic stability (Rao and Sen, 2011). In the implementation of FRBMA, a rule based fiscal framework, enacted in 2003 was another major reform.

**Table 2: Dependence of Individual States on Fiscal Transfers from Centre**

| <b>Central Transfers as proportion of States' Aggregate Revenue: 1991-92 to 2010-11</b> |             |             |             |
|---|-------------|-------------|-------------|
| <b>States</b>   | <b>1991</b> | <b>2001</b> | <b>2010</b> |
| <b>I. Non-Special Category States</b>   |             |             |             |
| Bihar   | 0.61        | 0.57        | 0.68        |
| Orissa  | 0.55        | 0.45        | 0.48        |
| Jharkhand   |             | 0.45        | 0.46        |
| Uttar Pradesh   | 0.55        | 0.43        | 0.42        |
| Madhya Pradesh  | 0.44        | 0.36        | 0.41        |
| Chhattisgarh  |             | 0.35        | 0.41        |
| Rajasthan   | 0.40        | 0.31        | 0.34        |
| West Bengal   | 0.47        | 0.33        | 0.33        |
| Andhra Pradesh  | 0.40        | 0.32        | 0.27        |
| Karnataka   | 0.28        | 0.30        | 0.26        |
| Tamil Nadu  | 0.30        | 0.21        | 0.22        |
| Kerala  | 0.39        | 0.25        | 0.19        |
| Maharashtra   | 0.27        | 0.12        | 0.18        |
| Haryana   | 0.24        | 0.12        | 0.16        |
| Goa   | 0.43        | 0.12        | 0.16        |
| Punjab  | 0.31        | 0.13        | 0.16        |
| Gujarat   | 0.21        | 0.20        | 0.15        |
| <b>II. Special Category States</b>  |             |             |             |
| Nagaland  | 0.87        | 0.82        | 0.83        |
| Manipur   | 0.85        | 0.80        | 0.81        |
| Arunachal Pradesh   | 0.92        | 0.79        | 0.80        |
| Meghalaya   | 0.78        | 0.73        | 0.76        |
| Tripura   | 0.87        | 0.74        | 0.75        |
| Jammu & Kashmir   | 0.80        | 0.77        | 0.69        |
| Mizoram   | 0.96        | 0.70        | 0.66        |
| Assam   | 0.69        | 0.59        | 0.59        |
| Sikkim  | 0.75        | 0.33        | 0.52        |
| Himachal Pradesh  | 0.37        | 0.55        | 0.45        |
| Uttaranchal   |             | 0.42        | 0.42        |

Computed by dividing the gross total transfers from centre to states by aggregate receipts of states.  
Source: RBI (2004, 2010, 2012)

This Act, which required central government to take appropriate steps to reduce fiscal deficit and eliminate revenue deficit by 2007-08 was a major policy change in the fiscal history in India. These targets dates were shifted further to be achieved by March 2009, with fiscal deficit to be reduced at 3 percent of GDP. The agenda of FRBMA is to ensure inter-temporal equity in fiscal management and long term sustainability of central government finances. It covered the finances of central government only (Simone and Topalova, 2009). As states accounted for roughly half of the fiscal deficit, hence reducing their deficit was also an important task to ensure overall sustainability. Afterwards TWFC outlined a restructuring plan in which consolidated fiscal deficit was aimed at 6 percent of GDP including fiscal deficit target of 3 percent of GDP for central government and 3 percent of GSDP for each state. States were given autonomy to design their Fiscal Responsibility Laws (FRL) to bring

down their fiscal deficit and revenue deficit. All the states did not implement FRBMA in the same year. Some states have implemented FRBMA during 2003 itself and some have implemented it during 2005 or later (Appendix, A4). During the TWFC access to Debt Consolidation and Relief Facility (DCRF) and debt write off facility was made conditional upon the enactment of FRBMA for states. Revised instructions were put forward during 13<sup>th</sup> FC to make FRBM process effective: (i) transparent and comprehensive; (ii) system to effectively monitor the compliance, (iii) sensitive to countercyclical changes (Rao and Sen, 2011).

The goal of making finances sustainable requires a combination of actions such as: reducing unproductive expenditure; increasing own tax collection etc. Hence it is important to test the effect of FRBMA.

### **2.3 Debt**

Another important component of revenue is borrowing that includes loans from the central government, loans from market and National Social Security Fund (NSSF) securities etc. These components together make the internal debt of the States. Market loan is the major component of the total debt which has increased from 3.1% of total revenue in 1991-92 to 8.9% of total revenue in 2010-11.

Three sources described above, namely States' own tax revenue; transfers from the centre; and borrowing constitute approximately 87% of the total revenue of the States. Rest of the revenue comes from interest receipts, profits, lotteries, dividends etc. Since these form a small proportion of the total revenue, they are not considered in this study.

## **3. Methodological Developments**

Four approaches are widely used in the literature to estimate the tax capacity of a government: *Income Approach*; *Representative Tax System (RTS)* and *Aggregate Regression Approach* (Bahl, 1972; Rao, 1993; Paincastelli, 2001; and Purohit, 2006). The fourth and the latest approach is stochastic frontier analysis.

### **3.1. Income Approach**

In this approach, revenue capacity is calculated by taking state/national income as the tax base. Further tax effort is defined as the ratio of actual tax collection to the state/national income. This measure is considered inadequate as it assumes income to be the only factor determining the differences in the tax revenue, ignoring other potential tax bases.

### **3.2. Representative Tax System**

This approach was developed by Advisory Commission on Intergovernmental Relations (ACIR, 1962). Tax capacity, according to RTS method is defined as the hypothetical revenue amount a state or local government could raise, provided all governments imposed an identical effective tax rates to their tax bases. The 1962 RTS methodology estimated tax capacity and tax effort at the aggregate level of tax revenue. Its scope was increased in 1971 report by calculating these measures for individual components of aggregate tax revenue and also for remaining revenue sources other than own tax revenue of the state and local governments. RTS methodology analyses the individual tax revenue to calculate disaggregated estimates of tax capacity and tax effort. In order to calculate the tax capacities of each type of tax this technique requires identification of close proxies for the tax base respective to each tax. Purohit (2006) using RTS approach has ranked the Indian states based on the realized tax potential of individual tax bases for the period 2000-03.

RTS method is transparent as each category of tax revenue is related with its respective tax bases. However, proxies of tax bases are used in practice because it is difficult to find accurate and reliable tax bases (Thimmaiah, 1979; and Rao, 1993). In the absence of closely defined tax bases the estimates of tax capacity are arbitrary (Thimmaiah, 1979). If the analysis has to be conducted at the sub-national level then the availability of the data on respective tax bases can be a complicated task.

### **3.3. Aggregate Regression Approach**

The third widely used approach is the *Aggregate Regression Approach*, which incorporates a set of independent variables explaining variation in the inter-regional tax-revenue. Estimates of tax capacity are computed by relating aggregate tax revenue with macro parameters of the respective entity. These parameters could be GSDP of various sectors e.g. primary, secondary and tertiary etc. A set of demographical, social, geographical and political variables can also be included in the analysis to explain the variation in the tax-revenue. Majority of studies have applied this approach. Gupta (2007) in a multi-country dynamic panel model finds significant effect of structural variables like per-capita Gross Domestic Product (GDP), share of agriculture sector in GDP, trade openness and foreign trade on the tax revenue of these countries. Davoodi and Grigorian (2007) included a measure of shadow economy and a measure of institutional quality as a proxy for quality of governance, rule of law and corruption. Mahdavi (2013) computed the tax effort indices for separate categories of taxes for American States using regression method.

Studies in Indian context have mainly applied regression approach. Oomen (1987) had regressed the aggregate tax–income ratio on the income of agricultural sector; manufacturing sector; and income from hotels, trade and commerce. The actual tax-income ratio has been divided by the estimated tax-income ratio to create an index of state tax effort. Thimmaiah (1979) has applied the multiple regression approach at the disaggregated level to estimate marginal revenue effort of south Indian States. The author has used tax base proxies and other structural variables as set of explanatory variables.

Rao (1993) categorizes Indian States into three categories: high capacity States, middle capacity States and low capacity States using the modified RTS method. Modified RTS method here refers to the multiple regression analysis at disaggregated level of tax revenue using structural variables like level of urbanization, income disparities as potential explanatory variables along with the tax bases.

The major criticism of regression approach is that the residual error which can contain a random component is taken as the measure of tax effort (Rao, 1993).

### **3.4. Stochastic Frontier Approach (SFA)**

SFA is an extension of regression approach. Analogous to the production function, a stochastic tax frontier measures the maximum output i.e. maximum revenue a unit (a state in this study) can achieve given a set of inputs i.e. tax base and other determinants of tax revenue. The difference between the actual revenue and the maximum revenue indicates the technical inefficiency of that unit as well as policy issues (Pessino & Fenochietto, 2010, 2013). The standard econometric stochastic frontier model is presented by Aigner, Lovell and Schmidt (1977). Several variants of this model have been applied in the literature with different structure of the inefficiency term and with different distributional assumptions. We apply the Battese and Coelli (1995) model where inefficiency term is assumed to be a linear function of a set of explanatory variables. The distribution of inefficiency term is assumed to be truncated normal. Stochastic frontier for panel data is defined as:

$$Y_{it} = \exp (X_{it}\beta + v_{it} - u_{it}) \quad \dots(1)$$

Where  $Y_{it}$  denotes the own tax revenue for  $i$ -th ( $i=1, 2, \dots, N$ ) state at  $t$ -th ( $t=1, 2, \dots, T$ ) time period;

$X_{it}$  is (1XK) vector of values of function of inputs affecting tax revenue and other explanatory variables;

$\beta$  is a  $(K \times 1)$  vector of unknown parameters;

Error component is decomposed into two parts  $v_{it}$  and  $u_{it}$ :

$u_{it}$  is a non-negative error component which represents the time varying technical inefficiency term. It is obtained by truncation of normal distribution with mean  $Z_{it} \delta$  and variance  $\sigma^2$ ; and  $v_{it}$  is statistical noise term with symmetric distribution. It can have negative or positive value.

$Y_{it} = f(\beta X_{it})$  represents the deterministic part of the frontier. With inclusion of symmetric error term  $v_{it}$  this represents the stochastic frontier. This term stands for macro-economic factors which are outside the state's control. Both these terms together constitute the 'stochastic frontier'. The shortfall of actual output from the optimal output is captured via term  $u_{it}$ , termed as technical inefficiency, which includes state specific factors. Inefficiency term obtained from this model is assumed to be a function of explanatory variables  $Z_{it}$ , which could be specified as:

$$u_{it} = Z_{it} \delta + W_{it}, \text{ where} \quad \dots(2)$$

$W_{it}$  is a random variable, defined by the truncation of normal distribution with zero mean and variance  $\sigma^2$ .

Since it explains the structure of technical inefficiency in terms of other variables, this model is well suited to our objectives. It simultaneously estimates the stochastic frontier and the inefficiency equation. The underlying estimation method is the maximum likelihood method.

Technical efficiency of  $i$ -th state at  $t$ -th time period is defined as  $\text{Exp}(-u_{it})$ . Given the specification of the model, we test the following hypotheses:

- (i) Technical inefficiency term is not effected by explanatory variables, hence  
 $H_0: \delta = 0$ ;
- (ii) Technical inefficiency term is not stochastic, hence  
 $H_0: \lambda = 0$ , where  $\lambda = \frac{\sigma_u}{\sigma_v}$ , which is expressed as ratio of standard deviation of inefficiency term to the standard deviation of error term. It provides information on the relative contribution of both error components in total error term.

The construction of error term is the conceptual difference between the estimates of regression model and SFA model. In regression model the error term, which represents the inefficiency, can be positive or negative, indicating that a state can deviate from the average predicted revenue by under-performing or over-performing. In other words tax effort can



exceed hundred percent also. On the other hand in SFA analysis the non-negative component of error term ensures that a unit can achieve optimal output at maximum i.e. the actual revenue cannot exceed the optimal revenue (Pessino & Fenochietto, 2010, 2013; and Cyan et. al. 2013).

The technique of stochastic frontier has been applied to estimate tax capacity in a few studies. Pessino & Fenochietto (2010& 2013) have applied this approach to estimate the tax effort and tax capacity for 96 countries. In the earlier version of the paper authors have considered variables such as per-capita GDP as indicator of level of development, openness of the economy indicated by exports and imports as percentage of GDP, income distribution, lower share of agricultural sector indicating an ease in collecting taxes, and corruption etc. In the latter paper authors have extended the analysis by including countries in which revenue from natural resources represented more than 25% of total revenue. In a latest study Cyan et. al. (2013), authors have examined the determinants of tax collection across 94 countries using conventional regression approach as well as SFA. After mentioning the shortcomings of regression method authors compute tax effort index using results from SFA. Similar kind of variables has been included in the analysis e.g. economic, demographic and social variables.

In Indian context few studies have been conducted to measure the tax effort of the individual States. All of the studies have either applied regression approach or RTS approach except one study with approach of stochastic frontier analysis by Jha et.al. (1999). Authors have studied tax effort for 15 major states for the period of 1981-1992, but with a narrow coverage of variables.

A set of literature seeks to establish the link between federal transfers and actual tax revenue controlling for structural variables such as distribution of income, level of urbanization and level of development etc. Naganathan and Sivagnanam (2000) find adverse effect of union transfers on the revenue-income ratio of the States. Similarly, Panda (2009) relates per-capita own tax revenue with the per-capita transfers received by respective States and finds a negative relationship. Dash and Raja (2013) establish the effect of conditional and unconditional transfers on direct and indirect tax collection at the sub-national level. Their results show that the tax collection is inversely related to the unconditional transfers. Direct tax collection responds most sensitively to the transfers.

Only one study in literature (Jha et. al., 1999) combines two sets of literature i.e. effect of fiscal federalism on the estimated state tax efforts using SFA. Authors have not studied the

potential implications of fiscal, political and governance factors on tax effort. The present study fills this gap. Our study is the improvement over Jha et. al. (1999) study in terms of incorporating comprehensive data set which includes structural, economic, fiscal, political and governance variables for the latest period of 1992-92 to 2010-11.

#### **4. Data and Variables**

Variables can be classified into two sets. First set includes variables to estimate the tax capacity whereas second set includes variables affecting inefficiency in total tax revenue.

Tax capacity variables are as follows:

1. Economic variables;
2. Indicators of infrastructure availability;
3. Structural and demographic variables.

Variable explaining the technical inefficiency are of 4 types:

1. Fiscal variables;
2. Administrative and governance variables;
3. Structural variables;
4. Political variables.

The data related to finances of the States, which includes revenue, expenditure and their components is taken from Reserve Bank of India (RBI) (2004, 2010, 2012), PC (2004), and Economic and Political Weekly (EPW) research foundation. Data related to law and order variables is obtained from National Crime Records Bureau (NCRB) reports for various years. Urban income inequality variable has been obtained from Das et. al.(2010). Data for effective number of political parties (ENP) till the year 2005 has been taken from Kaushik and Pal (2012). For the rest of the years it has been calculated. The detailed list of data sources and variable construction has been given in the Appendix.

##### **4.1. Dependent Variable**

As the objective taken up in this study is to estimate tax capacity at the sub-national level with respect to their own tax revenue, hence states' own tax revenue as ratio of GSDP (at current prices) is the dependent variable, taken in logarithmic form.

## 4.2. Explanatory Variables for Estimating Tax Capacity

### (i) Economic Factors

Variables considered in this category represent the level of economic development. *Per-capita GSDP* is considered as the tax base for overall tax collection and as well as an indicator of development. This is commonly used to explain the tax potential of a unit and it is expected to have positive effect on the tax income of a state. Another important variable considered is the *proportion of labor force* in the total population. This variable has been calculated using the National Sample Survey Organisation (NSSO) data for various years. NSSO survey on employment uses 3 different reference periods to compute the working or not-working status of a person. Those approaches are: Usual Status Approach - using reference period of past one year from the date of survey; Weekly Status & Daily Status approaches using reference period of past one week from the date of survey. In this analysis labour force has been defined on the basis of Usual Status Approach as it indicates the chronic unemployment. Labour force includes employed and involuntarily unemployed persons, whereas fraction of population which is voluntarily unemployed i.e. people who are 'out of labour force' are excluded from estimation of labour force. This variable is also expected to have a positive sign on the tax collection of a state. Another variable of concern is the *urban income inequality*. This variable is measured by gini-coefficient, which measures the deviation of distribution of consumption expenditure in a state from equal distribution. It is considered to represent the intra-state disparity in per-capita income. Pessino and Fenichietto (2013) have observed the negative impact of gini-coefficient on tax effort at country level where majority of revenue comes from income tax. Whereas in our study sales tax is the major component of revenue at sub-national level, hence the effect of gini-coefficient is ambiguous.

### (ii) Indicators of Infrastructure Quality

Two variables namely *road density* and *per-capita power consumption* have been taken as an indicator of infrastructure availability in a state. Road density is defined as the ratio of total road length (km.) in a state to total area (sq. km.). It signifies the connectivity within state as well as across states. Power consumption refers to the total power sold within a state. The latter variable is taken as proxy for total power consumption. Better availability of infrastructure indicates positive externalities for development in a state. Hence higher should be the tax collection.

### (iii) Demographic Factors

*Literacy rate* and *share of urban population* represent the demographic profile of a state. Higher literacy is expected to raise awareness to pay taxes and lower evasion of taxes. Hence literacy level is expected to have positive sign with the tax collection. Similarly higher urban population is also expected to be positively related with tax collection as it indicates higher level of development and as well as larger industrial and service sector.

(iv) Structural Factors

*Share of agriculture GSDP in total GSDP* explains the structure of an economy. Bharagava (1999) highlighted that the importance of agricultural tax has declined from third five year plan onwards. This sector suffers from relative lack in buoyancy in tax revenue (Chatterjee, 1968). India has high exemption base of agriculture income from taxation (Sengupta and Rao, 2012) and these exemption limits are not same across states (Bhargava, 1999). Under-taxation of agriculture sector has led to the horizontal inequity in tax structure in favour of rich farmers (Krishna, 1972). Due to all these rigidities we expect a negative relationship between size of agriculture sector and total tax collection of a state.

#### **4.3. Explanatory Variables for Inefficiency Equation**

(i) Federal Transfers net of loan component

Fiscal factors considered here are: transfers net of loan components. Total transfers include States' share in central taxes; grants; and loans from central government. Loan component of transfers adds to the liability of the states which states have to repay. Other two components can be considered as the statutory transfers by the Finance Commission and the plan and non-plan grants from Planning Commission and various ministries. As states do not have to repay these transfers, they might affect states' own tax collection adversely. A state, believing it will receive large transfers, might reduce its tax effort. Hence we expect inefficiency to increase with larger transfers from the centre. Several studies have reported negative impact of central transfers on states' tax collection (Jha et. al. 1999; Naganathan & Sivagnanam, 2000; Panda, 2009; and Dash & Raja, 2013). These studies differ with respect to the methodology used to compute tax effort index for states.

(ii) Total expenditure to GSDP (at current prices) ratio

Another variable is total expenditure to GSDP ratio as an indicator of the size of the government. It signifies the desired level of public goods and services to be provided by a state to its citizens. Ho and Huang (2009) explained the "Tax-and-Spend"; "Spend-and-Tax"; and "Fiscal-Synchronisation" hypothesis. The first hypothesis states that changes in

government revenue influences changes in government spending. Governments frame their expenditure policy based on their tax revenue and try to balance their budget by increasing tax revenue. On the other hand the second hypothesis emphasises that desired level of tax revenue in a state is determined by their perception of desired level of expenditure. Hence larger the expenditure responsibility, larger should be the effort to collect taxes to finance these expenditure responsibilities. The third hypothesis suggests that both tax revenue and expenditure levels are determined simultaneously. Authors giving brief literature on the validity of these hypotheses, explain that the consensus has not been reached in favour of one hypothesis and literature has given the inconclusive results. Hence this suggests a bi-direction influence of tax revenue and expenditure responsibility of state governments, which can further cause a problem of endogeneity into our model. In order to avoid this problem the lag of total expenditure to GSDP ratio has been used.

(iii) Governance Index

Another variable which can affect efficiency in tax collection is the quality of administration and governance in a state. Better the administrative efficiency of a state, better should be the process of tax collection. Although governance can be indicated by a number of factors like protection of property rights, legal system and rule of law etc. (Dash and Raja, 2009), infrastructure and social services delivery, fiscal performance, law and order, etc. (Mundle et. al.2012), here four variables are used to compute an index of overall administration and governance<sup>6</sup>. These variables capture mainly the law and order aspect of governance. The index is used as proxy for governance indicator. These variables are:

- (a) *Reciprocal of crime rate*: Crime rate here is equivalent to the ratio of total cognizable crimes listed under Indian Penal Code to total geographical area of a state. Higher the crimes, lower the quality of governance expected. Reciprocal of this variable has been taken so that higher value represents improvement in the governance.
- (b) *Value of property recovered as a ratio to property stolen*: This variable represents the value of stolen property recovered by police. Higher value of this variable represents improvement in administration.

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<sup>6</sup> Some of variables included in other studies to construct governance index are already used in our study as dependent or independent variables. For example, while states' own tax revenue is included in Mundle (2012) study, it is our dependent variable. Similarly Literacy and Road length are part of governance index in Mundle (2012), these are independent variables in our study. Hence we have constructed a composite variable covering law and order aspect as proxy for governance, rather than using governance index from literature to avoid any overlap and correlation between independent variables.

(c) *Reciprocal of pendency rate of crimes by courts*: This variable captures the legal efficiency in a state. It is defined as the proportion of pending cases out of total IPC cases referred to court. Higher pendency rate also signifies low quality of administration. Hence reciprocal of this variable has been taken so that higher value represents improvement in governance.

(d) *Police strength w.r.t. population*: This variable is defined as the ratio of total state police personal to total population. Police personal comprise both civil police as well as armed police. Higher the police strength better is expected the governance.

Principal Component Analysis (PCA) is applied to compute an index using these four variables. PCA reduces the dimensionality of a data set that has large number of correlated variables. It gives principal components whose number is equal to the total variables used to compute PCA. These components are uncorrelated components which capture the variation in the data set with first component capturing the maximum variation. This variation declines with successive number of components. The first component is used in this analysis which captured the 38.63 percent of the variation of these four variables. This index is further used as proxy of better administration and better governance. A higher value indicates better administration.

(iv) Outstanding Debt Liabilities as Ratio of GSDP (at current Prices)

Outstanding liabilities as ratio of GSDP (at current prices) consist of cumulative liabilities in the form of internal loans, loans from the centre etc. The outstanding liabilities and its repayment are financial burdens for States. This variable affects the behavior of the government. A government should make more effort in its tax collection when it has more debt to repay. In other words inefficiency in tax collection should decline with higher amount of outstanding debt. Hence a negative link is expected between tax inefficiency and this variable. Outstanding liabilities can be influenced by both expenditure and tax revenue of states as well as by political structure of state, hence contemporaneous values of this variable can cause endogeneity. Therefore the first lag of this variable is considered.

(v) Debt repayment

This variable is constructed as the total debt repayment in fiscal year to the ratio of total revenue. The idea is to compare effect of this variable on tax inefficiency with the effect of outstanding liabilities. Debt repayment can also be effected by the expenditure responsibility

and the tax collection, hence to avoid the potential endogeneity problem the first lag of this variable is considered.

(vi) FRBM Dummy

Implementation of FRBMA has influenced states' finances. This induces state governments to increase their revenue and reducing their expenditure. The implementation year of FRBMA varies for each state (Appendix, A4). A dummy has been constructed to indicate the implementation of FRBMA for each state. It takes value of 1 for year of FRBMA implementation and onwards. It is 0 otherwise. This variable indicates the regime change. It is expected to improve the tax efficiency i.e. negative sign is expected between FRBM dummy and tax inefficiency.

(vii) Division of a State

Total number of districts represents the division inside a state. As the geographical boundaries of states and districts (within a state) have been subject of change over time, hence this variable gives important information. This variable is used as control variable in explaining link between federal transfers and political variables.

#### **4.4. Political Variables**

Political parties serve as the link between the state and the civil society. Economic and institutional factors, influenced by the form and ideology of ruling party, operate in a political environment. Hence political approach along with other economic and institutional determinants can help to explain the variation in the tax revenue and state inefficiency to collect taxes. In order to capture the effect of political environment on the fiscal actions of the States, following measure of political influence has been defined:

(a) *Dummy indicating same party at the centre and state*: A dummy variable is constructed to indicate whether the central and state governments are same or not. This variable is constituted in the following way. If the ruling party at state level in the form of single party or any member party of the coalition is same as the ruling central government, either as a single party government or as a part of the coalition at the centre level, then we consider that parties at central and state level as the same. Then this dummy variable is assigned the value of 1. It is 0 otherwise. The expected relationship of this variable and the tax inefficiency is positive. A state government might exhibit lower efficiency in tax collection in a hope to receive more transfers and other benefits if ruling party in state is same as the ruling party in central government.

(b) *Effective Number of Parties at the State level*: Indicating electoral competition within the state this variable is defined as the effective number of parties in the state assembly w. r. t. seats won.

$$ENP_S = \left[ \sum_{i \in P} \left( \frac{S_i}{\sum_{j \in P} S_j} \right)^2 \right]^{-1}$$

Where  $ENP_S$  denotes the effective number of parties w. r. t. seats won;  $S_i$  denotes the number of seats won by  $i$ -th party and  $P$  signifies the set of political parties. Higher the electoral completion, higher is expected to be the tax collection, in other words lower tax inefficiency.

(c) *Election Year*: A dummy has been taken to represent the election year in the state. As the functioning of government is diverted due to election in the then current fiscal year, hence this variable might indicate lower tax collection in election year i. e. higher tax inefficiency.

(d) *State's Lobbying Power in Central Government*: This variable is defined as a state's contribution of Lok Sabha seats in forming the ruling government at the centre, either as single party government or coalition government. In other words it can be defined as out of total seats of MPs of ruling party at the central level, how many seats each state contributes. This contribution can be either of ruling party or opposition party at the state level. As this variable represents the link between a state and centre up to some extent which might further indicate behavior of state governments in collecting its taxes. Some studies indicate positive effect of lobbying power a state exercises in central government, over the transfers it receives (Singh and Vashishtha, 2004; Biswas et. al., 2010). With higher representation in the centre government, a state government might exhibit lower efficiency in tax collection in the hope of receiving more transfers.

The descriptive statistics of variables is reported in Table 3. Data indicates the across state variation in all the variables considered in this study over the period of 1992-93 to 2010-11. The total data points for each variable are 266 except urban gini coefficient as data is not available for Haryana for all the years.



**Table 3: Summary Statistics**

| <b>Variable</b>   | <b>Observations</b> | <b>Mean</b> | <b>Std. Deviation</b> | <b>Min.</b> | <b>Max.</b> |
|---|---------------------|-------------|-----------------------|-------------|-------------|
| <b>Dependent Variable<sup>7</sup></b>                             |                     |             |                       |             |             |
| Ratio of Own Tax Revenue to GSDP (current)                        | 266                 | 0.07        | 0.02                  | 0.03        | 0.10        |
| <b>Independent Variables to estimate Tax Capacity<sup>7</sup></b> |                     |             |                       |             |             |
| Per Capita GSDP (in Rs.)  | 266                 | 26555.74    | 12970.58              | 4584.43     | 66199.20    |
| Agriculture Share in GSDP (in %)                                  | 266                 | 25.16       | 8.31                  | 8.14        | 42.44       |
| Literacy Rate (in %)  | 266                 | 65.66       | 11.58                 | 39.30       | 93.69       |
| Labor Force (per '000)  | 266                 | 41.96       | 5.33                  | 28.50       | 52.80       |
| Road Density (Km. per Sq. Km.)                                    | 266                 | 1.13        | 0.94                  | 0.04        | 5.27        |
| Urban Gini  | 249                 | 32.92       | 3.28                  | 23.50       | 47.96       |
| <b>Other Variables</b>  |                     |             |                       |             |             |
| Ratio of Transfers net of loan to Rev. Receipts                   | 266                 | 0.35        | 0.16                  | 0.09        | 0.82        |
| Ratio of Total Expenditure to GSDP (Current)                      | 266                 | 0.17        | 0.03                  | 0.11        | 0.26        |
| Ratio of Outstanding Liabilities to GSDP (Current)                | 266                 | 0.33        | 0.10                  | 0.17        | 0.62        |
| Ratio of Debt Repay to Total Rev.                                 | 266                 | 0.23        | 0.13                  | 0.07        | 0.84        |
| Governance Index  | 266                 | -0.01       | 1.25                  | -2.24       | 4.18        |
| FRBMA   | 266                 | 0.33        | 0.47                  | 0           | 1           |
| ENP   | 266                 | 2.94        | 1.02                  | 1.41        | 5.44        |
| State Govt. Share in Central Govt.                                | 266                 | 0.06        | 0.04                  | 0.00        | 0.22        |
| Election Year   | 266                 | 0.20        | 0.40                  | 0.00        | 1.00        |
| Same Party  | 266                 | 0.42        | 0.49                  | 0.00        | 1.00        |
| Number of Districts   | 266                 | 31.4        | 14.5                  | 13          | 83          |

<sup>7</sup> These variables are considered in logarithmic form in the model estimation.

## **5. Political Economy of Inter-governmental Transfers**

Although the transfers by FC were designed to fulfil the goal of equity but some level of discretion is pursued in transfers (Khemani, 2003; Arulampalam et. al. 2008; Biswas et. al. 2010). Plan grants in the form of State Plan Scheme (SPS) transferred by central government are based on a formula decided by National Development Council (NDC). Hence these grants are not considered as discretionary transfers in fiscal literature. On the other hand, grants in the form of CPS and CSS transfers are discretionary as these components are not distributed on the basis of any formula (Bagchi, 2003; Arulampalam et. al. 2008; Biswas et. al. 2010). Similarly central loans are transfers where government has some discretion.

To explore the link between inter-governmental transfers and the political scenario we test if the linkage between state & central government has any effect on the distribution of transfers. For this purpose following categories of transfers are considered: total transfers, total transfers net of central loans, and central loans. A study by Khemani (2003) suggests that intergovernmental transfers across Indian states are influenced by political environment when political agents have decision making authority over the distribution of resources. Singh and Vashishtha (2004) studied the impact of lobbying power of states in central government (also termed as states' bargaining power) on the per-capita transfers. Here states' bargaining power was defined as ratio of a states' representation of MPs in ruling party at the centre to total MPs from that state. Using data for 1983-92 time period authors showed that states with larger bargaining power tend to receive larger per-capita transfers. Arulampalam et. al. (2008) set up a theoretical model to test a hypothesis whether inter-governmental transfers are motivated by political considerations. Using data for the period of 1974-75 to 1996-97 for 14 major Indian states, their study shows that the a state government is likely to receive 16% higher grants (discretionary components of transfers only) if it is both swing in the last state election and aligned with central government. Biswas et. al. (2010) using data for 14 major Indian states for the period of 1974-75 to 2002-03 found positive impact of state lobbying power on its per-capita share of discretionary fund disbursement from centre, where representation of a state in council of ministers at the centre is used as a proxy variable indicating state lobbying power.

A preliminary analysis of linkage between political variables and inter-governmental transfers controlling for other variables is given in Table (4). In model 1 & 2 we consider the total transfers with and without central loans respectively. Both the models show that the presence of same party in the state ruling government and the central government has positive

effect on the share in the total transfers. More the effective number of parties inside a state, lesser are the transfers as indicated by negative and significant relationship in both the models. Hence we can say that inter-governmental transfers, in aggregate, are influenced by the political linkage of a state government with central government up to some extent.

Central loans to states like total transfers are also positively influenced by the same party government at the state and the central level and negatively influenced by effective number of parties in a state. Hence political environment has some effect on transfers and loans.

**Table 4: Relation between Inter-governmental Transfers and the Political Environment (1991-2010): Fixed Effect Panel Data Model**

| Dependent Variable                             | Ratio of Total Transfers to Total Revenue |         | Ratio of Total Transfers(Net of Loans) to Total Revenue |         | Ratio of Central Loans to Total Revenue |         |
|--|---|---------|---|---------|---|---------|
|  | Model 1                                   |         | Model 2   |         | Model 5                                 |         |
|  | Coeff.                                    | p-value | Coeff.  | p-value | Coeff.                                  | p-value |
| Population Density                             | -4.69                                     | 0.75    | 9.17  | 0.43    | -14.28 ***                              | 0.00    |
| Per-capita GSDP (at const. prices in billions) | -0.01                                     | 0.42    | -0.02 *   | 0.08    | 0.01 *                                  | 0.09    |
| No. of Districts                               | 0.002                                     | 0.42    | 0.002   | 0.32    | 0.00                                    | 0.86    |
| Election Year                                  | -0.005                                    | 0.72    | -0.002  | 0.87    | -0.00                                   | 0.49    |
| States' lobbying power in Central Govt.        | -0.11                                     | 0.56    | -0.13   | 0.37    | 0.02                                    | 0.72    |
| Same Party                                     | 0.04 ***                                  | 0.00    | 0.02 **   | 0.04    | 0.02 ***                                | 0.00    |
| ENP  | -0.03 ***                                 | 0.00    | -0.02 **  | 0.02    | -0.01 **                                | 0.01    |
| N  | 280                                       |         | 280   |         | 280                                     |         |
| R-Sq Overall                                   | 0.17                                      |         | 0.43  |         | 0.31                                    |         |
| F-Statistics                                   | 4.61                                      |         | 3.45  |         | 28.63                                   |         |
| P-value  | 0.00                                      |         | 0.00  |         | 0.00                                    |         |

Note: 1) P-value is given in the parentheses. \*\*\*p<0.01, \*\*p<0.05, \*p<0.1;  
2) Time dummies have been taken in each of the model.

## 6. Computation of Tax Capacity and Tax Effort: Individual States

In this section tax capacity and tax effort is estimated for 14 major Non-Special category States over the period of 1992-93 to 2010-11.

The problem of endogeneity can arise due to following reasons. First, our independent variable inter-governmental transfer itself has been influenced by political environment (Table 4). Second, mentioned in Section (2.2) revenue raising ability was one of the important criteria to determine federal transfers to each state. Hence there can be bi-directional causality. Third, as indicated by literature there can be bi-direction causality between tax revenue and total expenditure of states (Section 4.3). Fourth, outstanding liabilities can be affected by expenditure and tax revenue at the same time. Hence to avoid this problem of endogeneity first lag of fiscal variables (including total transfers net of loan) is taken.

The estimation results for parameters of *own tax revenue* of States using stochastic frontier approach are presented in Table (5). Different specifications of the model have been applied to check the robustness of the results<sup>8</sup>. In all the models time dummies have been included. All the models differ with respect to the variable inclusion in the inefficiency equation except third model where urban gini is added to investigate its effect in measurement of tax capacity. First two models differ as governance index is included the second specification. In the fourth and fifth specification all variables other than urban gini are included. These two specifications differ as two variables outstanding liabilities and debt repayment are included interchangeably.

The magnitude of the parameters does not vary much across different specifications except for some variables. Also the sign and significance of parameters is more or less robust. Model 3 indicates that the urban income inequality leads to higher tax collection but its effect is insignificant. As the data for urban gini coefficient is not available for the whole period of study, the observations fall from 266 to 249. But sign of all other coefficients are robust to inclusion of this variable. While estimation of fifth model has been used to compute tax effort indices of the states over the years, the results of other three specifications have been reported to show the robustness of the outcomes.

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<sup>8</sup>Variables namely urban population and per-capita power consumption have been removed from the analysis due their very high and significant correlation with the proportion of agricultural GSDP.

Tax collection is positively and significantly related with per-capita GSDP suggesting that larger tax base as shown by higher per-capita GSDP leads to higher tax collection. One percentage change in per-capita GSDP leads to 2.01 percent change in tax-GSDP ratio (Model 5). The square term of this variable is negative and statistically significant in all five models. Hence at higher levels of per-capita GSDP the elasticity of tax-GSDP ratio declines suggesting that tax-GSDP ratio increases at decreasing rate. The coefficient of share of agriculture GSDP is negative and statistically significant in all the models as expected. This negative relationship suggests that large size of agriculture sector has negative impact on tax collection which could be due to exemptions and lower incomes in this sector. Literacy rate, a sign of development and awareness, has a positive and significant association with tax-GSDP ratio in the fifth model. It could be due to higher incomes or compliance among literate population. Hence literacy rate is an important variable to explain the taxation capacity of a state. The proportion of labor force displays a positive and significant association with tax-GSDP ratio in all the models. Larger labor force improves the tax base which further leads to higher tax collection. Same holds true for road density which represents infrastructure availability and has positive and significant association with tax-GSDP ratio.

### **6.1. Interpreting the Inefficiency Equation<sup>9</sup>**

It turns out that in all five models the lambda parameter is statistically significant, which indicates the presence of technical inefficiency. We estimate technical inefficiency after controlling for real per-capita GSDP, structural variables like share of agricultural sector, and economic variables like literacy rate, road length and labour force that affect tax potential of a state. Next, we include a number of variables affecting technical inefficiency itself. The sign and significance of the parameters in inefficiency equation is robust to inclusion or exclusion of variables. In all the specifications, effect of fiscal variables indicated that the central transfers to States are positively and significantly related with the inefficiency in tax collection which indicates that central transfers up to some extent substitute States' own tax collection. One percentage point increase in central transfers (net of loan) to total revenue receipts ratio leads to 1.80 percentage point increase in the inefficiency (model 5). The sign and significance of this parameter is robust to inclusion of other variables in rest of the models.

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<sup>9</sup> The dependent variable in inefficiency equation is the *Tax Inefficiency*. The coefficients in this equation are also interpreted as effect on *efficiency*. Hence variables with positive (negative) effect on inefficiency are explained to have negative (positive) effect on efficiency.

**Table 5: Simultaneous Estimation of Tax Revenue and Technical Inefficiency: Stochastic Frontier Approach (1992-93 to 2010-11)**

| Dependent Variable: Ln (Ratio of Total Own Tax Revenue to GSDP)    | Model 1  |         | Model 2   |         | Model 3   |         | Model 4  |         | Model 5  |         |
|--|----------|---------|-----------|---------|-----------|---------|----------|---------|----------|---------|
|  | Coeff.   | p-value | Coeff.    | p-value | Coeff.    | p-value | Coeff.   | p-value | Coeff.   | p-value |
| Ln PC Real GSDP  | 2.39***  | 0.00    | 1.97***   | 0.00    | 2.82***   | 0.00    | 1.51***  | 0.00    | 2.01***  | 0.00    |
| Sq (Ln PC Real GSDP)   | -0.14*** | 0.00    | -0.12***  | 0.00    | -0.17***  | 0.00    | -0.09*** | 0.00    | -0.12*** | 0.00    |
| Ln (Agriculture share in GSDP)                                     | -0.06*   | 0.07    | -0.07**   | 0.04    | -0.07**   | 0.02    | -0.06**  | 0.04    | -0.07**  | 0.02    |
| Ln (Literacy Rate)   | 0.09     | 0.45    | 0.29**    | 0.02    | 0.09      | 0.36    | 0.24**   | 0.03    | 0.24**   | 0.04    |
| Ln(Labor Force)  | 0.35***  | 0.00    | 0.28***   | 0.00    | 0.51***   | 0.00    | 0.25***  | 0.00    | 0.20**   | 0.02    |
| Ln(Road Density)   | 0.03*    | 0.07    | 0.02      | 0.25    | 0.06***   | 0.00    | 0.04**   | 0.01    | 0.04**   | 0.03    |
| Ln (Urban gini)  | -        |         |           |         | 0.11      | 0.18    |          |         |          |         |
| Constant   | 13.64*** | 0.00    | -12.08*** | 0.00    | -16.15*** | 0.00    | -9.90*** | 0.00    | 12.00*** | 0.00    |
| <b>Inefficiency Equation</b>                                       |          |         |           |         |           |         |          |         |          |         |
| (Ratio of Transfers net of loan to Rev. Receipts) <sub>t-1</sub>   | 2.21***  | 0.00    | 1.84***   | 0.00    | 2.53***   | 0.00    | 2.00***  | 0.00    | 1.80***  | 0.00    |
| (Ratio of Total Expenditure to GSDP(current)) <sub>t-1</sub>       |          |         |           |         | -1.84***  | 0.00    | -1.50*** | 0.00    | -2.32*** | 0.00    |
| (Ratio of Outstanding Liabilities to GSDP(current)) <sub>t-1</sub> |          |         |           |         |           |         |          |         | 0.66***  | 0.00    |
| (Ratio of Debt Repay to Total Rev) <sub>t-1</sub>                  |          |         |           |         |           |         | 0.39***  | 0.00    |          |         |
| (Governance Index) <sub>t-1</sub>                                  |          |         | -0.06***  | 0.00    | -0.03**   | 0.04    | -0.04*** | 0.00    | -0.04*** | 0.00    |
| FRBMA  | -0.12*** | 0.00    | -0.10***  | 0.00    | -0.06*    | 0.09    | -0.07**  | 0.02    | -0.05*   | 0.09    |
| ENP  | -0.04*** | 0.01    | -0.04***  | 0.00    | -0.06***  | 0.00    | -0.04*** | 0.00    | -0.04*** | 0.01    |
| State Govt. Share in Central Govt.                                 | -0.13    | 0.58    | 0.08      | 0.71    | 0.06      | 0.80    | 0.00     | 0.99    | 0.07     | 0.75    |
| Election Year  | 0.01     | 0.57    | 0.02      | 0.37    | 0.01      | 0.63    | 0.01     | 0.55    | 0.02     | 0.33    |
| Same Party   | -0.01    | 0.80    | -0.01     | 0.77    | 0.03      | 0.15    | 0.01     | 0.52    | 0.01     | 0.66    |
| Constant   | -0.38*** | 0.00    | -0.26***  | 0.00    | -0.14*    | 0.08    | -0.20*** | 0.01    | -0.10    | 0.17    |
| N  | 266      |         | 266       |         | 249       |         | 266      |         | 266      |         |
| Log-Likelihood   | 208.8    |         | 218.9     |         | 231.5     |         | 241.2    |         | 240.7    |         |
| sigma_u  | 0.08***  | 0.00    | 0.06***   | 0.01    | 0.11***   | 0.00    | 0.05**   | 0.01    | 0.06**   | 0.04    |
| sigma_v  | 0.09***  | 0.00    | 0.09***   | 0.00    | 0.04***   | 0.00    | 0.09***  | 0.00    | 0.09***  | 0.00    |
| Lambda   | 0.94***  | 0.00    | 0.68***   | 0.00    | 2.50***   | 0.00    | 0.52***  | 0.00    | 0.68***  | 0.00    |

Note: 1) P-value is given in the parentheses. \*\*\*p<0.01, \*\*p<0.05, \*p<0.1;

2) Time dummies have been taken in each of the model.

Proportion of expenditure to GSDP has negative and significant impact on inefficiency as expected. One percentage point increase in total expenditure to GSDP ratio leads to -2.32 percentage point decrease in the inefficiency. Larger expenditure responsibilities of a government call for more tax collection and hence less technical inefficiency in tax collection.

Comparing fourth and fifth model we can see that the outstanding liabilities and debt repayment both raise inefficiency of states. While one percentage point increase in debt repayment to total revenue ratio leads to 0.39 percentage point increase in the inefficiency, same increase in outstanding liabilities increase inefficiency by 0.66 percentage points. Hence debt repayment causes lesser inefficiency than outstanding liabilities as indicated by lower magnitude of the coefficient. This might indicate the positive effect of an attempt to improve state finances.

The governance index has negative and significant impact on inefficiency in tax collection. It implies that better governance in general reduces inefficiency in tax collection by States. Econometric analysis also reveals that FRBMA Act, which is aimed to achieve fiscal discipline among states, has contributed to reduce their inefficiency in tax collection.

While observing the effect of political environment on tax inefficiency, only one variable, effective number of political parties (ENP), effects tax inefficiency with negative and significant sign. More competition among political parties may be making them more accountable and efficient, raising tax effort of the state government. Other variables do not have any significant effect on the inefficiency in tax collection, although we saw that other political variables affect transfers (with and without central loans) that in turn affect tax effort.

## **6.2. Tax Effort Index**

The fifth model from Table (5) has been chosen to compute the tax effort. Table (6) reports the estimates of tax effort scores and ranks of states for the years 1992, 2001 and 2010. Figure (2) presents state-wise trends in tax efficiency score during the period 1992 to 2010 and Table (7) presents the comparison of tax efficiency score before and after the implementation of FRBMA.

**Table 6: Tax Effort Index and Rank of States: SFA Approach (1992, 2001, 2010)**

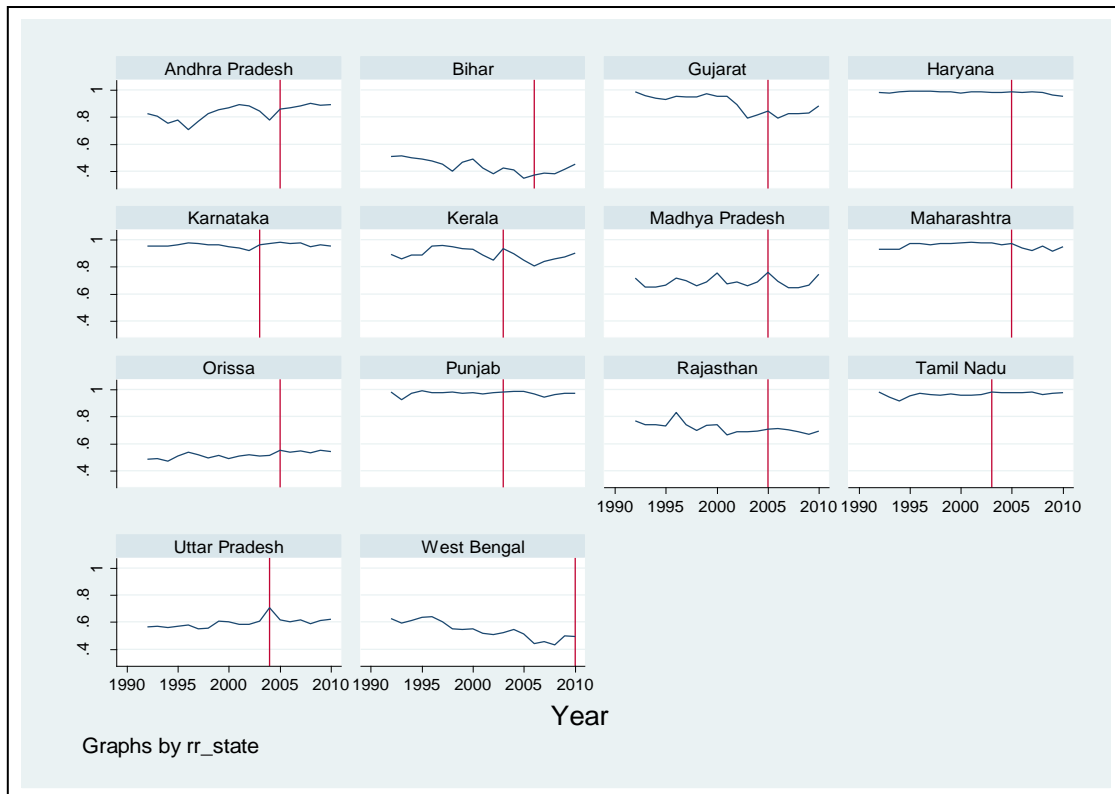
| State          | 1992  | Rank | 2001  | Rank | 2010  | Rank |
|----------------|-------|------|-------|------|-------|------|
| Andhra Pradesh | 0.83  | 8    | 0.89  | 7    | 0.89  | 7    |
| Bihar          | 0.51  | 13   | 0.42  | 14   | 0.45  | 14   |
| Gujarat        | 0.986 | 1    | 0.95  | 5    | 0.88  | 8    |
| Haryana        | 0.984 | 2    | 0.986 | 1    | 0.95  | 4    |
| Karnataka      | 0.954 | 5    | 0.94  | 6    | 0.95  | 3    |
| Kerala         | 0.89  | 7    | 0.89  | 8    | 0.90  | 6    |
| Madhya Pradesh | 0.72  | 10   | 0.67  | 9    | 0.75  | 9    |
| Maharashtra    | 0.93  | 6    | 0.98  | 2    | 0.95  | 5    |
| Orissa         | 0.48  | 14   | 0.51  | 13   | 0.54  | 12   |
| Punjab         | 0.98  | 3    | 0.97  | 3    | 0.97  | 2    |
| Rajasthan      | 0.77  | 9    | 0.66  | 10   | 0.69  | 10   |
| Tamil Nadu     | 0.98  | 4    | 0.96  | 4    | 0.976 | 1    |
| Uttar Pradesh  | 0.56  | 12   | 0.58  | 11   | 0.62  | 11   |
| West Bengal    | 0.62  | 11   | 0.51  | 12   | 0.49  | 13   |

| Efficiency (1992-2010) |       |
|------------------------|-------|
| Mean                   | 0.78  |
| Std. Dev               | 0.19  |
| Min.                   | 0.34  |
| Max.                   | 0.994 |

Note: Computed using efficiency scores obtained from fifth model in Table 5.

**Figure 2: Trend in the Efficiency Score of States (1992-2010)**



Note: 1) Computed using efficiency scores obtained from fifth model in Table 5.  
 2) Red line shows the year of implementation of FRBMA.



Results show wide variation in index of tax effort among States. The range is 34.0% to 99.4% over a period of 19 years. As per these estimates we see that the States near 100% of tax effort are Gujarat, Karnataka, Maharashtra, Punjab, Haryana and Tamil Nadu. States showing very low tax effort are Orissa, Bihar, West Bengal and Uttar Pradesh. As indicated earlier these are the states which receive larger central transfers. Except Bihar and West Bengal the other two states show an improvement over the years with short run fluctuations. Among rest of the states Andhra Pradesh has improved their tax effort over the years.

Apart from analysing various factors effecting tax inefficiency at sub-national level in Table (5), we also study extent of disparity in tax efficiency among states over time. The presence of disparities in tax efficiency score reported in Figure (2) and Table (6) motivates to investigate whether the extent of disparity is declining over time.

**Table 7: Sigma convergence in Tax Efficiency Score**

| <b>Dependent Variable:</b> Standard Deviation of Tax efficiency score | Std.           |       |              |      |
|---|----------------|-------|--------------|------|
|   | Coefficient    | Error | t-statistics | P> t |
| Year  | 0.01**         | 0.00  | 3.30         | 0.00 |
| Year_square   | -0.0001*       | 0.00  | -2.95        | 0.00 |
| Constant  | 0.13           | 0.03  | 4.48         | 0.00 |
| Number of Observations  | 19             |       |              |      |
| R-Sq Overall  | 0.54           |       |              |      |
| F-Statistics (p-value)  | 9.30*** (0.00) |       |              |      |

Note: 1) Computed using cross section Ordinary Least Square (OLS) estimates.

2) P-value is given in the parentheses. \*\*\*p<0.01, \*\*p<0.05, \*p<0.1;

For this purpose we study the standard deviation of tax efficiency over time, also termed as the sigma-method of convergence. To obtain trend via sigma-convergence we compute regression coefficient of standard deviation on time and square of time. If states are converging over time with respect to their tax effort score then standard deviation should decline over time and vice-versa. Positive and significant coefficient of time variable 'Year' (Table, 8) indicates that states show divergence in tax efficiency score. Also, note that the coefficient of 'Year\_square' is negative and significant. Thus, standard deviation of tax efficiency across states is increasing at a decreasing rate over time. Figure (2) shows long term developments in the form of short term fluctuations in the tax efficiency score for each state. It indicates that states with high performance are consistent in their performance over time, whereas the less performing states show wide fluctuations in tax efficiency scores. Hence less performing states are not catching upto the level of better performing states.

## 7. Conclusion

Constitution divides the revenue and expenditure responsibilities between centre and state governments. States' own tax revenue is the one of the important tools to finance their expenditure responsibilities. It constitutes sales tax; taxes on land revenue & agricultural income; taxes on mineral rights; taxes on profession, trades, & callings; and taxes on the consumption of electricity etc. Sales tax is an indirect tax and forms the majority of revenue of Indian states. This paper empirically estimates the own tax capacity and tax effort of 14 Indian states for the period of 1992-2010 using SFA and a comprehensive panel data set. SFA is an improvement over traditional approaches to measure tax capacity such as RTS and aggregate regression approach. It allows us not only to compute the tax effort index but also to study the factors affecting tax inefficiency. The present study also uses comprehensive data on factors which can be broadly put in following categories: structural variables, political variables, economic variables and governance variables. Tax effort index is constructed to measure the gap between estimated tax capacity and actual tax revenue. While tax capacity is the maximum potential tax revenue that a government can generate, tax effort indicates what part of maximum potential revenue a state has generated. Our results indicate that the tax capacity is influenced not only by its tax base but also by economic, demographic, infrastructure, political variables, index for administration & governance and fiscal incentive variables. Different models are estimated to ensure robustness of the results.

Variables included have expected effect on the tax collection of the states. Tax revenue varies positively and significantly with the per capita GSDP (in real terms) which is considered as tax base for states. But share of agriculture adversely effects the tax collection. Variables like labour force, literacy rate and infrastructure have positive and significant influence on tax collection.

There is large variation in tax effort of individual states. States with consistently higher level of tax efficiency are Haryana, Punjab, Karnataka, Kerala and Maharashtra. Low tax efficiency score was observed in Bihar, Orissa, Uttar Pradesh and West Bengal. Inequality in tax efficiency among states, measured by standard deviation, has increased over time.

Tax effort/efficiency of a state is adversely influenced by the magnitude of transfers it receives from the central government. In other words these transfers substitute the own tax collection of a state up to some extent. Higher outstanding liabilities of a state also have an adverse effect on tax efficiency. Effect of debt repayment is also adverse but is less adverse

as compared to the effect of outstanding liabilities, implying reducing dependence on union transfers and efforts to reduce the outstanding liabilities over time would increase tax effort. Higher government expenditure has a favourable effect on tax efficiency. Among other variables, law and order index, considered as a proxy for administration and governance, has a favourable effect on tax efficiency. Although the large size of agricultural sector reduces overall tax collection, high literacy rate and infrastructural facilities increase tax collection. Implementation of FRBMA has had a favourable effect on tax efficiency. During TWFC fiscal incentives in terms of availing DCRF and debt write off facility to state governments were made conditional upon implementation of FRBMA and all state governments were given autonomy to design their FRLs. As tax efficiency shows better results during FRBMA regime, hence we can say that FRBMA, a self-sustaining rule which aims to bring down primary & fiscal deficit and reduce the debt liabilities, has helped states improve their tax collection.

Political variables did not give conclusive results, although the effective number of parties with respect to seats won, which indicates political competition inside a state, has a favourable effect on the tax efficiency. But the same party at the centre and the state tends to increase transfers to states, and the latter reduces tax efficiency. States with more political competition have a better tax effort. Decreasing the centre's discretion would also improve states tax effort.

There exists disparity in tax effort across states and it is widening over time. Conditional benefits of DCRF and the debt write-off scheme attached with implementation of FRBMA improved the tax effort of states, but the absence of convergence suggests these effects have not been large enough. Therefore the elements of conditional transfers and debt write offs should be increased in future Finance Commission awards. Since more development, better infrastructure and governance improve tax effort, transfers can also be made conditional on expenditure in areas like health, education, sanitation, and infrastructure that contribute to development. This would also help the Finance Commission move back to its original constitutional mandate of providing uniform public services through the country. The imposition of planning soon after independence led to a dilution of this mandate (Goyal, 2013).

Transfers have to be accompanied by discipline otherwise they motivate the weaker states to remain weak and underprovide the public services the transfers are made to finance. Such

conditionality should also accompany other types of transfers, even as the share of discretionary transfers is reduced. This would also increase the share of formula based transfers such as the Finance Commissions award. Incentive mechanisms work best when isolated from political renegotiation. The Centre should absorb less of the risk of market borrowings by states, so market discipline also contributes. One of our results is larger expenditure responsibilities are followed by higher tax effort. To the extent conditional transfers maintain expenditure their effect on weakening expenditure and lowering tax effort would be reduced. More research is required on the extent to which states met FRBM targets by reducing expenditure, and how to ring fence productive expenditure.

Conditionality in transfers can reduce freedoms for states. At present tight restrictions on end use and delays in sanctions reduce the utility of the transfers for states. But conditionality and better local projects are consistent if transfers are made more time-bound and outcome rather than use based. The changes have to be gradual and in step with local capacity creation to deliver outcomes.

Strengthening of factors associated with better tax collection is a long term process. Nevertheless a sharper identification of the variables that affect these factors, allows policies to better target these variables, so that improvements, such as in per-capita GSDP which is the overall tax base, take place faster.

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## Appendices

**Table A1: Criteria of FC Transfers**

| Finance Commission | Criteria   |          |                   |               |                       |      |                         |            |                   |                          | Applicable to                       |
|--------------------|------------|----------|-------------------|---------------|-----------------------|------|-------------------------|------------|-------------------|--------------------------|-------------------------------------|
|                    | Population | Distance | Inverse of Income | Poverty Ratio | Index of Backwardness | Area | Index of Infrastructure | Tax Effort | Fiscal Discipline | Fiscal Capacity Distance |                                     |
| Eighth             | 25         | 50       | 25                | -             | -                     | -    | -                       | -          | -                 | -                        | 90% of Shareable IT                 |
| Ninth (I report)   | 25         | 50       | 12.5              | 12.5          | -                     | -    | -                       | -          | -                 | -                        | 40% of UED                          |
| Ninth (II report)  | 25         | 50       | 12.5              | -             | 12.5                  | -    | -                       | -          | -                 | -                        | 90% of Shareable IT                 |
|                    | 29.94      | 40.12    | 14.97             | -             | 14.97                 | -    | -                       | -          | -                 | -                        | 37.575% of UED                      |
| Tenth              | 20         | 60       | -                 | -             | -                     | 5    | 5                       | 10         | -                 | -                        | 100% of Shareable IT and 40% of UED |
| Eleventh           | 25         | 50       | -                 | -             | -                     | 10   | -                       | 7.5        | 7.5               | -                        | -                                   |
| Twelfth            | 10         | 62.5     | -                 | -             | -                     | 7.5  | 7.5                     | 5          | 7.5               | -                        | -                                   |
| Thirteenth         | 25         | -        | -                 | -             | -                     | 10   | -                       | -          | 17.5              | 47.5                     | -                                   |

Source: Finance Commission (2000, 2004, 2009)

**Table A2: Criteria for PC Transfers: Gadgil Formula**

|           | <b>Criteria</b>  | <b>Modified Gadgil Formula (1980)</b>                  | <b>NDC Revised Formula (1990)</b>                      | <b>NDC Revised Formula (1991)</b>                      |
|-----------|--|--|--|--|
| <b>A.</b> | <b>Special Category States (10)</b>  | 30% share of 10 States excluding North Eastern Council | 30% share of 10 States including North Eastern Council | 30% share of 10 States excluding North Eastern Council |
| <b>B.</b> | <b>General Category States (15)</b>  |  |  |  |
| (i)       | Population (1971)  | 60   | 55   | 60   |
| (ii)      | Per Capita Income  | 20   | 25   | 25   |
|           | <i>Of which</i>  |  |  |  |
| a.        | According to the 'deviation' method covering only the states with per capita income below the national average | 20   | 20   | 20   |
| b.        | According to the 'distance' method covering all the fifteen states   | -  | 5  | 5  |
| (iii)     | Performance  | 10   | 5  | 7.5  |
|           | <i>Of which</i>  |  |  |  |
| a.        | Tax effort   | 10   | -  | 2.5  |
| b.        | Fiscal management  | -  | 5  | 2.5  |
| c.        | National objectives  | -  | -  | 2.5  |
| (iv)      | Special problems   | 10   | 15   | 7.5  |
|           | <b>Total</b>   | <b>100</b>   | <b>100</b>   | <b>100</b>   |

**Notes:** 1. Fiscal management is assessed as the difference between states' own total plan resources estimated at the time of finalizing Annual Plans and their actual performance, considering latest five years.

2. Under the criterion of the performance in respect of certain programmes of national priorities the approved formula covers four objectives, viz.: (i) population control; (ii) elimination of illiteracy; (iii) on-time completion of externally aided projects; and (iv) success in land reforms.

**Source:** PC(2012).

**Table A3: PCA Results**

| <b>Correlation Coefficient Before Applying PCA</b> |         |              |             |               |
|--|---------|--------------|-------------|---------------|
| <b>Variable</b>                                    | Pol_Str | Rec_Pencourt | Rec_cr_rate | Val_prpty_rec |
| Pol_Str  | 1       |              |             |               |
| Rec_Pencourt                                       | 0.048   | 1            |             |               |
| Rec_cr_rate  | 0.23*** | -0.13**      | 1           |               |
| Val_prpty_rec                                      | 0.25*** | 0.43***      | 0.14**      | 1             |

Note: 1) P-value is given in the parentheses. \*\*\*p<0.01, \*\*p<0.05, \*p<0.1;  
 Abbreviations: Pol\_Str : Police Strength w. r. t. Population;  
 Rec\_Pencourt: Reciprocal of IPC Pendency Rate of Court;  
 Rec\_cr\_rate : Reciprocal of Crime Area Rate; and  
 Val\_prpty\_rec: Proportion of Value of stolen Property Recovered.

| <b>Weights Assigned in PCA</b> |             |             |             |             |
|--------------------------------|-------------|-------------|-------------|-------------|
| <b>Variable</b>                | Component 1 | Component 2 | Component 3 | Component 4 |
| Pol_Str                        | 0.46        | 0.44        | -0.75       | 0.15        |
| Rec_Pencourt                   | 0.5         | -0.56       | 0.12        | 0.64        |
| Rec_cr_rate                    | 0.24        | 0.69        | 0.61        | 0.29        |
| Val_prpty_rec                  | 0.68        | -0.13       | 0.2         | -0.69       |

Abbreviations: Pol\_Str : Police Strength w. r. t. Population;  
 Rec\_Pencourt: Reciprocal of IPC Pendency Rate of Court;  
 Rec\_cr\_rate : Reciprocal of Crime Area Rate; and  
 Val\_prpty\_rec: Proportion of Value of stolen Property Recovered.

**Table A4****State-wise Year of Implementation of FRBMA**

| State          | Year of Implementation of FRBMA             |
|----------------|---|
| Andhra Pradesh | October 2005                                |
| Bihar          | April 2006                                  |
| Gujarat        | March 2005                                  |
| Haryana        | July 2005                                   |
| Karnataka      | August 2002 (came into force on April 2003) |
| Kerala         | September 2003                              |
| Madhya Pradesh | August 2005                                 |
| Maharashtra    | April 2005                                  |
| Orissa         | May 2005                                    |
| Punjab         | May 2003                                    |
| Rajasthan      | May 2005                                    |
| Tamil Nadu     | May 2003                                    |
| Uttar Pradesh  | February 2004                               |
| West Bengal*   | 2010  |

Source: Misra and Khundrakpam (2009), RBI Staff Studies.

\* Government of West Bengal (2011)

**Table A5: Variable List**

| <b>Fiscal Variables</b>                                      |   |             |
|--|---|-------------|
| <b>Variable</b>  | <b>Data Source</b>  | <b>Year</b> |
| 1. Total Revenue Receipts                                    | 1. Reserve Bank of India (2004, 2010): Handbook of Statistics on State Government Finances.<br><br>2. Reserve Bank of India (2012): State Finances: A Study of Budgets of 2011-12.  | 1991 - 2010 |
| 2. Total Expenditure   |   |             |
| 3. Total Outstanding Liabilities                             |   |             |
| 4. Total Own Tax Revenue                                     |   |             |
| 5. Various Components of Total Tax Revenue                   |   |             |
| 6. Total Transfers and its various Components                |   |             |
| <b>Governance Index</b>                                      |   |             |
| 7. Total Cognizable Crimes under IPC                         | Crime in India, National Crime Records Bureau, Ministry of Home Affairs, Government of India. (20 Reports referred for years from 1991-2010)  | 1991 - 2010 |
| 8. Value of Property Recovered as a ratio to Property Stolen |   | 1991 - 2010 |
| 9. Pendency Rate of Crimes by Courts                         |   | 1993 - 2010 |
| 10. Police Strength  |   | 1991 - 2010 |
| <b>Political Variables</b>                                   |   |             |
| 11. ENP  | 1.) Kaushik, A. and R. Pal (2012): "Political Strongholds and Budget Allocation for Developmental Expenditure: Evidence from Indian States, 1971-2005". Working Paper, IGIDR, WP-2012-015.<br><br>2.) <a href="http://www.elections.in/">http://www.elections.in/</a> | 1991 - 2010 |
| 12. Dummy for Election Year                                  | <a href="http://www.elections.in/">http://www.elections.in/</a>   | 1991 - 2010 |
| 13. Same Party   |   | 1991 - 2010 |
| 14. State's share in Central Govt.                           |   | 1991 - 2010 |

| <b>Other Control Variables</b> |   |             |
|--------------------------------|---|-------------|
| 15. FRBM                       | Reserve Bank of India (2010): Handbook of Statistics on State Government Finances   | 1991 - 2010 |
| 16. Total Population           | Census of India, 1991, 2001, 2011   | 1991 - 2010 |
| 17. Urban Population           |   | 1991 - 2010 |
| 18. Literacy Rate              |   | 1991 - 2010 |
| 19. Labour Force               | India-Employment and Unemployment Report, NSSO, Government of India. (Reports referred for various years from 1991-2010)  | 1992-2010   |
| 20. Urban Gini                 | Das et. al. (2010): “Regional Convergence of Growth, Inequality and Poverty in India-An Empirical Study”, Economic Modelling, 27, pp.1054-1060.   | 1991 - 2010 |
| 21. Road Density               | 1.) Basic Road Statistics of India 2004-05, 2005-06, 2006-07, 2007-08, Government of India, Ministry of Road and Transport Highways,<br>2.) <a href="http://www.indiastat.com/">http://www.indiastat.com/</a> | 1991 - 2010 |
| 22. Power Sold                 | EPW Research Foundation,<br><a href="http://www.epwrfits.in/">http://www.epwrfits.in/</a>   | 1991 - 2010 |
| 23. Agriculture GSDP           |   | 1991 - 2010 |
| 24. Total GSDP                 |   | 1991 - 2010 |

## **List of Abbreviations**

|       |  |
|-------|--|
| ACIR  | Advisory Commission on Intergovernmental Relations |
| CSS   | Centrally Sponsored Scheme                         |
| DCRF  | Debt Consolidation and Relief Facility             |
| EFC   | Eleventh Finance Commission                        |
| FC    | Finance Commission                                 |
| FRBMA | Fiscal Responsibility and Budget Management Act    |
| GDP   | Gross Domestic Product                             |
| GSDP  | Gross State Domestic Product                       |
| MTRFP | Medium Term Fiscal Restructuring Policy            |
| MP    | Member of Parliament                               |
| NDC   | National Development Council                       |
| NSSF  | National Social Security Fund                      |
| NSSO  | National Sample Survey Organisation                |
| NCRB  | National Crime Records Bureau                      |
| NFC   | Ninth Finance Commission                           |
| NPG   | Non Planning Grant                                 |
| PC    | Planning Commission                                |
| PCA   | Principal Component Analysis                       |
| RBI   | Reserve Bank of India                              |
| RTS   | Representative Taxation System                     |
| SFA   | Stochastic Frontier Analysis                       |
| TFC   | Tenth Finance Commission                           |
| THFC  | Thirteenth Finance Commission                      |
| TWFC  | Twelfth Finance Commission                         |