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DESIGNING FISCAL TRANSFERS: A NORMATIVE APPROACH

K.R. Shanmugam

and

D.K. Srivastava

MADRAS SCHOOL OF ECONOMICS
Gandhi Mandapam Road
Chennai 600 025
India

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K.R. Shanmugam
Professor
Madras School of Economics,
Gandhi Mandapam Road, Chennai – 600 025, Tamil Nadu, India
shanmugam@mse.ac.in

and

D.K. Srivastava
Director
Madras School of Economics,
Gandhi Mandapam Road, Chennai – 600 025, Tamil Nadu, India
srivastava@mse.ac.in

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MADRAS SCHOOL OF ECONOMICS
Gandhi Mandapam Road
Chennai 600 025
India

Phone: 2230 0304/ 2230 0307/2235 2157
Fax : 2235 4847 /2235 2155
Email : info@mse.ac.in
Website: www.mse.ac.in

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Abstract

The successive Finance Commissions have adopted an approach where the assessment of tax revenues of the states is determined on the past performance and there is hardly any reference to the efficiency in raising tax revenues. The Planning Commission also uses the age old Gadgil formula. As a result, a continuing widening of regional disparities has taken place in the provision of public services. In order to overcome the flaws in the existing system, this study proposes a normative methodology to determine the transfers from the centre to the state governments. This approach provides a framework for achieving equalization consistent with both efficiency and equity.

Specifying a tax revenue function, this study estimates the tax revenue potentials of 15 major state governments in India and applies them along with a benchmark level of public services to derive the fiscal transfers required so that each state can provide the same amount of services to its people subject to maintaining state level tax effort and efficiency. This study also attempts to correct endogeneity bias that arises due to the impact of the past transfers on current transfers.

Key Words: *Inter government transfers, frontier function, panel data, Indian States*

JEL Codes: D24; H71; L94

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INTRODUCTION

The central problem in determining the fiscal transfers in a federal country like India is to neutralize the adverse incentives inherent in the gap filling approach of transfers. The robust design of the fiscal transfers involves a normative determinant of revenues and expenditures of sub national governments namely State Governments. Theses norms can be defined with respect to average performance of State Governments as well as the Most Efficient Performance.

The Finance Commissions (FCs) in India have typically used an approach where the assessment of tax revenues of the States is determined based on the past performance. There is hardly any reference to efficiency in raising tax revenues. The Planning Commission also distributes the Central government's assistance in the form of grants and loans among (non-special category) States using the Modified Gadgil formula. In the schemes of Central transfers to the States, the poor States are being given larger shares. The successive Finance Commissions had written off part of States' debt or reschedule of repayments of it every five years from the 5^{th} Finance Commission onwards. Despite all these efforts, a steady widening of regional disparities has taken place. These disparities are in Per Capita Government spending, Per Capita transfers (in per capita terms), growth rates etc.

This paper proposes a methodology where a normative approach to determine the tax revenues and cost of providing public services of the States for the purpose of fiscal transfers can be framed with reference either to the performance at average level or to the Most Efficient Level.

A normative approach to fiscal transfers is normally designed with reference to the principle of equalization as it is consistent with both efficiency and equity. There are two well-established models of equalization, i.e., respectively in Canada and Australia. In both cases, potential tax revenues need to be determined of the different States. In the Canadian case, the tax-by-tax approach is followed and the potential tax revenue is calculated with reference to the average tax effort. There is no reference to the efficiency consideration. In the Australian approach, the efficiency considerations are also not brought in.

The 7th Finance Commission carried out a regression exercise in order to explain the main determinants of tax revenues of States and found the aggregate SDP (State Domestic Product) in current prices as the major determinant. This was a beginning of the use of the distance formula in the Finance Commission Works. However, the 7th Finance Commission did not directly use the regression in determining transfers. The only commission where the Representative Tax System (RTS) approach to some extent used was the 9th Finance Commission. The subsequent commissions had used only the GSDP (Gross State Domestic Product) at current prices as the determinant of taxable capacity and used it in a buoyancy-based measure to the assessment of the tax revenues.

The major problem associated with the RTS and other approaches such as Aggregate Regression (AR) is that the taxable capacity that is derived using the regression method (i.e., OLS) is closer to the average rather then maximum or potential tax capacity. Moreover the difference between tax ratio and taxable capacity is taken as the degree of tax effort. Thus, the tax effort measures the extent to which a sub-nation government uses its taxable capacity.

Given the above fact that the robust design of the fiscal transfers requires a normative determinant of revenues with respect to the most efficient performance, we need to measure the actual tax potential of State Governments. By tax potential, we mean the tax revenues that would result if the State Government uses all its resources and ability to collect all obtainable tax revenues from a given bundles of determinant characteristics of tax revenues. Technically speaking, it is the estimated tax revenues resulting from the regression analysis of the stochastic frontier (tax) function. The tax efficiency score for each State for a given period is the ratio between its actual and potential tax revenues.

In this paper, we attempt to estimate the tax potential and the tax efficiency of the State Governments using State Finances data in India during the post reform period 1993-94 to 2002-03. We incorporate the equity aspect by considering the (bench mark or) equal amount of public services by all State Governments. Then, we explain our methodology of deriving (or predicting) fiscal transfers to State Governments for any given year.

This study contributes to the fiscal transfers literature in two main ways: (i) it demonstrates how the stochastic frontier tax function can be specified and estimated to measure tax potential and efficiency, and (ii) it suggests how the estimates of stochastic tax function (efficiency) results and chosen benchmark (equity) level of public service level can directly be used in designing appropriate transfers formula. Although we use the Indian data to demonstrate our newly designed fiscal transfer system, the model is relevant for other fiscal transfer systems.

The study proceeds as follows. Section 2 explains the methodology of designing fiscal transfers and also the methodology of determining tax potentials of State Governments. The data and model of measuring tax potentials of States are discussed in Section 3. Section 4 deals with the empirical results and also demonstrates how potential tax revenues and chosen level of public services can be used to derive fiscal transfers to State Governments. The final Section 5 provides the concluding remarks.

METHODOLOGY

As indicated earlier, the Australian and the Canadian systems are the two well-established systems of equalization. The former prepares a standard budget, which brings together all expenses and revenue categories of State budgets. The standards are equal to all State averages in expenditures as well as revenues. Any departure from average per capita expenditure needs to be justified on account of cost disabilities. Then, it calculates (i) the per capita expense for each service that the State would incur if it were to provide the average standard of service and (ii) the per capita revenue each State would rise if applied the average revenue effort to its revenue base. The Canadian system uses an elaborate RTS approach where each tax or revenue source is considered individually and the average or representative tax effort is applied to the difference between the standard revenue base and the actual base. Thus, the Australian model looks at both revenue and expenditure sides while the Canadian model makes reference only to equalization in fiscal capacity. Both systems are still grappling with issue of efficiency (Rangarajan and Srivastava, 2004).

Our methodology of determining transfers considers the efficient tax performance, i.e., tax potentials of States and provision of uniform level of public services. Let the current transfers system is being designed to cover the revenue gap. Therefore, the per capita transfer to the State i (T) is the difference between the per capita cost of providing public services (C) and its per capita own revenues (R). In a given base year 0, assuming overall revenue account balance, for each State, $T_0 = C_0 - R_0$. The question is: how much are the additional transfers required in order to provide the benchmark level of public services (C_1) by the given State Government given its T_0, C_0, and R_0?

The provision of benchmark (or uniform) level of public services by each State will ensure the equalization subject to the average own revenue effort. The efficiency aspect can be ensured by considering full tax potential (or average tax potential) of State Government (R_1). Therefore, the percentage change in (per capita) transfers (denoted by lower case letter) is:[1]

$$t = c\frac{C_0}{T_0} - r\frac{R_0}{T_0} \qquad \text{...(1)}$$

Since our methodology requires the efficient tax performance, we can derive the tax potential (or tax efficiency) utilizing the frontier production function models, which identify the agents which operate on the frontier as efficient and others operate below the frontier as inefficient. The efficient agents essentially produce (generate) maximum possible output (revenue) from the current (given) set of inputs while others produce outputs which are less then their potential levels of outputs. The ratio between the actual and potential output is the measure of (technical) efficiency.

In this study, we consider the State as an "agent". The efficiency of a State would essentially mean either improving its own tax revenue by utilizing the current level of resource base or raising the given own tax revenue with less resource base. For any given State, its actual own tax revenue is known. The task is to find the potential tax revenue, which will be used to calculate the efficiency. That is, the appropriate benchmark is required to assess the tax efficiency of a given State. One can use either a

[1] We are thankful to Dr. Peter Griffin for providing valuable suggestions on the designing of this formula.

normatively desired performance or best practice reference as suggested by Farrell (1957).

Farrell's (1957) seminal paper demonstrates how based on the actual (sample) observations the frontier specifies for an agent the maximum amount of output (tax revenue) it can generate given any level of resource base inputs. Consequently, the efficient observation will be positioned on the best practice frontier and distance of an inefficient agent from the best one is the indicator of inefficiency of that agent. He used the Data Envelopment Approach (DEA), which was extended by Aigner and Chu (1968), and Timmer (1971).[2]

Later, Aigner, Lovell and Schmidt (1977), and Meeusen and Broeck (1977) independently developed the stochastic frontier approach (SFA) to measure the efficiency using the cross section data. In this approach, the error term is a composite variable, consisting of the usual random error term and a one-sided residual term (which follows a half normal distribution or truncated normal distribution).[3] The maximum likelihood estimation (MLE) technique is employed to estimate the stochastic frontier function.

The SFA for cross section data suffers from three serious drawbacks. First, the estimated inefficiency is not consistent. One can consistently estimate the (whole) error term for a given observation, but it contains statistical noise as well as tax inefficiency term. The variance of the

[2] The DEA has the following two major limitations: (i) In this approach, all sample units share a common frontier and any variation in the efficiency can be measured relative to this frontier. Hence, this approach ignores any random factors that can influence the efficiency of a sample unit (State), and (ii) the results of this approach are very sensitive to the selection of variables and sample observations.

[3] The second error is non-positive and represents tax inefficiency, i.e., failure to raise potential revenue, given the set of tax bases used. Realized output (tax revenue) is bounded from above by a frontier that includes the deterministic part of the regression plus the part of the error representing noise, so the frontier is stochastic.

distribution of inefficiency term conditional on the composite error term does not vanish when the sample size increase (Jondrow *et al.*, 1982). Second, the estimation of the model and separation of inefficiency from the statistical noise require specific distributional assumptions on the inefficiency term. Finally, it may be incorrect to assume that the inefficiency term is independent of regressors included in the model.[4]

Schmidt and Sickles (1984) introduced the stochastic frontier models for panel data, by taking account the individual (State) effect.[5] The panel data approach is free from above three serious problems. This study utilizes the stochastic frontier approach for panel data to measure the tax efficiency and tax potential.

We start with a simple production function corresponding to actual tax revenue of i^{th} sample State in time period t (Y_{it}) as:

$$Y_{it} = f(X_{it}; \beta) \exp(-u_i); \qquad i=1,2,..,n; \qquad t=1,2,..,T; \qquad ...(2)$$

where f (.) is the frontier (tax) function, X_{it} is a vector of resource bases (inputs) and β is a vector of parameters. In the present study, the per capita own tax revenue of the State Government is the measure of Y_{it}, and the inputs are: per capita GSDP (Gross State Domestic Product), GSDP deflator and per capita transfers from the Centre. u_i ($u_i \geq 0$) is a one-sided (non-

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[4] If a State knows its tax inefficiency, then it will affect its choice on resource base (inputs).

[5] This approach essentially provides "time-invariant efficiency values (see later). Cornwell et al. (1990) proposed a stochastic frontier model for panel data that allows for both firm and time effects (providing time varying efficiency values). Battese and Coelli (1992) and Kumbhakar (1990) proposed alternative time varying models. In the former, the inefficiency term is specified as $u_{it} = u_i \eta_{it} = u_i \exp\{-\eta(t-T_i)\}$;i =1,…..,n, $t \in g(i)$; where u_is are non-negative random variables, assumed to be independently and identically distributed (i.i.d) as truncated normal with mean μ and variance σ_u^2, η is an unknown parameter to be estimated and g(i) represents the set of T_i time periods for which observations for state i are available. This model is useful to verify whether u_{it} decreases, remains constant, or increases overtime. In the latter, the efficiency term is modeled as: $u_{it} = [1+ \exp\{bt+ ct^2\}]^{-1} u_i$; where u_i's follows a half normal distribution and b and c are unknown parameters to be estimated.

negative) residual term, representing the tax (in) efficiency of the State and differs across States.

Adding a random noise variable v_{it} along with u_i will make the actual function (given by (2)) as:

$$Y_{it} = f\,(.)\,\exp\,(v_{it} - u_i) \qquad \text{...(3)}$$

Assuming the Cobb-Douglas functional form (and * indicate the logarithmic values), the equation (3) can be written as:

$$Y_{it}^{*} = \alpha + X_{it}^{*\prime}\,\beta + v_{it} - u_i \qquad \text{...(4)}$$

As usual, v_{it} represent the usual normally distributed statistical noise accounting for random disturbances beyond the control of the State, measurement errors and minor omitted variables and are uncorrelated with the regressors, X_{it}. We assume u_i to be independently and identically distributed (iid) with mean μ and variance σ_u^2.

The u term reflects that the tax performance of a State must lie on or below the frontier, $\alpha + X_{it}^{*\prime}\,\beta + v_{it}$. Although u_i is unobserved, its permanence implies that the States tend to observe u_i and consider its level into account when deciding levels of resource bases in future. This violates the linear model assumption of the uncorrelatedness of regressors with the error term rendering the estimation inconsistent. However, including the firm specific effects u_i as regressors rather than relegating them to the error term removes any bias that would have resulted from correlation between u and X variables.

Letting $\alpha_i = \alpha - u_i$ the equation (4) is rewritten as:

$$Y_{it}^{*} = \alpha_i + X_{it}^{*\prime}\,\beta + v_{it} \qquad \text{...(5)}$$

It fits exactly the usual framework in panel data literature with a firm effect but not time effect. The α_i is a State specific effect and can be estimated using the fixed effects "within" method.[6]

The performance of a State can be examined relative to the level achieved by the Most Efficient State (MES). If the N estimated intercepts are: $\hat{\alpha}_1$, $\hat{\alpha}_2$, ..., $\hat{\alpha}_N$, then $\hat{\alpha}_i^*$ [=max ($\hat{\alpha}_i$)] is the tax performance of the MES. Then, the relative efficiency of i^{th} State will be: $\hat{u}_i = \hat{\alpha}_i^* - \hat{\alpha}_i$. This ensures that all $\hat{u}_i \geq 0$. A high value of $\hat{u}_i$ implies that State i is very inefficient relative to the MES. The State specific estimates of efficiency are given by:

$$\text{Tax Efficiency}_i = \exp(-\hat{u}_i); \qquad i=1,2,....,N \qquad ...(6)$$

Thus, in the fixed effects model, at least one State in the sample is assumed to be 100% efficient and the efficiency values of others are measured relative to the MES.

One can also treat the individual effect in equation (4) as random by assuming that they are uncorrelated with the regressors. Therefore, the efficiency term is added with the regular noise term. This leads to the Generalized estimates of equation (4) and as same as the random effect model in panel data literature.[7] Like the fixed effects model, the random

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[6] This procedure estimates a separate intercept for every State by suppressing the overall intercept term and by adding a dummy variable for each of the N sample States or equivalently by keeping the overall intercept and adding N-1 dummies. Another equivalent procedure is to apply the within transformation, i.e., to apply OLS after expressing all data in terms of deviation from the State Means. The N intercepts are recovered as the means of the residuals by States.

[7] Given the GLS estimates of β say $\hat{\beta}$ one can recover the estimate the individual State intercept, $\hat{\alpha}_i$ from the residuals. Let $\varepsilon_{it} = y_{it} - x_{it}'$. Then one can estimate $\hat{\alpha}_i$ from the mean (overtime) of the residual for State i as: $\hat{\alpha}_i = (1/T) \sum_t \hat{\varepsilon}_{it}$; i=1,2,…N. Then one can get max ($\hat{\alpha}_i$) and $\hat{u}_i$ and finally, exp ($-\hat{u}_i$) as explained above.

effects model also does not use any strong distribution assumptions of the u term and provides consistent estimate of the inefficiency of a particular sample unit as T $\to\infty$.

However, the random effects model assumes that firm-specific effects are uncorrelated with the regressors, which may not be reasonable in many cases. The fixed effects model allows for such a correlation. The fixed effects model is an appropriate specification if the focus is on a specific set of cross sectional series such as the States in our study. The inference in this case is conditional on the particular N States that are observed (Baltagi, 1995). The Hausman's statistics can help to choose the relevant method of estimation for a given data set. It tests the null hypothesis of no correlation (i.e., random effect model).

A few attempts have been made in the literature to measure tax efficiency of Governments. Jha and Sahni (1997) used Cornwell et al., (1990)'s time varying stochastic frontier approach to measure the tax efficiency of Canadian Provincial Governments for the period 1971 to 1993. Alfirman (2003) applied the frontier model for cross section data to measure the tax efficiency of provincial Governments in Indonesia from 1996 to 1999. Jha et al., (1999) applied the Battese and Coelli's (1995) model to measure tax efficiency of the Indian State Governments during 1980-81 to 1992-93. However, none of these studies demonstrate how the estimated efficiency values or tax potentials can be used in designing fiscal transfers.

Data and Model

This study uses the annual data pertaining to 15 major State Governments in India drawn from various published sources (per capita GSDP, population and GSDP deflator from CSO and Own tax revenues and transfers from Twelfth Finance Commission Report). The sample States are: (i) Northern Sates-

Haryana, Punjab, Rajasthan and Uttar Pradesh; (ii) Western States-Gujarat, Madhya Pradesh and Maharastra; (iii) Southern States-Andhra Pradesh, Karnataka, Kerala, and Tamil Nadu and (iv) Eastern States-Assam, Bihar, Orissa and West Bengal. The data covering a ten years period-1993-94 to 2002-03 is a balanced panel of 150 observations on:

- per capita own tax revenues (in 1993-94 prices),
- per capita GSDP (gross state domestic product) in 1993-94 prices,
- GSDP deflator (1993-94 as the base), and
- per capita transfers from the Centre (in 1993-94 prices).

The per capita GSDP in nominal term is usually considered as a proxy for the tax base. It can be decomposed into its real counterpart and the GSDP deflator. These two are included in order to capture the different response coefficients with respect to changes in these two components. Further, it will enable us to have different assumptions regarding inflation and real growth during the study period. It may be noted that we are using the per capita transfers as a separate independent variable.[8] This means that in order to determine future transfers the impact of past transfers has been taken into account. That is, transfers become dependent on transfers themselves and it requires an endogenous treatment of transfers. We resolve the endogeneity issue when we determine the transfers in a later Section below.

Table 1 reports the means and average annual growth rates of the study variables. The average per capita own tax revenue varied widely from Rs. 189 in Assam to Rs. 1143 in Maharastra and the average per capita

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[8] In the preliminary exercise, we included the non-primary sector share in GSDP, the road length, the railway length and motor vehicle density and per capita power consumption as determinants of own tax revenues. We dropped them in the final estimation as they got either insignificant effects or negative effects.

transfers from Rs. 816 in Assam to Rs. 284 in Maharastra. The mean per capita GSDP ranged between Rs. 4723 in Bihar and Rs. 15922 in Punjab.

Table 1: State wise Means and Average Annual Growth Rates of Study Variables (1993-94 to 2002-03)

States	Per Capita Own Tax Revenue		Per Capita GSDP		Per Capita Transfers		GSDP Deflator
	Mean	Growth Rate (%)	Mean	Growth Rate (%)	Mean	Growth Rate (%)	Mean
Andhra Pradesh	692	8.1	10105	4.6	470	2.6	1.42
Assam	189	1.9	6666	1.1	816	-1.3	1.47
Bihar	212	6.9	4723	2.5	468	4.4	1.29
Gujarat	1109	3.3	14901	3.7	394	4.1	1.30
Haryana	1071	5.4	14697	3.3	293	-0.4	1.43
Karnataka	977	4.7	11185	5.5	427	4.9	1.35
Kerala	934	3.7	10828	4.2	410	0.1	1.54
Madhya Pradesh	469	5.1	8138	1.7	454	3.3	1.34
Maharashtra	1143	4.8	15749	2.9	284	-2.5	1.37
Orissa	307	6.2	6232	2.2	567	2.9	1.45
Punjab	1089	3.0	15922	2.6	313	0.6	1.39
Rajasthan	537	5.3	8944	2.9	514	1.4	1.34
Tamil Nadu	1110	4.9	12725	4.3	425	0.5	1.37
Uttar Pradesh	337	4.9	6448	1.6	417	1.8	1.41
West Bengal	448	1.1	9551	5.5	413	4.9	1.40

Source: Authors calculations.

During the study period, the real per capita own tax revenue of Andhra Pradesh grew at the highest rate of 8.1 percent. In Karnataka and West Bengal the per capita GSDP increased at the same rate of 5.5 percent per annum and the per capita transfers at 4.9 percent. However, the per capita own tax revenue increased at 4.1 percent in Karnataka and at 1.1 percent in West Bengal. Thus, wide variations exist in the average values of study variables and their growth rates in different States.

Table 2: Estimates of Stochastic Frontier Tax Function for the Indian States

(Dep. Variable: Logarithm of Per Capita Own Tax Revenue)

(Figures in parentheses are absolute t values)

Variables	*Model 1*	*Model 2*	*Model 3*
Ln (Per Capita GSDP)	0.3613	0.3134	0.3509
	(2.313)	(2.003)	(2.017)
Ln (GSDP Deflator)	0.4328	0.3150	0.2930
	(4.756)	(2.909)	(2.570)
Ln (Per Capita Transfers)	0.2657	0.2570	0.2269
	(3.840)	(3.746)	(2.575)
Dummy (till 1997-98=0; otherwise =1)	-	0.0584	-0.0981
		(1.960)	(0.113)
Dummy x Ln (Per capita GSDP)	-	-	-0.006
			(0.107)
Dummy x Ln (Per Capita Transfers)	-	-	0.0353
			(0.464)
State Specific Effects			
Andhra Pradesh	0.0804	0.0849	0.0857
Assam	-1.2016	-1.2087	-1.1851
Bihar	-0.7820	-0.8247	-0.8012
Gujarat	0.5181	0.5302	0.5123
Haryana	0.5172	0.5363	0.5194
Karnataka	0.4567	0.4595	0.4533
Kerala	0.3814	0.3968	0.3958
Madhya Pradesh	-0.1808	-0.1933	-0.1876
Maharashtra	0.5876	0.6055	0.5849
Orissa	-0.6104	-0.6243	-0.6049
Punjab	0.5067	0.5269	0.5064
Rajasthan	-0.1135	-0.1204	-0.1155
Tamil Nadu	0.5302	0.5406	0.5320
Uttar Pradesh	-0.4261	-0.4444	-0.4299
West Bengal	-0.2638	-0.2650	-0.2655
R^2	0.9796	0.9802	0.9803
Hausman Wu statistics	39.1325	50.5494	39.9546
Average Tax Efficiency	0.6332	0.6259	0.6349
Sample Size	150	150	150

Source: As in Table 1.

In a preliminary analysis, the study tried fitting various functional forms of a State's tax frontier function and found that the Cobb-Douglas form fits the data best. Further the Hausman-Wu statistics (reported in Table 2) supports the fixed effects model. Therefore, the study uses the following tax revenue frontier function using the Cobb-Douglas form:

$$\begin{aligned} Ln\,[\text{Per Capita Own Tax}_{it}] = \alpha_i + \beta_1 Ln\,(\text{Per Capia GSDP}_{it}) \\ +\beta_2 Ln\,(\text{GSDP Deflator}_{it}) \\ +\beta_3 Ln\,(\text{Per Capita Transfers}_{it}) + v_{it} \qquad \ldots(7) \end{aligned}$$

where α_i is specified as in equation (3) and $\beta_j^{'}s$ are parameters to be estimated using the fixed effect "within" method (i.e., OLS method).

The study also analyzed the issue of stationary vs. trend stationary. There is a large literature debating this issue. It is often the case that the trend stationary series with a structural break has mistakenly taken as the series with unit root. In our case, up to 1998-99 states levied low sales tax rates and after 1998-99 there was an upward shift in the sales tax buoyancy, thereby an upward shift in the States own tax revenues. We have confirmed these by applying Im, Pesaran and Shins (IPS) Panel unit root test and using annual growth rates in our preliminary analysis. Therefore, we have defined a dummy D, which takes value 1 for the years 1998-99 and after and 0 otherwise and included the dummy along with other X variables in one specification and in another specification we allow the dummy to interact with per capita GSDP and per capita transfers.

Empirical Results

Deriving Potential Tax Revenues

Table 2 presents the fixed effects within estimation results. Model 1 includes only X variables and state specific effects. Model 2 includes the dummy variable additionally and Model 3 allows the dummy interaction terms. As indicated earlier, the Hausman-Wu statistics is statistically significant at 1 percent level in all three models. Thus, the null of no correlation between the state effect and regressors is rejected and the fixed effects model is clearly preferable to the random effect model.

As expected, the coefficients of all three X variables are positive and statistically significant at 5 percent level in the all three models. In Model 2, the dummy is also having positive coefficient and is statistically significant at 5 percent level. However, when the interaction terms allowed in Model 3, both dummy and all its interaction terms are not statistically significant even at 10 percent level. Therefore the Model 2 is relevant for our discussion below.

The results indicate that States with higher per capita income, and higher GSDP deflator have higher per capita own tax revenues. Further the results imply that higher the per capita transfer from the Centre, higher is the per capita own tax revenue. There is therefore no adverse effect of transfers on the own tax revenues. In fact, instead of substituting for own tax revenues, the fiscal transfers are complements to own tax efforts.

The State specific effects ($\hat{\alpha}_i$ s) shown in Table 2 indicate that the unobserved characteristics of the following States negatively influence their own tax revenues: Assam, Bihar, Madhya Pradesh, Orissa, Rajasthan, Uttar Pradesh and West Bengal. As the state effect is used to calculate the relative efficiency of that state ($\hat{u}_i = \hat{\alpha}_i^* - \hat{\alpha}_i$) and a low value (negative value) of $\hat{\alpha}_i$ will mean very inefficient relative to the MES, the above States with negative values require policy attention.

Table 3: Relative Efficiency Scores

(percent)

States	Model 1	Rank	Model 2	Rank
Andhra Pradesh	60.22	8	59.42	8
Assam	16.71	15	16.3	15
Bihar	25.42	14	23.93	14
Gujarat	93.29	3	92.75	4
Haryana	93.20	4	93.32	3
Karnataka	87.73	6	86.41	6
Kerala	81.37	7	81.16	7
Madhya Pradesh	46.38	10	44.99	10
Maharashtra	100.00	1	100	1
Orissa	30.18	13	29.24	13
Punjab	92.23	5	92.44	5
Rajasthan	49.60	9	48.39	9
Tamil Nadu	94.43	2	93.72	2
Uttar Pradesh	36.29	12	35	12
West Bengal	42.68	11	41.87	11

Source: As in Table 1.

The State-wise efficiency scores are computed (using exp ($-\hat{u}_i$)) and are shown in Table 3. The overall mean efficiency score is 0.63, indicating that on an average the State Governments in India approximately utilized only 63 percent of their tax potential during the study period. Therefore, it could be possible for the State Governments in India to raise their existing own tax revenues approximately by 58 percent with the existing tax bases/resources[9]. The efficiency scores varied widely from 16.3 percent in Assam to 100 percent in Maharastra (Model 2). Since significant variations in the efficiency values exist across States, a great deal of effort is required still to increase their own tax revenues. The per capita potential (average) tax revenues (in 1993-94 prices) derived from efficiency analysis above for the sample states for the year 2002-03 are shown in column (3) of Table 4.

[9] This is computed using the following procedure: Since the average efficiency score is 0.6332, the inverse of 0.6332 minus one equals 0.5793. This means that the on an average the States can raise their existing tax revenues by about 58 percent in order to achieve full potential level.

Table 4: Actual and Derived Transfers (2002-03)
(Scenario -1 Average Tax Efforts and Top 3 Average Expenditures)

(Per Capita figures in Rupees)

States	Revenue Expenditure	Tax Revenue with Average Effort	Actual Transfers	Required Transfers: Without Endogeneity Correction	Required Transfers: With Endogeneity Correction	Additional Transfers Required (6)-(4)
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*
Andhra Pradesh	1670	985	508	1154	896	388
Assam	1235	905	801	1263	1212	411
Bihar	1779	794	608	704	670	62
Gujarat	2146	791	535	1136	841	306
Haryana	1920	949	331	1243	710	378
Karnataka	1951	841	495	1231	895	400
Kerala	2267	907	427	796	580	153
Madhya Pradesh	1661	857	560	1024	897	337
Maharashtra	2173	863	229	938	460	231
Orissa	1366	928	695	1201	1104	410
Punjab	2600	932	319	530	377	58
Rajasthan	1638	858	558	1091	944	386
Tamil Nadu	2232	897	434	1014	698	263
Uttar Pradesh	1079	775	470	1416	1203	732
West Bengal	1628	762	494	980	846	353

Note: Revenue expenditures are adjusted figures after deducting own non tax revenues. All figures are in 1993-94 prices.

Deriving Transfers

The per capita revenue expenditures after adjusting for per capita own non-tax revenues in 2002-03 are shown in Table 4. They are considered as the proxy for cost of providing public services. For demonstration purpose, we can consider the average of top three highest per capita expenditures spent by Punjab, Tamil Nadu and Kerala as the benchmark (uniform) level of services (scenario 1). Using (1), we derive the additional transfers required to provide the benchmark level of public services, given average tax effort and own tax revenue and actual transfers. Table 4 shows the required transfers for each state taking into account their average tax efforts and uniform level of public services.

To resolve the endogeneity issue, the following procedure is used. In our first stage of analysis, the per capita own tax revenue (R) function was specified as:

$$\text{Ln (R)} = \alpha_i + \beta_1 \text{Ln} (X_1) + \beta_2 \text{Ln}(X_2) + \beta_3 \text{Ln (T)} + \beta_4 D \qquad \text{...(8)}$$

where, X_1 per capita GSDP, X_2 GSDP deflator, and T per capita Transfers. We can write the total derivative of the equation (8) as:

$$d \ln R = d\,\alpha + \beta_1 d \ln X_1 + \beta_2 d \ln X_2 + \beta_3 d \ln T + \beta_4 d \qquad \text{...(9)}$$

Using lower case letter to denote the percentage change in respective variable, the above equation can be written as:

$$r = a + \beta_1 x_1 + \beta_2 x_2 + \beta_3 t + \beta_4 d \qquad \text{...(10)}$$

Substituting (10) in (1) and solving for t, we get:

$$t = \frac{c.\frac{C_0}{T_0} - \frac{R_0}{T_0}(a + \beta_1 x_1 + \beta_2 x_2 + \beta_4 d)}{1 + \frac{R_0}{T_0}\beta_3} \qquad \text{...(11)}$$

We can derive the additional transfers (real) required to provide benchmark level of public services given average tax effort after removing the endogeneity bias using (11). Table 4 presents the state wise per capita transfers (in real term) required without endogeneity bias. Since every state is required to provide the benchmark level of services, all require additional transfers given their average tax efforts. Table 5 shows how much total and additional transfers (in current prices) would be required for each state so that each state would provide the same amount of public services, given their average tax effort. The total transfers required for all these major States worked at Rs. 183526 crore in 2002-03 (in nominal prices) without endogeneity correction. After endogeneity bias correction, this amounted to Rs. 146023 crore. Therefore the additional transfers required amounted to be Rs. 62,977 crore.

Table 5: Derived Transfers in 2002-03: With and Without Endogeneity Bias
(Scenario -1 Average Tax Efforts and Top 3 Average Expenditures)

(Rs. crore)

States	Actual Transfers	Required Transfers: Without Endogeneity Correction	Required Transfers: With Endogeneity Correction	Additional Transfers Required (4)-(2)
Andhra Pradesh	6856	15568	12088	5232
Assam	4166	6565	6300	2134
Bihar	10144	11758	11182	1037
Gujarat	4351	9230	6838	2488
Haryana	1300	4875	2784	1484
Karnataka	4451	11064	8051	3600
Kerala	2653	4942	3603	950
Madhya Pradesh	7724	14121	12363	4640
Maharashtra	3786	15520	7616	3830
Orissa	4606	7960	7321	2715
Punjab	1325	2199	1564	239
Rajasthan	5259	10291	8900	3641
Tamil Nadu	4634	10822	7445	2810
Uttar Pradesh	14965	45067	38269	23304
West Bengal	6825	13543	11699	4875
Total	*83046*	*183526*	*146023*	*62977*

Note: All values are in current prices.

In another scenario-2, we consider average tax effort and average level of public services (Bihar's is taken as the benchmark). In that case, no additional resources are required. In fact, every state should forego some portions of their existing transfers (Table 6).

Annexure Table 6: Derived Transfers (2002-03)
(Scenario 2: Average Tax Effort and Average Expenditures)

States	Without Endogeneit Correctior	With Endogeneit Correctior	Additiona Transfer Requirec	Without Endogeneit Correctior	With Endogeneit Correctior	Additiona Transfer Requirec
	Per Capita Figures in Rs.			*Rs. Crore*		
Andhra Pradesh	567	497	-11	7646	6710	-146
Assam	676	666	-136	3512	3462	-704
Bihar	117	149	-458	1954	2494	-7650
Gujarat	548	465	-70	4457	3783	-567
Haryana	655	430	98	2571	1685	385
Karnataka	643	529	34	5784	4756	305
Kerala	208	236	-191	1294	1466	-1187
Madhya Pradesh	437	439	-121	6024	6050	-1674
Maharashtra	350	230	1	5800	3802	16
Orissa	613	598	-97	4067	3965	-641
Punjab	-57	98	-221	-238	408	-917
Rajasthan	504	494	-64	4752	4658	-601
Tamil Nadu	427	370	-64	4554	3953	-681
Uttar Pradesh	829	728	257	26377	23156	8191
West Bengal	392	382	-112	5423	5282	-1542
	Total			*83977*	*75630*	*-7416*

Note: Revenue expenditures are adjusted figures after deducting own non tax revenues. Per Capita Figures are in 1993-94 prices while others are in current (2002-03) prices.

In Scenario -3, we have considered potential tax revenues and the highest per capita revenue expenditure (incurred by Punjab). In this scenario, the additional transfers required will be Rs. 30735 crore (Table 7).

Table 7: Derived Transfers (2002-03)
(Scenario 3: Max Tax Effort and Max Expenditure)

States	Potential Tax Revenue	Without Endogeneity Correction	With Endogeneity Correction	Without Endogeneity Correction	With Endogeneity Correction
	Per Capita figures in Rs.			*Rs. Crore*	
Andhra Pradesh	1574	799	655	10775	8834
Assam	1446	956	926	4968	4815
Bihar	1269	463	456	7734	7616
Gujarat	1263	897	688	7289	5596
Haryana	1516	909	551	3566	2160
Karnataka	1344	962	728	8645	6542
Kerala	1449	487	400	3027	2482
Madhya Pradesh	1369	746	679	10280	9368
Maharashtra	1378	656	349	10852	5784
Orissa	1482	880	828	5834	5488
Punjab	1488	207	224	858	928
Rajasthan	1370	812	730	7659	6884
Tamil Nadu	1434	711	529	7590	5644
Uttar Pradesh	1238	1187	1017	37766	32365
West Bengal	1217	758	671	10477	9277
	Total			*137319*	*113781*

Note: Revenue expenditures are adjusted figures after deducting own non tax revenues. Per Capita Figures are in 1993-94 prices while others are in current (2002-03) prices.

CONCLUSION

In this study an attempt has been made to design an appropriate methodology to determine the transfers from the Centre to the State governments. It provides a normative approach to fiscal transfers with reference to the principle of equalization as it is consistent with both efficiency and equity. Specifying a tax revenue function this study has estimated the tax revenue potentials of State Governments in India and used those revenue potentials along with a benchmark level of public services to derive the fiscal transfers required so that each State can provide the same amount of services to people in the country.

The advantages of this approach are as follows: It provides a single measure of transfers instead of complicated gap filling and modified Gadgil formulae etc. It is simple to implement. The bench mark services level can be altered. It takes into account the actual population, same amount of public services to all citizens, and is free from endogeneity bias that arises due to the impact of the past transfers on current transfers. It also provides an incentive for the States to collect their revenues efficiently.

If every State is expected to provide the benchmark level of services with average tax effort (scenario 1), the additional transfers required is amounted to Rs. 62977 crore. However, if every State is able to raise their tax revenues efficiently, all will be able to provide the highest bench mark level of services with an additional resources of Rs. 30735 Crore. In this scenario-3, we need to have one time adjustment. About Rs. 30000 crore additional resources are required to achieve the target. Once it can be done, based on percentage changes in GSDP, and GSDP deflator, additional transfers can be determined for every next year. If any State is not able to perform efficiently in raising revenues, they can avail appropriate consultancy from either neighboring (better performing) States or from the Centre or from tax experts.

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