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THE EFFECT OF CENTRAL FINANCIAL TRANSFERS ON TAX EFFORTS OF STATES IN INDIA: A PANEL DATA ANALYSIS

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Abstract: Central government financial transfers and states' own tax revenue is interlinked as the transfer policies may encourage or discourage the own tax effort of the states. This paper analyses the effects of central transfers on states' own own tax revenue, using panel data for l5 major states from 1980-81 to 2019-20 applying panel fixed effects and random effects regression methods. The estimated results show a negative relationship between central transfers and grants and the own tax efforts of the states, indicating revenue substitution by states. More central government assistance means less dependence on own tax revenue dampening the states' revenue mobilisation efforts. The existence of a strong positive relationship between NSDP per capita and state tax revenue shows the high tax potential of the states. The incentive criterion for tax effort as used both in the finance commissions devolutions and in the Gadgil formula used by the planning commission is not reflected in the federal system of India. The central transfers adversely affect the incentives to states to mobilise their own resources and fail to induce a desired positive revenue generation in states.

INTRODUCTION

The constitution of India provides independent revenue-raising and spending power to both the central and state governments. It also admits the existence of vertical fiscal imbalances in taxing power that exist because of unequal assignment of resources and responsibilities among different tiers of government (Roy and Raychaudhuri, 2007). Federal fiscal transfers are justified to offset the fiscal disadvantages of states that arise from low taxable capacity and low unit cost of providing public services. Federal transfers help states to reduce the vertical and horizontal fiscal imbalances and to achieve equity and efficiency. Even though transfers supplement

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state revenues to achieve equity and efficiency, they are not substitutes for states' own revenues. The federal transfers are shared by the centre with states through many channels: (i) the finance commission that distributes the divisible taxes and provides grants-in-aid, (ii) the planning commission that makes transfers in the form of state plans, and (iii) various central ministries.

Since the expenditure of states exceeds their tax revenue, inter-governmental transfers make an important and significant part of the states' total revenue. Table 1 presents sources of revenue of states in India and the relative share of the various components in total revenue during the period 1991-92 to 2010-11. These components consist of states' own tax revenue, transfers from central government and various ministries, borrowing and other revenue sources. In states, their own tax revenue forms 39.3% percent of their total revenue in 2010-2011. Among the tax revenues of states, a major part, about 85%, comes from state sales tax, tax on property and capital transactions and state excise tax. All other taxes such as motor vehicle tax and entertainment tax are minor taxes. Generally, between 1991-92 and 2010-11, the state taxes revenue sources remained more or less at the same level and the central transfers declined from 42% of state revenues to 33%. As the dependence of states on central transfers has declined, and their own tax revenue has not increased over time, the states have resorted to the loans, which have increased from 5% to 15% during this period.

Table 1: Sources of Revenue for States in India (percent)

Source	*1991-92*	*2001-02*	*2010-11*
1. Own tax revenue	33.2	33.7	39.3
Sales tax	19.5	20.0	23.8
State excise tax	5.0	4.5	5.0
Property and capital transaction tax	3.1	3.5	5.2
Vehicle tax	1.7	2.0	2.1
Tax on duties on electricity	1.5	1.3	1.5
Tax on goods and passengers	1.1	1.0	1.0
Tax on profession trades and callings	0.4	0.8	0.3
Agricultural income tax	0.2	0.02	0.0
Entertainment tax	0.3	0.2	0.1
2. Total transfers	41.9	32.6	33.4
Central tax transfers	15.6	14.3	18.7
Grants	14.1	11.7	13.9
Plan grants	11.1	8.0	9.8
Non-plan grants	3.0	3.7	4.2
Central loans	12.1	6.7	0.8
3. Internal loans	4.7	18.3	14.5
Market loans	3.1	5.2	8.9
4. Other sources	41.9	15.4	12.8

Source: Reserve Bank of India: Statistics on State Finances (2012).

In understanding the inter-governmental transfers mechanism and the rules applied in transferring resources from centre to state in India, it is very important to know the criteria used by different finance commissions and the planning commission. So far, 15 finance commissions have been in force in India and each commission has followed different criteria while the planning commission of India follows a different mechanism for central transfers to states. The finance commissions of India have been using criteria like population, poverty, backwardness, income distance, inverse income, area, infrastructure, fiscal discipline, tax effort and forest cover of states as main criteria for determining the inter se shares of the states in the central tax pool of income tax and excise duty for fiscal capacity equalisation and vertical transfers. In addition to tax devolution to the states, the union government also gives grants-in-aid to states on the basis of the difference between the assessed expenditure and the sum of the projected own revenues and shares in central taxes to fill the revenue gaps of states. Table 2 summarises the transfer criteria of the finance commissions of India in giving grants-in-aid and sharing income tax and excise tax between the centre and states.

On the other hand, the planning commission of India transfers resources on the basis of population, per capita income, tax effort, fiscal management, literacy, land reform, etc. The transfer of the planning commission is based on a formula where 30% of the transfers are in the form of grants and 70% as loans. The grants and loans are tied together; states have to accept loans with grants. The criteria used by the planning commission in transferring resources to the states are 60% on the basis of the population of the state; 15% on the basis: (i) 7.5% on the basis of tax effort, fiscal management (including the speed of utilization of committed foreign aid and state's performance of revenue collection) and progress in respect of national objectives, and (ii) 7.5% to meet special problems of the states such as population control, literacy and land reform; 25% on the basis of per capita state domestic product (SDP) based on a formula: (i) 20% to only states with less than average per capita SDP on the basis of the inverse formula, and (ii) 5% according to the distance formula. The inverse formula is specified as:

$$\textit{Inverse formula}: \frac{\frac{P_i}{Y_i}}{\Sigma\left(\frac{P_i}{Y_i}\right)} \tag{1}$$

which is inversely related to the per capita income of the state. The distance formula is specified as:

Table 2: Transfer Criteria of Finance Commissions of India for Grants to States

Finance commission	*Transfers and criteria*	
First Finance Commission (1952-57)	Grants	For four states - Assam, Bihar, Odisha, West Bengal - to cover their deficits during 1951-56
		For eight states to improve their primary education facilities
	Income tax	55% in the proceeds; 80% on the basis of the population, 20% on the basis of revenue collection of the state
	Excise duty	40% of the net proceeds on the basis of population
Second Finance Commission (1957-62)	Grants	Larger grants in aid for meeting development
	Income tax	60% in the proceeds; 90% on the basis of population, 10% on the basis of revenue collection
	Excise duty	25% of the net proceeds
Third Finance Commission (1962-66)	Grants	₹550 crores to all states except Maharashtra to cover part of their revenue expenditure
		₹45 crores for all states for improvement of communications
	Income tax	60% in the proceeds; 80% on the basis of population and 20% on the basis of revenue collection of the state
	Excise duty	20% of net proceeds
Fourth Finance Commission (1966-69)	Grants	₹610 crores to cover deficits during the period 1966-71
	Income tax	70% in the proceeds; 80% on the basis of population, 20% on the basis of revenue collection of the state income taxes
	Excise duty	20% of net proceeds
Fifth Finance Commission (1969-74)	Grants	₹638 crores to cover deficits during the period 1969-74
	Income tax	75% in the proceeds; population criterion of devolution of income tax
	Excise duty	No change
Sixth Finance Commission (1974-79)	Grants	₹2510 crores for 14 out of 21 states to cover non-plan revenue deficit
	Income tax	80% in the proceeds; population criterion of devolution of income tax
	Excise duty	No change
Seventh Finance Commission (1978-84)	Grants	₹1600 crores to cover deficits of a few poor states during the period 1980-85 and to upgrade the standard of administration
	Income tax	85% in the proceeds; population criterion of devolution of income tax
	Excise duty	40% of the net proceeds; 25% weight equally for population, increase in per capita income, percentage of poor in each state; a formula for income equalisation between states
Eighth Finance Commission (1984-89)	Grants	₹1556 crores to cover deficits for the period 1985-90; ₹915 crores to certain states to upgrade the standard of administration
	Income tax	85% of the net proceeds as states share; 10%on the basis of income tax collection; Out of the remaining 90%, 25% on the basis of population, 25% on the basis of the inverse of per capita income of the state multiplied by population, 50% on the basis of the distance of per capita income of a state from the highest per capita income state multiplied by the population of the state
	Excise duty	44% of the net proceeds; 5% to deficit states
Ninth Finance Commission (1989-95)	Grants	₹15017 crores to cover deficits of plan and non-plan revenue account during 1990-95; special annual grant of Rs.603 crores towards centre's contribution for the calamity relief fund totalling ₹3015crores for five years 1990-95; ₹122 crores to Madhya Pradesh towards expenditure on rehabilitation and relief of victims of Bhopal gas leak
	Income tax	85% in the proceeds; followed the 8th Finance Commission formula; added the backwardness of states on the basis of scheduled castes and scheduled tribes population and the number of agricultural labourers in states as in the 1981 census
	Excise duty	45% in the proceeds; 25% on the basis of the 1971 census; 12.5% on the basis of the index of backwardness; 33.5% on the basis of per capita income of the state from the highest per capita income state; 12.5% on the basis of income adjusted total population; 16.5% among states with deficits, after taking into account their shares from all shareable taxes

Tenth Finance Commission (1995-2000)	Grants	₹20300 crore s; ₹7583 crores to such states for meeting the special requirement; Rs. 5380 crores to local bodies like municipalities and panchayats; Rs. 6304 crores to Calamity Relief Fund
	Income tax	77.5% of the net proceeds as states share; 20% on the basis of population of 1971; 60% on the basis of distance of per capita income of a state from that of the state having highest per capita income; 5% on the basis of area adjusted; 5% on the basis of an index of infrastructure; 10% on the basis of tax effort
	Excise duty	47.5% of net proceeds to be shared among states on the basis of the same formula used in sharing income tax; 40% distributed among major states; 7.5% distributed among deficit states
	Additional excise duty	50% on the basis of population; 40% on the basis of state domestic product; 10% on the basis of state sales tax collection
Eleventh Finance Commission (2000-2005)	Grants	₹35359 crores for states facing revenue deficit after devolution of grants; ₹4793 crores for certain states for up-gradation of administration and special problems; ₹8000 crores to panchayats and ₹2000 crores to municipalities for five years 2000-2005
	Share of union tax revenues	29.5% share to states in the net proceeds of union taxes and duties
	Income tax	20% on the basis of population; 62.5% on the basis of distance of per capita income of a state from that of the state having highest per capita income; 7.5% on the basis of (i) 7.5% weight to index of infrastructure, and (ii) 7.5% weight to fiscal discipline
	Excise duty	47.5% of net proceeds to be shared among states on the basis of the same formula used in sharing income tax; 40% distributed among major states; 7.5% distributed among deficit states
Twelfth Finance Commission (2005-10)	Grants	₹142639 crores from non-plan revenue account; ₹56856 crores non-plan revenue deficit grant to 15 states; ₹10172 crores for the education sector to eight states; ₹5887 crores for the health sector for seven states; Rs.15000 crores for roads and bridges; ₹20000 crores for the Panchayati raj institutions; ₹4000 crores for urban local bodies; ₹21333 crores Calamity Relief Fund
	Share of union tax revenues	30.5% share to states in the net proceeds of union taxes and duties; ₹755751 crores share of central taxes and grants-in-aid
Thirteenth Finance Commission (2010-15)	Share of union tax revenues	32% share to states in the net proceeds of union taxes and duties; criteria: 47.5% income distance; 25% 1971 population; 15% fiscal discipline and 10% area
Fourteenth Finance Commission (2015-20)	Grants	₹38.48 lakh crores; grants to local bodies – 90% weight of 2011 population; 10% weight of area; 90:10 ratio of basic to performance grant for panchayats; 80:20 ratio for municipalities
	Share of union tax revenues	42% share to states in the net proceeds of union taxes and duties; criteria: 50% income distance; 17.5% 1971 population; 15% area; 10% 2011 demographic change and 7.5% forest cover
Fifteenth Finance Commission (2020-25)		Yet to recommend

$$Distance\ formula: \frac{(Y_h - Y_i)P_i}{\Sigma[(Y_h - Y_i)P_i]} \tag{2}$$

where Y_i and Y_h denote the per capita SDP of the i^{th} and the richest state in India respectively, P_i denotes the population of the state. The indicator increases as the distance of income of the state from the richest state increases.

Table 3 presents the share of individual states in the union transfers. The share of the general category states has been as high as 97%, declined

later to 86% and then rose again above 90% in recent finance commission awards. The share of special category states has also changed accordingly from a high of 13% to a range of 7-8%. Within the general category states, the share of middle income states has been falling and the share of low income states has been rising largely at the cost of the high income states.

Table 3a: Share in Central Taxes and Duties Recommended by Finance Commissions of India - General Category States

State	*1st FC*	*2nd FC*	*3rd FC*	*4th FC*	*5th FC*	*6th FC*
Andhra Pradesh	4.8	8.22	7.8	7.56	7.55	8.03
Bihar	11.75	8.71	9.34	9.11	11.05	10.40
Chhattisgarh	-	-	-	-	-	-
Goa	-	-	-	-	-	-
Gujarat	-	4.20	6.02	5.58	5.01	5.19
Haryana	-	-	-	1.57	1.64	1.70
Jharkhand	-	-	-	-	-	-
Karnataka	1.04	5.11	5.08	5.15	4.98	5.40
Kerala	0.39	3.43	4.08	3.87	3.98	3.82
Madhya Pradesh	6.29	6.63	7.01	6.78	7.45	7.66
Maharashtra	18.75	12.90	11.20	11.88	10.57	10.02
Odisha	4.23	3.53	4.52	3.98	3.97	3.84
Punjab	4.05	4.78	5.53	2.93	2.46	2.38
Rajasthan	3.79	4.17	4.61	4.44	4.64	4.70
Tamil Nadu	11.39	8.56	7.48	7.90	7.56	7.59
Uttar Pradesh	18.81	16.63	13.87	14.86	16.77	16.20
West Bengal	11.99	9.33	8.78	8.94	8.17	8.28
Total	**97.29**	**96.19**	**95.40**	**94.54**	**95.79**	**95.21**
	7th FC	*8th FC*	*9th FC*	*10th FC*	*11th FC*	*12th FC*
Andhra Pradesh	7.81	7.72	7.48	7.91	7.70	7.36
Bihar	11.18	11.23	11.00	11.29	14.60	11.03
Chhattisgarh	-	-	-	-	-	2.65
Goa	-	-	0.39	0.25	0.21	0.26
Gujarat	5.01	3.97	3.86	3.88	2.82	3.57
Haryana	1.60	1.20	1.29	1.24	0.94	1.08
Jharkhand	-	-	-	-	-	3.36
Karnataka	5.23	4.80	4.51	4.86	4.93	4.46
Kerala	3.98	3.53	3.32	3.50	3.06	2.67
Madhya Pradesh	7.98	7,81	7.44	7.40	8.84	6.71
Maharashtra	8.91	7.33	6.87	6.23	4.63	5.00
Odisha	4.24	4.38	5.25	4.97	5.47	5.61
Punjab	2.18	1.71	1.72	1.53	1.15	1.30
Rajasthan	4.91	4.31	5.25	4.97	5.47	5.61
Tamil Nadu	7.68	6.85	6.84	6.12	5.39	5.31
Uttar Pradesh	16.65	16.58	15.79	16.25	19.80	19.26
West Bengal	8.18	7.90	7.12	6.84	8.12	7.06
Total	**95.22**	**89.32**	**87.73**	**86.54**	**92.70**	**91.83**

Source: Reports of Finance Commissions, Government of India.

Table 3b: Share in Central Taxes and Duties Recommended by Finance Commissions of India – Special Category States

State	*1st FC*	*2nd FC*	*3rd FC*	*4th FC*	*5th FC*	*6th FC*
Arunachal Pradesh	-	-	-	-	-	-
Assam	2.71	2.69	3.24	2.89	2.39	2.61
Himachal Pradesh	-	-	-	-	0.49	0.61
Jammu & Kashmir	-	1.13	1.29	1.51	0.91	0.83
Manipur	-	-	-	-	0.07	0.19
Meghalaya	-	-	-	-	0.17	0.18
Mizoram	-	-	-	-	-	-
Nagaland	-	-	0.07	1.05	0.08	0.10
Sikkim	-	-	-	-	-	-
Tripura	-	-	-	-	0.11	0.28
Uttaranchal	-	-	-	-	-	-
Total	**2.71**	**3.81**	**4.60**	**5.46**	**4.21**	**4.79**
	7th FC	*8th FC*	*9th FC*	*10th FC*	*11th FC*	*12th FC*
Arunachal Pradesh	-	-	0.60	0.66	0.24	0.29
Assam	2.58	3.51	3.38	3.42	3.28	3.24
Himachal Pradesh	0.57	1.49	1.44	1.81	0.68	0.52
Jammu & Kashmir	0.83	2.07	2.52	2.86	1.29	1.30
Manipur	0.20	0.84	0.81	0.82	0.37	0.36
Meghalaya	0.19	0.68	0.64	0.74	0.34	0.37
Mizoram	-	-	0.73	0.68	0.20	0.24
Nagaland	0.09	0.91	0.89	1.06	0.22	0.26
Sikkim	-	0.18	0.18	0.27	0.18	0.23
Tripura	0.31	1.00	1.09	1.13	0.49	0.43
Uttaranchal	-	-	-	-	-	0.94
Total	**4.78**	**10.68**	**12.27**	**13.46**	**7.30**	**8.17**

Source: Reports of Finance Commissions, Government of India.

As Table 4 shows there have been large variations in transfers received by individual states. Among the non-special category states, Bihar and Orissa received the largest proportion of transfers in 2010-11. Bihar shows an increasing dependence on central transfers whereas a declining trend is observed in the case of Orissa, Uttar Pradesh, Rajasthan and West Bengal. States least dependent on central transfers are the high income states, mainly Punjab, Haryana and Gujarat. The intergovernmental transfers are a major source of revenue for all the special category states. Nagaland received the highest funds in 2010-11 followed by Manipur while Himachal Pradesh and Uttaranchal have received lowest funds.

Table 4: Central Fiscal Transfers as Proportion of State Aggregate Revenue

State	*1991*	*2001*	*2010*	*State*	*1991*	*2001*	*2010*
General category states							
Goa	0.43	0.12	0.16				
Bihar	0.61	0.57	0.68	Punjab	0.31	0.13	0.16
Odisha	0.55	0.45	0.48	Gujarat	0.21	0.20	0.15
Jharkhand	-	0.45	0.46	***Special category states***			
Uttar Pradesh	0.55	0.43	0.42	Nagaland	0.87	0.82	0.83
Madhya Pradesh	0.44	0.36	0.41	Manipur	0.85	0.80	0.81
Chhattisgarh	-	0.35	0.41	Arunachal Pradesh	0.92	0.79	0.80
Rajasthan	0.40	0.31	0.34	Meghalaya	0.78	0.73	0.76
West Bengal	0.47	0.33	0.33	Tripura	0.87	0.74	0.75
Andhra Pradesh	0.40	0.32	0.27	Jammu & Kashmir	0.80	0.77	0.69
Karnataka	0.28	0.30	0.26	Mizoram	0.96	0.70	0.66
Tamil Nadu	0.30	0.21	0.22	Assam	0.69	0.59	0.59
Kerala	0.39	0.25	0.19	Sikkim	0.75	0.33	0.52
Maharashtra	0.27	0.12	0.18	Himachal Pradesh	0.37	0.55	0.45
Haryana	0.24	0.12	0.16	Uttaranchal	-	0.42	0.42

The financial transfers from the union government to states have been designed to fill the fiscal gap in the state budgets. The relationship between union transfers and the state's own tax revenue is interlinked in the sense that the transfer policies may encourage or discourage the tax effort of the states. When the size of such central transfers is more than the required financial assistance by the states, such states are discouraged in their own revenue efforts and vice versa. Thus, the central financial transfers create a revenue substitution effect in the state's budget. Hence, this paper aims to analyse the effects of central transfers on a state's own revenue income or own tax revenue. This paper uses a state-wise panel for 15 major states of India from 1980-81 to 2019-20. The variables considered are own tax revenue, total revenue, grants from the centre, share in central taxes and revenue expenditure, NSDP and NSDP per capita. In the empirical analysis, the panel data methodology of fixed effects and random effects regression models are used along with the Hausman specification test.

REVIEW OF LITERATURE

Vasishtha and Rajaraman (2000) investigate the impact of state grants on the tax effort of rural local governments (panchayats) in Kerala using data for 1993-94. They regress own tax revenue separately on total grants and untied grants, after controlling for the population as a tax capacity proxy, for each district. They also regress the own tax per capita on untied grants per capita in a separate specification and find a significant negative impact

of total grants and untied grants on the own tax revenue of panchayats in many districts of the state. Though this study is exclusively related to state-local transfers, it provides vital inferences on the impact of transfers on the tax efforts of the recipient government.

Panda (2009) examines the incentive effects of federal transfers on states' own revenue using the fixed and random effects panel regression models in India. The estimated results show that per capita resource transfers from the centre are significantly and negatively associated with states' own revenue, own tax revenue and own non-tax revenue in per capita terms, irrespective of linear and log specifications. This result indicates that central transfers have a dampening effect on states' revenue efforts. Further, the results show that the incentive criteria for tax effort as used in the finance commission devolutions and in the Gadgil formula used by the planning commission are not reflected in the system and it has failed to induce the desired positive revenue pattern in states. The paper suggests assigning a higher weight to tax effort in the devolution formula and for more effective coordination among different channels in designing criteria and incentives.

Sharma (2011) examines the concept of vertical fiscal imbalance (VFI). The paper derives the estimates of VFI by comparing the revenues and expenditures of two levels of government, much like accounting or deficit measurements. The paper aims to clarify the multiple usages of the symbolically loaded terms VFI and VFG (vertical fiscal gap) by critically engaging the fundamental assumptions and premises underlying these similar notions. The paper proposes an alternative conceptual framework and introduces the concepts of vertical fiscal asymmetry (VFA) and vertical fiscal difference (VFD) that have the potential to better structure public debate on issues of vertical fiscal relations and stimulate a sensible appreciation of the problem and possible remedies.

Bhatt and Scaramozzino (2015) analyse the relationship between transfers, state domestic product, and fiscal deficit in India for a panel of states for the period l990-2010. Generally, the system of federal transfers has been criticised on the grounds that it distorts the incentives for states to promote fiscal discipline. The paper finds a positive long-run relationship and bidirectional causality between primary/gross fiscal deficits and non-plan transfers. Further, a negative long-run relationship and one-way causality between state domestic product and transfers are observed, with causality going from state domestic product to transfers. These results are also confirmed by the multivariate cointegration analysis, which finds a long-run relationship between fiscal transfers, state product per capita and the primary deficit of the states. The evidence in the paper is consistent with the system of fiscal transfers being gap filling.

DATA AND METHODOLOGY

The data used in this study is state-wise panel data for 15 major states of India from 1980-81 to 2019-20, collected from various government databases. The 15 states considered are Andhra Pradesh, Bihar, Goa, Gujarat Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh and West Bengal. The data for the variables own tax revenue, total revenue, grants from the centre, share in central taxes and revenue expenditure are obtained from the Reserve Bank of India Handbook of Statistics on State Finances, and the data on variables NSDP and NSDP per capita are collected from Finance Ministry's Economic Surveys.

Panel data consists of repeated data on the same observations over a time i.e. repeated cross sectional time series. The major advantage of panel data over a cross section is that it allows great ûexibility in modelling differences in behaviour across individuals as it controls for both the time invariant observed and unobserved individual heterogeneity. The basic framework is a regression model of the form:

$$y_{it} = \alpha z_i + \beta x_{it} + u_{it}\ i = 1,\ldots,\ n\ t = 1,\ldots,\ T_i \qquad (1)$$

The observed heterogeneity or individual effect is z which contains a constant term and a set of individual or group specific variables which are observed such as race, sex, location, etc. and unobserved such as family specific characteristics, individual heterogeneity in skill preferences, etc. If all the observed and unobserved individual or group specific heterogeneity are taken to be constant over time, the model is a classical regression model, then the entire model can be estimated by the ordinary least squares method. The complications arise when the unobserved heterogeneity is correlated with the error term, then OLS estimation will produce biased (inconsistent and inefficient) estimates. Generally, panel data is estimated by pooled data, least squares dummy variables, fixed effects and random effects regression models.

Pooled Regression: If z contains only a constant term, then OLS estimation provides consistent and efficient estimates of the common and the slope vector β. The assumptions of the pooled model are:

$$y_{it} = \alpha + \beta x_{it} + u_{it} \qquad (2)$$

$$E(u_{it} \mid x_{it}) = 0 \quad E\left(u_{it}^2\right) = \sigma_u^2 \quad Cov(u_{it}, x_{it}) = 0 \qquad (3)$$

The pooled regression is also called as population averaged model as the presence of any latent heterogeneity is averaged out. To the pooled data, the least squares regression is applied under the assumptions of zero conditional mean of the error, homoscedasticity, independence across observations and strict homogeneity of x.

Fixed Effects Regression: If z is unobserved, but correlated with x, then the least squares estimator of β is biased and inconsistent as a consequence of an omitted variable bias. In this instance, the observable individual effects are assumed to be fixed or remain constant over time and such a fixed effects model is specified as:

$$y_{it} = \alpha_i + \beta x_{it} + u_{it} \tag{4}$$

where $\alpha_i = \alpha z_i$ is a group specific constant term. However, the omitted unobservable individual effects, λ_i, may be correlated with the x variables. That is:

$$E(\lambda_i \mid x_{it}) = c(x_i) \Rightarrow E(u_{it} \mid x_{it}) \neq 0 \tag{5}$$

Because the conditional mean is the same in every period, the model is written as:

$$y_{it} = \beta x_{it} + c(x_i) + [\lambda_i - c(x_i)] + u_{it} \tag{6}$$

$$y_{it} = \alpha_i + \beta x_{it} + [\lambda_i - c(x_i)] + u_{it} \tag{7}$$

By construction, the bracketed term is uncorrelated with x and is absorbed in the disturbance term. Hence, the fixed effects panel regression model is specified as in equation (4). The fixed effects regression model captures the differences in the constant term i and each i is treated as an anonymous parameter to be estimated. The fixed effects regression models the differences between cross sectional units strictly as parametric shifts of the regression function. However, estimating so many constant terms as there are cross sectional observations is costly in terms of degrees of freedom lost.

Random Effects Regression: If the unobserved individual heterogeneity, however formulated, is assumed to be uncorrelated with x, then the individual specific constant terms may be assumed as randomly distributed across cross sectional units. This is tantamount to assuming that sampled cross sectional units are drawn from a large population. As there is no need to estimate each of the α_i separately, the number of parameters to be estimated is reduced drastically. Thus, a linear regression model can be estimated with a compound disturbance that may be consistent, although inefficiently, by least squares. This random effects regression approach specifies that λ_i is a group specific random element similar to u_{it} but there is a single draw that enters the regression identically in each period. A reformulation of the regression model can be specified as:

$$y_{it} = \beta x_{it} + E(\alpha z_i) + [\alpha z_i - E(\alpha z_i)] + u_{it} \tag{8}$$

$$y_{it} = \beta x_{it} + \alpha + \lambda_i + u_{it} \tag{9}$$

where the single constant term is the mean of the unobserved heterogeneity $[\alpha]E(z_i)$. The component λ_i is the random heterogeneity specific to the i^{th} observation and is constant through time. The assumptions of the random effects regression model are:

$$\begin{aligned} &E(u_{it} \mid x_{it}) = E(\lambda_i \mid x_{it}) = 0 \\ &E\left(u_{it}^2\right) = \sigma_u^2 \qquad E\left(\lambda_i^2\right) = \sigma_\lambda^2 \\ &E\left(u_{it}\lambda_j \mid x_{it}\right) = 0 \quad \textit{for all } i,t,j \\ &E\left(u_{it}u_{js} \mid x_{it}\right) = 0 \qquad \textit{if } t \neq s \textit{ and } i \neq j \\ &E\left(u_i u_j \mid x_{it}\right) = 0 \quad \textit{if } i \neq j \end{aligned} \tag{10}$$

In terms of group specific observations, $\mathbf{y}_i$, $\mathbf{x}_i$, $\lambda_i\mathbf{i}$ and $\mathbf{u}_i$ for T observations, the composite error term is specified as:

$$\varepsilon_{it} = (u_{it} + \lambda_i) \text{ and } \varepsilon_i = [\varepsilon_{i1}, \varepsilon_{i2}, \ldots, \varepsilon_{iT}]' \tag{11}$$

The assumptions for this formulation are:

$$\begin{aligned} &E(\varepsilon_{it} \mid \boldsymbol{x}) = \sigma_u^2 + \sigma_\lambda^2 \\ &E(\varepsilon_{it}\varepsilon_{is} \mid \boldsymbol{x}) = \sigma_\lambda^2 \quad \textit{if } t \neq s \\ &E(\varepsilon_{it}\varepsilon_{is} \mid \boldsymbol{x}) = \sigma_\lambda^2 \quad \textit{for all } t \textit{ and } s \textit{ if } i \neq j \end{aligned} \tag{12}$$

For the T observations of cross sectional unit i:

$$E(\varepsilon_i\varepsilon_i' \mid \boldsymbol{x}) = \Sigma = \begin{bmatrix} \sigma_u^2 + \sigma_\lambda^2 & \sigma_\lambda^2 & \cdots & \sigma_\lambda^2 \\ \sigma_\lambda^2 & \sigma_u^2 + \sigma_\lambda^2 & \cdots & \sigma_\lambda^2 \\ \cdots & \cdots & \cdots & \cdots \\ \sigma_\lambda^2 & \sigma_\lambda^2 & \cdots & \sigma_u^2 + \sigma_\lambda^2 \end{bmatrix} \tag{13}$$

$$\Sigma = \sigma_u^2 \boldsymbol{I}_T + \sigma_\lambda^2 \boldsymbol{i}_T \boldsymbol{i}_T' \tag{14}$$

where $\mathbf{i}_T$ is a Tx1 column vector of 1s. As cross section units i and j are independent, the covariance matrix of the disturbance term for the full nT observations is:

$$\Omega = \begin{bmatrix} \Sigma & 0 & \cdots & 0 \\ 0 & \Sigma & \cdots & 0 \\ \cdots & \cdots & \cdots & \cdots \\ 0 & 0 & \cdots & \Sigma \end{bmatrix} = I_n \otimes \Sigma \tag{15}$$

Then, the estimates of slope parameters $\hat{\boldsymbol{\beta}}$ are obtained from the generalised least squares (GLS) estimation as:

$$\hat{\boldsymbol{\beta}} = (\boldsymbol{x}'\boldsymbol{\Omega}^{-1}\boldsymbol{x})'\boldsymbol{x}'\boldsymbol{\Omega}^{-1}\boldsymbol{y} = [\Sigma_{i=1}^{n} x_i' \boldsymbol{\Omega}^{-1}\boldsymbol{x}_i]^{-1} \Sigma_{i=1}^{n} \boldsymbol{x}_i' \boldsymbol{\Omega}^{1}\boldsymbol{y}_i \quad (16)$$

Thus, the GLS estimator, like the OLS estimator, is a matrix weighted average of the within and between cross sectional units estimators.

Hausman Specification Test: The crucial distinction between fixed and random effects is whether the unobserved individual effect embodies elements that are correlated with the regressors in the model, not whether these effects are stochastic or not. There is little justification for treating the individual effects as uncorrelated with the other regressors, and hence the random effects model suffers from the inconsistency due to possible correlation between the included variables and the random effect. On the other hand, the fixed effects estimation shifts only the intercepts leaving the slope coefficients unchanged, thus there is no difference between the two different estimation methodologies. Moreover, too many parameters need to be estimated as there are cross sectional units. A pertinent question is which one is appropriate in the empirical estimation. Hausman (1978) argues that under the hypothesis of no correlation, both OLS, fixed effects and random effects estimators are consistent, but OLS is inefficient, whereas under the alternative, fixed effect is consistent, but the random effect is not. Therefore, under the null hypothesis, the two estimates should not differ systematically and hence a test is proposed on the difference.

The Hausman specification test tests the covariance matrix of the difference vector $[\hat{\beta}_{FE} - \hat{\beta}_{RE}]$ for orthogonality of the common effects and the regressors:

$$Var[\hat{\beta}_{FE} - \hat{\beta}_{RE}] = \text{var}\left(\hat{\beta}_{FE}\right) + \text{var}\left(\hat{\beta}_{RE}\right) - \text{cov}\left(\hat{\beta}_{FE}, \hat{\beta}_{RE}\right) - \text{cov}\left(\hat{\beta}_{RE}, \hat{\beta}_{FE}\right) \quad (17)$$

If there is no difference between the two estimators, as Hausman shows, then the covariance of an efficient estimator with its difference from an inefficient estimator is zero:

$$Cov[(\hat{\beta}_{FE} - \hat{\beta}_{RE}), \hat{\beta}_{RE}] = \text{cov}(\hat{\beta}_{FE} - \hat{\beta}_{RE}) - \text{var}\left(\hat{\beta}_{RE}\right) = 0 \quad (18)$$

$$Cov(\hat{\beta}_{FE} - \hat{\beta}_{RE}) = \text{var}(\hat{\beta}_{RE}) \quad (19)$$

$$Var[\hat{\beta}_{FE} - \hat{\beta}_{RE}] = \text{var}(\hat{\beta}_{FE}) - \text{var}(\hat{\beta}_{RE}) = \Psi \quad (20)$$

where Ψ is the covariance matrix for the test. Under the null hypothesis, the chi-square test is based on the Wald criterion:

$$W = \chi^2 = [\hat{\beta}_{FE} - \hat{\beta}_{RE}]' \hat{\Psi}^{-1} [\hat{\beta}_{FE} - \hat{\beta}_{RE}] \quad (21)$$

The estimated covariance matrices of the slope estimator in the fixed effects model and the estimated covariance matrix in the random effects model, exclusive of the constant term are used in $\hat{\psi}$. Though the Hausman test is a useful device for determining the preferred specification of the common effects model, it does not guarantee that the difference between the two covariance matrices will be positive definite in a finite sample i.e. nothing is there to prevent the statistic Ψ from being negative. Hence, the random effects model is not rejected, since the likeness of the covariance matrices is what is causing the problem, and under the alternative (fixed effects) hypothesis, they may be significantly dissimilar. Therefore, it is useful, to use the results of the fixed and random effect models, to recover the coefficient vector and estimated the asymptotic covariance matrix, $\hat{\beta}_{FE}$ and V_{FE} from the fixed effects results and the $\hat{\beta}_{RE}$ and V_{RE} (excluding the constant term). The test statistic is:

$$H = [\hat{\beta}_{FE} - \hat{\beta}_{RE}]' [V_{FE} - V_{RE}]^{-1} [\hat{\beta}_{FE} - \hat{\beta}_{RE}] \quad (22)$$

If the computed value of the testing statistic is greater than the critical value, the null hypothesis of the random effects model is rejected and the fixed effects model is the preferred specification for data.

EMPIRICAL ANALYSIS

In the empirical analysis, the own tax revenue of states as a ratio of NSDP is specified as a function of grants from the centre as a ratio of the total revenue, share in central taxes as a ratio of revenue, revenue expenditure as a ratio of NSDP and per capita NSDP. As the observations for a state may not be independent, panel data regression techniques are used to control for the individual differences. Table 5 presents the definition and the descriptive statistics of the variables used in the empirical analysis.

Table 5: Descriptive Statistics of Variables in the Analysis of Tax Efforts of States

Variable	*Definition*	*Mean*	*Std. dev.*
STR/NSDP	Own tax revenue of state as a ratio of NSDP	0.084	0.031
GRANTS/NSDP	Grants from the centre as a ratio of the state's total revenue	0.243	0.191
SCT/REV	Share in central taxes as a ratio of state revenue	0.414	0.409
REVEXP/NSDP	Revenue expenditure of state as a ratio of NSDP	0.192	0.083
NSDPpc	Per capita net state domestic product (Rs. at current prices)	1.538	1.855
Obs.		444	

The estimating empirical specification is:

$$STR/NSDP_{it} = \beta_0 + \beta_1 NSDP_{it} + \beta_2 GRANTS/REV_{it} + \beta_3 SCT/REV_{it} + \beta_4 REVEXP/NSDP_{it} + +u_{it} \quad (23)$$

Table 6 presents the estimates of pooled OLS, fixed effects and random effects panel regression models. The pooled OLS regression estimates show that a unit increase in grants from the centre will lead to a significant reduction of 4.8% in the tax effort of the states. Similarly, an increase in the share in central taxes will lead to a significant reduction in the tax effort of states by 1.9%. The revenue expenditure as a ratio of NSDP is also highly significant and the coefficient indicates a positive impact on the tax efforts of states. However, the coefficient of per capita NSDP has insignificant to states' tax efforts.

Table 6: Panel Regression Estimates of Tax Efforts of States

Dependent variable: STR/NSDP

Variable	*Pooled regression*	*Fixed effects*	*Random effects*
NSDPpc	0.00013 (0.31)	0.0092*** (3.04)	0.00093*** (2.96)
GRANTS/NSDP	-0.048*** (7.53)	-0.0057*** (3.06)	-0.0098*** (2.78)
SCT/REV	-0.193*** (6.53)	-0.0077*** (2.67)	-0.011*** (3.61)
REVEXP/NSDP	0.308*** (3.37)	0.324*** (5.18)	0.322*** (4.80)
Constant	0.044*** (9.87)	0.025*** (7.52)	0.027*** (9.04)
Within R-square	-	0.856	0.855
Between R-square	-	0.063	0.145
R-square	0.75	0.61	0.645
ρ-value $[\sigma_u^2/(\sigma_u^2 - \sigma_\varepsilon^2)]$	-	0.745	0.410
Hausman test	-	67.32	
Pro>Chi^2 (p-value)	-	0.00	

Note: Absolute t-values in parentheses. *** significant at 1% level.

The fixed effects regression that controls the state-wise heterogeneity of differences in economic, social and demographic factors, estimates show that NSDP per capita and revenue expenditure as a ratio of NSDP is statistically significant and positively influence the tax efforts of states. The coefficient of per capita NSDP, showing the tax capacity of sub-national units and the ability of states to raise tax revenue, implies that a unit increase in per capita NSDP leads to an increase of 1% increase in tax revenues of the states. Similarly, a 1% increase in revenue expenditure as a ratio of NSDP leads to a 32% increase in the tax effort of the states. This implies that an increase in the current expenditure of states will pressure the government to increase its effort to collect more taxes as they have to find

a way to finance the additional expenditure. The estimated coefficient of grants as a ratio of revenue is significantly and negatively associated with the tax effort of states. A 1% increase in grants, given the total revenue of the state, will reduce the tax effort of the state by half a per cent. This clearly states that grants from the central government have an adverse effect on the revenue mobilisation of states. The significant negative coefficient of the share in central taxes as a ratio of the total revenue of states shows that an increase in it will dampen the tax collection efforts of states.

The rho value for the fixed effects model shows that the group errors are correlated with regressors. The rho is the inter-class correlation which indicates the percentage of variance due to differences across panels. The rho value of 0.745 shows that 75% of the variance in revenue generation of states is due to differences across panels implying that there exists a wide inequality across the states of India in their tax efforts. There is a situation of the states being polar opposites; on one hand, there are states which exhibit a very promising situation of revenue generation and, on the other hand, there are states with alarmingly low tax efforts with a dire need of policy level overhaul to address revenue gaps. The within R-square value shows that nearly 85.61% variance in revenue collection is mainly explained by transfers and revenue expenditure.

In the random effects regression, the NSDP per capita and revenue expenditure as a ratio of NSDP has a statistically significant positive effect on the tax efforts of states. However, an increase in per capita NSDP has only a marginal impact on the tax efforts of states. A 1% increase in revenue expenditure as a ratio of NSDP leads to a 32% increase in the tax effort of the states. An increase both in union grants and share in central taxes decreases the tax efforts of states showing the dampening effect on the tax collection efforts of states. The rho value of the random effects model shows that about 41% of the variance in revenue generation of states is due to differences across panels and the between R-square value shows that nearly 14% of the variance in own tax revenue of states is due to differences across panels.

As both the fixed effects and random effects models produced estimates that are very close, the appropriateness of the models for data is checked with the Hausman specification test. The mill hypothesis for the Hausman test is that there is a random effect or differences between the models are not systematic whereas the alternative hypothesis states that there are no differences and the presence of a fixed effect. The calculated chi-square value for the Hausman test is highly significant and hence the null hypothesis of random effect is rejected and the alternative hypothesis of fixed effects model as appropriate for data is accepted.

CONCLUSION

Bridging the development gap between the economically and socially divergent regions and allocating resources, especially the tax collections, in a federal economy like India is a challenging task. A common way of dealing with this task is to provide additional financial support to the poorer states from the central revenue collections in order to help them develop and compete with their richer counterparts. Therefore, in a federal setup, the concepts of vertical and horizontal equity and efficiency are important considerations for such transfers. As the sub-national governments also have their own sources of revenue, there could be a temptation to seek less revenue mobilisation by the states, thus lacking efficiency, and the centre may direct transfers to those states with the largest fiscal imbalances or less revenue. This would undermine the credibility of the central government when it tries to enforce a binding budget constraint on the state governments and it could lead to a reduced effort by states to adhere to fiscal policy norms. The states with higher tax potential may tend to rely more on the central transfers and might not efficiently use their tax potential to generate more revenue.

This paper analyses the effect of federal transfers on the own tax revenue of states using a panel data set of transfers and taxes for 15 major states of India from 1980-81 to 2019-20. The estimated negative relationship between transfers, a grant from the centre and share in central transfers, and revenue mobilisation of states indicates revenue substitution by states; more central government assistance means less dependence on own tax revenue. Indian states increasingly depend on central grants, rather than improving efforts to increase their own revenues even when they have high tax potential or even when they are in dire need of financial assistance. Thus, the central transfers adversely affect the incentives of states to mobilise their own resources indicating that central transfers have a dampening effect on states' revenue efforts.

The panel analysis of this paper also shows a strong positive relationship between NSDP per capita and tax revenue showing the high tax potential of the states. However, the NSDP per capita alone can not be taken as a measure of tax capacity or the revenue base. This is because not all services are under the purview of state taxes and also agricultural income is included in NSDP but does not fetch any income tax for states. Further, the incentive criterion for tax effort as used both in the finance commissions devolutions and in the Gadgil formula used by the planning commission is not reflected in the federal system of India, and it has failed to induce a desired positive revenue generation in states.

Higher union transfers are justified to low state income states where the tax collection is low, may be due to a low tax base or capacity factors, in

order to reduce the vertical and horizontal fiscal imbalances. A higher transfer is a way to enable a state to provide a level of services at par with other states. However, richer states also depending on union transfers is to be discouraged. In the long run the effects of transfers must be either neutral or should encourage own revenue efforts in India.

References

Bhatt, A. and P. Scaramozzino, 2015; "Fiscal Transfers and Fiscal Discipline in India: An Empirical Investigation", *Public Finance Review*, 43, 1, 53-81.

Hausman, J.A., 1978; "Specification Tests in Econometrics", *Econometrica*, 46, 6, 1251-1271.

Khemani, S., 2007; "Does Delegation of Fiscal Policy to an Independent Agency Make a Difference? Evidence from Intergovernmental Transfers in India", *Journal of Development Economics*, 82, 2, 464-484.

Musgrave, R.A., 1961; "Approaches to a Fiscal Theory of Political Federalism", in Universities-National Bureau Committee for Economic Research (ed.): *Public Finances: Needs, Sources, and Utilization*, Princeton: Princeton University Press, 97-134.

Panda, P.K., 2009; "Central Fiscal Transfers and States' Own Revenue Efforts in India: Panel Data Models", *Margin: The Journal of Applied Economic Research*, 3, 3, 223-224.

Panda, P.K., 2016; "Economic and Political Determinants of Central fiscal Transfers in India: A Dynamic Panel Data Analysis of State Level Data", *Journal of Developing Areas*, 50, 2, 329-347.

Rangarajan, C. and D.K. Srivastava, 2011; *Federalism and Fiscal Transfers in India*, New Delhi: Oxford University Press.

Rao, M.G., 2002; "State Finances in India: Issues and Challenges", *Economic and Political Weekly*, 37, 31, 3261-3271.

Roy, P. and A. Raychaudhuri, 2009; "Intergovernmental Transfer Rules, State Fiscal Policy and Performance in India", in B. Dutta, T. Ray and E. Somanathan (eds.): *New Enduring Themes in Development Economics*, New York: World Scientific Publishing, 369-400.

Sham Bhat, K., 1993; "Determinants of Grants in Indian States", *Indian Journal of Economics*, 74, 293, 161-173.

Sham Bhat, K. and V. Nirmala, 1993; "Political Economy of Tax Revenue Determination in Indian States", *Indian Journal of Economics*, 73, 290, 383-396.

Sharma, C., 2011; "Beyond Gaps and Imbalances: Re-structuring the Debate on Intergovernmental Fiscal Relations", *Public Administration*, 90, 1, 99-128.

Singh, N. and G. Vasishtha, 2004; "Some Patterns in Center-State Fiscal Transfers in India: An Illustrative Analysis", *Economic and Political Weekly*, 39, 45, 4897-4903.

Vasishtha, G. and I. Rajaraman, 2000; "Impact of Grants on Tax Effort of Local Government", *Economic and Political Weekly*, 35, 33, 2943-2948.