

Tax Revenue Efficiency in India States: The case of Stamp Duty and Registration Fees

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1. Introduction:

Federal structure of India divided taxation powers between central government and state government on certain principles. But, over the years, it is argued that large part of the productive and progressive tax base is under the control of central government compared to states. On the other hand, Fiscal Responsibility and Budget Management Act (FRBMA) bind states to reduce their fiscal deficit to 3 percent of their gross state domestic product (GSDP) and eliminate the primary deficit. This limits the borrowing capacity of the states. In other words, states end up with few avenues to tax, low own tax revenues, FRBM rules and their dependence on federal transfers are increasing over the years given the increased expenditure responsibilities. This excessive dependency on federal transfers impacting the relationship between revenue-expenditure decisions of state governments and resulting in poor service delivery. Either of these outcomes would imply adverse implications for efficiency and accountability of state government's governance (Rao, 2013).

But, due to the goods and service tax (GST) implementation, states lost control over many taxes, since many state taxes were subsumed into GST (See Table-1). Now, any changes to GST rates or structure need to be done in consultation with GST council. This causes huge uncertainty on the states' revenue stream and adjustments according to the local needs. On the other hand, the states revenue situation has not improved very drastically (See Table-2). State

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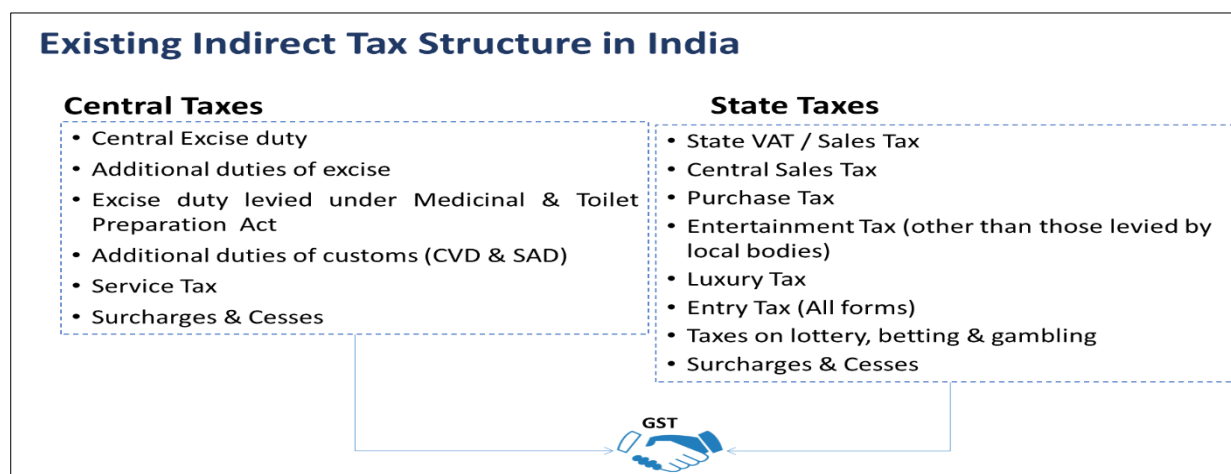
total revenue to GSDP growth is also very slow. It has increased from 12 percent in 2010-11 to 14.3 in 2015-16. Even this growth is largely due to federal transfers. The share of federal transfers in the states total revenues increased from 4.9 percent in 2010-11 to 7 in 2016-17. Over the years, states did put tax effort to improve its own tax revenues but despite of states efforts, the improvement is marginal. States' own-tax revenues (OTR) as a ratio to GSDP have increased from 5.83 per cent during 2000–01 to 6.4 per cent in 2011–12 and to 6.7 in 2016-17. In the post GST regime, the revenue losses to states due to subsuming certain taxes is not clear at this moment. The GST compensation is promised for the first 5 years of GST implementation based on the 2015 tax revenue data of states. On the other hand, there is lot of ambiguity on the magnitude and growth of Non-GST own tax revenues of the states.

An overview of different taxes at states

According to NIPFP (1992) report, “constitutionally, the Seventh Schedule of the Constitution of India (along with Article 246), clearly demarcates exclusive and concurrent jurisdictions of the Union and the constituent State governments. Residuary powers have been vested in the Union (Parliament) while Articles 249 to 254 qualify the functional distribution provided in the Seventh Schedule under certain circumstances. Other constitutional provisions regarding distribution of tax powers are contained in Articles 268-274, Articles 276, 277, 286, 287, 288 and 289”.

Rao (2005) points out that, “the broad based and mobile tax bases are assigned to the Centre. These are taxes on non-agricultural incomes and wealth, corporation tax, customs duties and excise duties on manufactured goods. States' tax powers include taxes on agricultural incomes and wealth, sales taxes, excises on alcohol, taxes on motor vehicles, passengers and goods, stamp duties and registration fees on transfer of property and taxes and duties on electricity”. Historically, major tax earner for states is sales tax, which is now subsumed under GST. The below table list out all the taxes which are subsumed under GST at centre and state level. **Appendix-1** explains the detailed classification of the GST and Non-GST revenues of the states. Here, the all the taxes are explained in detail with the respective budget codes and categories.

Table-1: Existing Indirect Tax Structure in India



Source: Central Board of Excise and Customs (CBEC)

Under this background, states need to focus on the other existing taxes to improve its own tax revenues. The major revenue yielding taxes to states in the post GST regime are excise tax and stamp duty and registration fees. This study focus on the stamp duty and registration fees. Stamp duty contributes a reasonably large share to a state's own tax revenues. Stamp duty constitutes the third or fourth important source of revenue for state governments, after sales tax and state excise duty and sometimes after tax on vehicles. The all-India average being between 7 per cent and 14 per cent of own tax revenue (Mukherjee, 2013).

Table-2: States Own Tax Revenues (OTR)

Year	Own Tax Revenues (OTR)	Own Revenue	Central Transfers	Total
1	2	3	4	(5 =3+4)
2010-11	6.2	7.1	4.9	12
2011-12	6.4	7.5	5.1	12.6
2012-13	6.6	7.8	4.8	12.6
2013-14	6.3	7.5	4.7	12.2
2014-15	6.3	7.4	5.4	12.8
2015-16 (RE)	6.5	7.7	6.6	14.3
2016-17 (BE)	6.7	8	7	15

Source: State Finances a study of budgets of 2016-17, Reserve Bank of India, 2017

Objectives of the Study:

This study seeks to contribute to the literature on tax effort by employing stochastic frontier analysis (SFA) to measure tax revenue performance of stamp duty and registration fees of 17 non-special category states. Under the background of FRBM regulations, GST implementation and, federal transfers, this study addresses the following questions: How efficient are Indian states in exploiting their tax potential? What factors determine the tax effort and efficiency? How diverse or similar are the Indian states in the overall tax effort?

Section two explains the background, constitutional provisions, various committees appointed over time. Section three will review major literature on in the area of stamp duty and registration and reviews some of the latest developments and policy changes that had happened in the last two decades. Section four, presents' trends in the stamp duty and registration fees. Section five, data and variables used in the empirical estimations. Section six presents discusses the methodology and empirical estimations. Then, final section includes conclusion, policy recommendations, future directions and limitations of the study.

2. Overview of Stamp Duty and Registration Fee³:

The Seventh Schedule of the Constitution of India (Article 246) clearly demarcates exclusive and concurrent jurisdictions of the Union and the constituent State governments (NIPFP, 1992, 1996). According to Sen (1999), the Constitution of India empowers the Union government and the State governments to legislate provisions regarding stamp duties⁴ as per their competence according to the Union list and the State list in the Seventh Schedule. Entry 44 of the Concurrent list covers matters other than the tax rate. Sen (1999) further says, the constitutional provisions regarding stamp duty appear to imply that as far as rates are concerned, the instruments connected to matters included in the Union list are in the domain

³ There is another stream of literature, which also shares the same tax base as stamp duties. Stamp duties on land transactions differ from recurrent land and property taxes. Where land and property taxes typically refer to recurrent taxes levied on the unimproved value of land by local governments, stamp duties only apply when real property is transferred from one owner to another (Davidoff and Leigh, 2013).

⁴ A similar tax sometimes has a different name in other countries, such as 'land transfer tax', 'mansion tax', 'property transfer tax' (Mukherjee, 2013).

of the Central government, while the rates on residual items can be legislated upon by the individual States. The stamp Duty in Indian states is levied under the Indian Stamp Act, 1899 and Indian Registration Act, 1908. Based on the central Acts, various states have further introduced their acts according to the states need. E.g.: Orissa Stamp rules (1952), Indian Stamp act (Orissa Amendment) Act, 1986 and Orissa Additional Stamp Duty Act, 1970, Punjab Stamp Rules, 1934, the Haryana Stamp (Prevention of Undervaluation of Instruments) Rules, 1978.

Stamp duty is leviable on the execution of instruments as per Schedule I-A of the Indian Stamp Act, 1899 and Registration Fee rates are fixed by the State Government based on Registration Act, 1908. 'Stamp duty' is defined as a tax on the value of instruments used in various business transactions. Currently in India, states collect revenue from two different types of 'stamp duty': (a) judicial stamp duty, collected as court fee and (b) non-judicial stamp duty, collected ad valorem as transaction tax on transfer of immovable property. A tax in the form of 'registration fee' is also collected by the states on notification of contracts. In some states it is collected ad valorem, while in some others it is collected per transaction (NIPFP, 1996; Sen, 1999; Alm et al, 2005).

In other words, a stamp duty and registration fee is paid to the government while transferring or registering various financial instruments or deeds relating to financial transactions⁵. For registering different types of instruments, differing amounts are charged as registration fee. For certain instruments (mainly movable property) registration is compulsory, for others (such as immovable property) it is optional. The base of the tax is generally the value of property bought and/or sold in the state (Sen, 1999, Mukherjee, 2013; Purohit, 2006). According NIPFP reports (1995, 1999) over 65 different kinds of such charges are imposed by the States in the 1990s. But, the current state of the system needs to be explored.

Committees: Various committees were appointed at All India level and at state level, to look and reform the stamp duty system. Report on Stamp Duties and Registration Fees in West

⁵ As said above, broadly, all the instruments can be classified into judicial and Non-Judicial. According to Sen (1999) Instruments covered under the Indian Stamp Act 1899 (Central Act) include: (1) bill of exchange. (2) Bill of Lading, (3) Cheque, (4) Debenture. (5) Letter of Credit, (6) Policy of Insurance, (7) Promissory Note, (8) Proxy, (9) Receipt and (10) Transfer of shares.

Bengal, by S. Gopala Krishnan and A. Das Gupta, National Institute of Public Finance and Policy (June, 1986). Economic Reforms and the Stamp Act, NIPFP (1995), committee of state finance ministers on stamp duty reform, NIPFP (1996), Reform of Stamp Duty in Orissa by Tapas Sen, NIPFP (1999), Tax Reform Commission of Karnataka (2001) and Tax Administration Reforms Commission by Parthasarathi Shome (2014). Most of the reforms that the above committees suggested were introduced by the states. The recommendations were mainly on the tax rates harmonisation, stamp duty structure, administrative reforms, computerisation of registration process, and periodic fixation of property valuations on in relation to market valuations.

3. Evolution of Literature on Stamp Duty and Registration Fee, Tax Effort, Tax Potential and Tax Efficiency:

Determinants of stamp duty and Registration fee: Apart from the above committee reports, the exclusive academic research on the issue of stamp duty in India is very scant. There are there papers which can be notable here. Alm et al (2004) (again this is a World Bank sponsored study). Mukherjee (2013) and Karnik and Raju (2015) are the exceptions.

Alm et al (2004) reviews all the policy changes in the area of stamp duty tax. The study mainly focuses on the tax rates and compiles their own tax rates data through various approximations. The study also presents international comparison of different aspects of stamp duty.

Mukherjee (2013) study exclusively the determinants of stamp duty revenue in Indian states. The study employs a panel data set from 18 states over the period between 1993– 2010. First it reviews the all the policy and tax administrative developments with respect to stamp duty. Then, a theoretical model is proposed to understand the determinants and with available data, this model is tested through panel regressions empirically. The study found that the tax rates and per capita income significantly affecting stamp duty revenue.

Karnik and Raju (2015) analyze the tax effort and tax potential of 17 Indian states from 2000-10 by using stochastic frontier analysis. This study analyses four state taxes namely: stamp duty and registration fees, state sales tax (replaced by value added tax (VAT) after 2005), state

excise duty on alcoholic beverages, motor vehicles tax (motor vehicles tax comprises of taxes on vehicles and taxes on goods and passengers). The study found that Indian states are operating with high inefficiencies and there is a need for more tax effort to exploit the tax potential.

Tax Rates and Structure: According to Alm et al (2004) India have higher rates of stamp duties and fees historically compared to International standards. In the early 2000 period, the average stamp duty tax in India is around 10 to 12 percent, whereas the international average is less than 5 percent. State governments indiscriminately used the power to tax with high rates and there is no uniformity across the states. High tax rates led to high transaction costs, tax evasion and destabilise urban land markets. Das-Gupta (2002), Sen (1999) found negative relation between tax rates and revenues in various states. But, over the years, tax rates reduced and tax administration improved. Now, as Mukherjee (2013) argue tax revenues are not determined by much larger market variables then tax rate alone.

Transactional Costs, evasion and Scams: Sen (1999) finds the existence of substantial transaction costs in stamp duty administration in Odisha. Alm et al (2004) found that evasion of stamp taxes through under declaration of property values in transactions has an impact on a number of other revenue sources, including the federal capital gains tax. In addition, the linkage of under declaration and black money further reduces tax revenues across the board. The “Telgi scam also came out around 2003. The scam is primarily printing and circulating duplicate stamp papers throughout India. The total amount of loss due these fake stamps to revenue found out to be around 780,000 million or US\$ 17 billion (Arvind, 2004). To address these problems and to incentivise states to harmonise tax rates, streamline tax administration and reduce transaction costs, government of India initiated the Urban Reform Incentive Fund in 2003. This fund was later subsumed in Jawaharlal Nehru National Urban Renewal Mission (JNNURM) in 2005-06 (Mukherjee, 2013, Alm et al, 2004).

Stamp Duty Administration: Following various committees (List mentioned above) recommendations, e-governance was introduced in various states. Franking machines were also extensively introduced to the fake stamp papers. Land record digitalisation is now under way in various states (Eg. Telangana) will bring the coherence different wings of the tax

administration. Various state governments are also periodically reviewing the land prices to curtail under valuation of the assets.

Determinants of Tax effort and Efficiency:

Tax collection differs across States depending on their tax base (known as taxable capacity) and tax efforts (also known as tax efficiency). Chelliah (1971) defines tax capacity as the ability of a government to raise tax revenues based on various structural factors including the level of economic development, the number of “tax handles” available, and the ability of the population to pay taxes. Bahl (1972) defines tax effort as a measure of how well a country is using its taxable capacity, in other words, tax effort is the ratio of actual tax revenue to taxable capacity. Over time, there are different methodologies emerged to estimate tax effort and tax potential of the governments. For excellent review of methodologies and possible merits and demerits, see Cyan, Vazquez and Vulovic (2013), Pitt and Lee (1981), Battese (1992), and Battese and Coelli (1992).

The studies primarily focused either sub-national or local government’s tax efforts for a single country or panel studies with international comparison of tax ratios. Alfirman (2003) analyzed the tax effort and efficiency of Indonesian local governments and found that there is a lot of scope to exploit the current tax potential instead of imposing new taxes. Fenochietto and Pessino (2013) analyze a panel data to estimate tax effort for 113 countries. The study found that higher per capita GDP, high education levels, low or stable inflation, openness of the economy, low corruption and income distribution lead to higher efficiency in tax revenues. Over the years, there are many Indian studies that analysed tax effort. Below table-3 explains some of the important studies. The studies mainly used regression approach, representative tax approach and stochastic frontier approach.

Table-3: Indian Tax Effort Studies

Study	Methodology	States	Years
Reddy (1975)	Regression Approach	16	1970-72
Thimmaiah (1979)	Regression Approach	16	
Oommen (1987)	Step-wise Regression Approach	16	1970-81
Rao (1993)	Modified RTS method		

Sen (1997)	Cross-Section Regressions	15	1991-93
Coondoo, et al (2001)	Quantile Regression	16	1986-96
Purohit (2006)	Regression Approach	16	2000-03
Garg, Goyal and Pal (2014)	Stochastic Frontier Analysis	14	1991-2010
Karnik and Raju (2015)	Stochastic Frontier Analysis	17	2000-2010

Source: Author compiled from literature.

4. Current Trends of Tax Revenues from Stamp Duty and Registration Fee:

Stamp duties amount to a significant source of revenues for most State governments own tax revenues, after excise and sales tax. Table-4 presents data on stamp duty and registration fee and different components of it as the ratio of total tax revenue. Maharashtra (10.28 in 2001 to 16.19 in 2014) and Goa (3.90 in 2001 to 13.76 in 2014) are receiving highest percentages from stamp duty. Goa tax revenues have drastically increased over time. For all other states, stamp duty taxes have increased more or less steadily. There are 3 components under the head stamp duty and registration fee, Judicial, non-judicial and registration fee. Among the 3 components, non-judicial stamps contribute the maximum percentage.

When it comes to judicial stamp duty, Uttar Pradesh gets good percentage of total tax revenue around 2.24 in 2014. But, over the years its share decreased from 6.79 percent in 2001 to 2.24 in 2014. One reason could be, its relative share has decreased compare to other taxes rather than in absolute decrease. Other states get in the range of 0.05 percent 0.8 percentages. The registration fee contributes around 1 to 2 percent in the last decade. Goa (2.58), Karnataka (1.58), Kerala (1.77) and West Bengal (2.20) receive good amount of registration fee revenue in 2014.

Table-4: Ratio of Revenue from Different Taxes to Total Tax Revenue

No	State	Ratio of Stamp Duty & Registration fee to Total Tax Revenue				Ratio of Judicial Stamp Duty to Total Tax Revenue				Ratio of Non-Judicial Stamp Duty to Total Tax Revenue				Ratio of Registration Fees to Total Tax Revenue			
		2001	2005	2010	2014	2001	2005	2010	2014	2001	2005	2010	2014	2001	2005	2010	2014
1	Andhra Pradesh	5.16	7.70	6.35	5.61	0.25	0.21	0.14	0.11	4.23	6.68	5.62	4.69	0.67	0.81	0.60	0.81
2	Bihar	3.58	3.61	3.25	4.68	2.07	0.20	0.17	0.08	1.40	2.81	2.29	3.46	0.12	0.61	0.78	1.14
3	Chhattisgarh	3.72	4.77	5.45	4.25	0.43	0.08	0.63	0.05	2.65	3.88	4.01	3.28	0.65	0.81	0.81	0.92
4	Goa	3.90	4.51	5.57	13.76	0.33	0.07	0.06	0.03	2.69	3.03	3.27	11.14	0.88	1.41	2.24	2.58
5	Gujarat	5.02	6.05	8.52	7.68	0.44	0.13	0.45	0.08	3.76	5.26	7.00	6.62	0.83	0.66	1.07	0.98
6	Haryana	9.01	13.03	12.15	9.97	1.19	0.20	4.44	0.88	7.22	12.66	7.60	8.53	0.59	0.18	0.11	0.55
7	Jharkhand	2.00	1.55	2.77	2.68	1.36	0.32	0.82	0.20	0.63	0.01	1.66	1.69	0.02	1.21	0.28	0.79
8	Karnataka	6.85	9.68	7.36	8.28	0.17	0.15	0.14	0.12	5.02	7.42	5.72	6.58	1.66	2.12	1.51	1.58
9	Kerala	5.23	8.96	9.50	6.16	0.32	0.43	0.28	0.23	3.49	6.93	7.01	4.16	1.42	1.59	2.21	1.77
10	Madhya Pradesh	5.48	6.53	6.78	6.42	0.20	0.24	0.24	0.59	4.84	5.32	1.75	4.80	0.43	0.98	4.80	1.03
11	Maharashtra	10.28	13.67	16.19	15.07	0.27	0.25	0.31	0.19	8.73	11.79	13.88	13.57	1.28	1.62	1.52	1.26
12	Odisha	2.15	2.39	1.92	2.22	0.10	0.33	0.00	0.07	1.67	1.39	1.38	1.26	0.38	0.67	0.54	0.89
13	Punjab	8.18	16.35	11.66	8.17	0.28	2.74	0.03	0.20	6.83	10.53	9.36	6.54	1.07	3.08	2.27	1.43
14	Rajasthan	5.60	6.80	5.77	5.45	0.37	0.20	0.13	0.09	3.60	4.21	4.53	4.62	1.63	2.38	1.12	0.73
15	Tamil Nadu	7.17	7.36	7.92	8.76	0.27	0.23	0.17	0.15	6.00	5.92	6.50	6.97	0.89	1.21	1.25	1.64
16	Uttar Pradesh	6.97	8.09	7.06	8.52	6.79	5.02	4.20	2.24	0.11	3.02	2.34	5.28	0.06	0.04	0.53	0.86
17	West Bengal	5.13	6.90	6.11	6.56	0.80	0.53	0.20	0.14	4.01	3.80	2.46	4.22	0.32	2.57	3.45	2.20

Source: Public Finance Statistics, Ministry of Finance and NIPFP data collection.

5. Data and Variables:

This study considered 16 general category states and the period of study is from 2000-01 to 2014-15. The lists of states included in the study are: Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Orissa, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal. All the data is from NIPFP Data bank, Public Finance Statistics, Ministry of Finance, NITI Ayog and Reserve Bank of India.

Dependent variable is the logarithm of the stamp duty and registration fee revenues of the state. A set of variables are used as independent variables. The dataset consists of various determinants of tax revenue collection of the state, which include macro and socio economic variables and state specific variables. All the variables are explained below.

GSDP: Gross state domestic product is the measure of overall development of the state and higher the GSDP, under the assumption of no loopholes, will generate higher tax revenues.

Interest Repayments by the states: The states with high debt burden will have fewer prospects for new asset creation in all sectors like housing and infrastructure etc. High interest payments indicate higher debt accumulation and hence push the state to put more tax effort to collect taxes.

Capital Expenditure: Capital spending reflects the size of the government and to the extent government is providing public goods and specific targeted private goods. It is expected that higher capital expenditure, creates higher infrastructure and assets, which will in turn create new assets and asset transactions. This will yield higher the tax revenues.

Number of industries and Power consumption: higher number of industries and higher power consumption indicates the prosperity of the society. In the recent times, NASA light and brightness data is used as an indicator of regional prosperity.

FRBM Dummy: Following Gerg et al (2016) FRBM dummy is introduced in the model. This reflects the regime shift from unconstrained state government borrowing situation to a rule

based fiscal management and optimises their tax revenue and expenditure flows. FRBM dummy takes the value “zero” prior to FRBM enactment and “one” post FRBM enactment.

Monsoon: Overall Rainfall as a proxy for good monsoon (given code as 1) or bad monsoon (given code as 0): But the data is available only at all India level. So we have used the same for all states. The rainfall data is collected from EPWRF database and the difference between the actual rainfall and the normal rainfall is used as an indicator of good or bad monsoon year.

Table 1. Summary Statistics

Variable		Mean	Std.Dev	Min	Max	Observations	
Stamp and Reg Revenue	overall	7.264	1.149	4.157	9.903	N	224
	between		0.960	5.216	8.968	n	16
	within		0.672	5.969	8.472	T	14
Capital Expenditure	overall	9.026	0.804	6.565	11.166	N	224
	between		0.587	8.148	10.002	n	16
	within		0.567	7.443	10.379	T	14
Interest Repayments	overall	8.503	0.760	6.551	10.084	N	224
	between		0.702	6.994	9.428	n	16
	within		0.337	7.774	9.380	T	14
GSDP	overall	12.329	0.849	10.293	14.399	N	224
	between		0.583	11.363	13.473	n	16
	within		0.632	10.688	13.521	T	14
Power consumption	overall	4.621	0.703	2.218	5.960	N	224
	between		0.624	2.942	5.535	n	16
	within		0.357	3.061	5.592	T	14
Number of industries	overall	8.789	0.892	7.132	10.542	N	224
	between		0.891	7.519	10.184	n	16
	within		0.221	8.391	9.314	T	14
FRBM Dummy	overall	0.696	0.461	0.000	1.000	N	224
	between		0.129	0.286	0.857	n	16
	within		0.443	-0.161	1.411	T	14
Monsoon	overall	0.214	0.411	0.000	1.000	N	224
	between		0.000	0.214	0.214	n	16
	within		0.411	0.000	1.000	T	14

6. Methodology: Stochastic frontier Analysis (SFA)

This study use stochastic frontier analysis to analyse and estimate tax efficiencies specifically with respect to stamp duty and registration fees of major Indian states. In the literature one issue is highlighted in using SFA as a methodology to estimate tax effort. Alfirman (2003) argues, in the case of production, the relation between output and inputs (capital and labour) are very clear. However, it is less clear when it comes to tax frontier. But, many studies like Fenochietto and Pessino (2013) and Garg et al (2017) take into cognizance of the issue and proceeds further by selecting most proximate determinates. So the selection of stochastic frontier analysis (SFA) as the methodology is justified.

The stochastic frontier models were originally proposed by Aigner, Lovell, Schmidt (1977) and Meeusen and van den Broeck (1977). The basic formulation of the model is as below and several new models are proposed with different distributional assumptions from this basic model. For complete review of the methodological developments and differences between different models, see Green (2005) and Kumbharkar (2016).

$$\begin{aligned}\ln y_i &= \alpha + \beta^T \mathbf{x}_i + v_i - u_i \\ &= \alpha + \beta^T \mathbf{x}_i + \varepsilon_i.\end{aligned}$$

Y_{it} and x_{it} represents dependent and set of independent variables for country i at time t , in the log form. β 's are vector of parameters. v_{it} is the random disturbance or error term.. u_{it} is the what represents technical inefficiency (TE). This inefficiency is the reason due to which states tax effort is fall short of tax capacity. TE is a non-negative random variable. Normality is assumed for v_{it} . Now, the different distributional assumptions on u_{it} lead to different class of models which are mentioned below. Finally, statistical independence between v_i and u_i is assumed and $u_{it} > 0$, but v_{it} can take any numerical value.

Panel Stochastic frontier Models:

Stochastic frontier models in the panel framework are first proposed by Pitt and Lee (1981) and Schmidt and Sickles (1984). They applied this method to study Indonesian weaving establishments and domestic airline industry in the USA. These models assumed technical inefficiency as time-invariant. Later, Cornwell et al (1990), Kumbhakar (1990) and Lee and Schmidt (1993) proposed time varying technical inefficiency models. The below table-5 presents different models of stochastic frontier analysis developed over time. Battese and Coelli (1995) introduced another model to estimate the time varying technical inefficiency stochastic frontier model, which became stand model in the stochastic frontier analysis literature. Green (2005) further came up with alternative formulations to deal with time invariant heterogeneity and proposed true fixed effects (TFE) and true random effects models (TRE).

Table-5: Different variants of SFA Models developed over the years

Stochastic Frontier Models
Cross-sectional model
Aigner, Lovell, and Schmidt (1977)
Meeusen and van den Broeck (1977)
Stevenson (1980)
Greene (2003)
Panel-data models
Schmidt and Sickles (1984)
Schmidt and Sickles (1984)
Pitt and Lee (1981)
Battese and Coelli (1988)
Cornwell, Schmidt, and Sickles (1990)
Lee and Schmidt (1993)
Kumbhakar (1990)
Battese and Coelli (1992)- Time variant Model
Battese and Coelli (1995)-Time Variant Model
Greene (2005a) TFE and TRE Models

Source: Belotti (2013)

Time invariant and variation in Inefficiency and Distributional assumption:

Mostly the earlier studies used time invariant models. Karnik and Raju (2015) employed the time-invariant inefficiency approach because their panel data set is not particularly long and these models yielded better results. But after 1990s, time invariant inefficiency assumption is questioned, especially in estimations involving long panels. The time variant decay models are proposed by Battese and Coelli (1992, 1995). Fenochietto and Pessino (2013) and Garg et al (2017) and many more studies used these models. The invariant models produce relative efficiency estimates. Here, inefficiency is with respect to best performing state. The best performing state will by default have efficiency value of 1. Time variant models give absolute measure efficiency estimates. Green (2005) true fixed effects (TFE) and true random effects (TRE) models need higher degrees of freedom. Belotti (2013) mentions that TFE and TRE models are ideally good and suitable for long panels. According to Green (2005) most of the recent results suggest that the estimates of inefficiency are reasonably robust to the model specification. Since all results are application specific, however, the question of ideal distributional assumption does not have an analytical answer. Based on above considerations, we estimated 4 stochastic frontier models: Schmidt and Sickles (1984) both fixed effects and random effects, Battese and Coelli (1995) and True fixed effects (TFE) Model of Green (2005).

7. Empirical Estimations:

The empirical estimation results of different time invariant and time variant models are presented in table-6. We have estimated five models namely, Schmidt and Sickles (1984) Fixed effects and Random Effects Models, Green 2005 TFE Model, and BC95 model for 16 major states. All the variables, except monsoon found to be statistically significant with proper sign. The signs, size and level of significance is also not varied much. It may infer that the underlying relation between stamp duty revenues and estimated repressors is fairly robust across different models. In other words, the set of variables selected are indeed good predictors.

Log Likelihood ratio and R-square were found to be large enough to confirm that the estimated model as a whole is highly significant. σ_u and σ_v parameters, which reflects the presence of technical efficiency, are statistically significant in Battese and Coelli (1995) model but they are not significant in Green-TFE model. Different alternative distributional

assumptions were assumed, but only exponential distribution gave good results and hence the study used only them. Remaining distributional assumptions did not converge or did not generate all statistics.

Schmidt and Sickles (1984) Fixed effects and Random Effects Models: The signs, size and level of significance of all the predictor variables, except monsoon found to be statistically significant. R-square found to be 0.953, which is large enough to confirm that the estimated model as a whole is highly significant. Time invariant models give technical efficiency with respect to best performing state. Here, Bihar state turn out to be most efficient and hence got the value of 1. The efficiency of other states vary between 0.2722 belongs to Jharkhand and 1 which is the efficiency of Bihar. Table-7 below presented the efficiency level across states over time.

Green 2005 TFE and TRE Models: We have tried to estimate both true fixed effects (TFE) and true random effects (TRE) models. But, TRE model did not converge. Only TFE model generated coefficients and efficiency estimates. As mentioned in the above sections, may be due to short panel and other reasons, event TFE model generated efficiency of all the states in the range of 0.9. Log likelihood ratio of 187.832 is large enough to confirm that the estimated model as a whole is highly significant. The σ_u is not significant in the case of TFE model.

Battese and Coelli (1995) Model: The signs, size and level of significance of all the predictor variables, except monsoon found to be statistically significant. Log likelihood ratio found to be -98.6916 for Battese and Coelli (1995) models, which is large enough to confirm that the estimated model as a whole is highly significant. σ_u and σ_v are 0.535 and 0.0484 are significant. Battese and Coelli (1995) model is time variant models and generates absolute technical inefficiency (unlike time invariant models like Schmidt and Sickles (1984) fixed effects and random effects models, which generate relative technical efficiency with respect to best performing state). Finally, we found that for given panel dataset, the model BC 1995 gives better results. The coefficients of the variables, Capital Expenditure (0.205), Interest Payments (0.332), GSDP (0.240), Power Consumption (0.153), Industries (0.367), FRBM Dummy (0.528) have got right signs and statistically significant. But, Monsoon (-0.0953) is not significant.

Trends in the tax frontier inefficiencies across states 2001-2013: After estimating the above models the efficiency and inefficiency estimates are computed. **Table-7** below presented the efficiency level across states over time. For all the models, the estimates indicate technical efficiency. The technical efficiency estimates vary from 0 to 1, one indicating 100% efficiency and vice-versa. The efficiency estimate indicates that, given the preconditions and all exogenous variables in the model, the state have a certain level of potential, i.e frontier level but due to some factors it's operating at the current level of efficiency. Efficiency estimates simply tells us how far the state is from the frontier level of efficiency.

Here, Bihar is operating at high efficient levels with efficiency estimates ranging from 97% in 2001 to 98 % in 2014. On the other hand, Odisha and Jharkhand are operating with low efficiency but there level of efficiency increased over time. Odisha's technical efficiency improved from 78.9% in 2001 to 86.9% in 2014. Tamil Nadu's efficiency is more or less constant. It reduced from 93.2 % in 2001 to 89.7% in 2005, but again increased to 92.7% in 2014. Gujrat's efficiency improved from 85.4 % in 2001 to 90.5% in 2014. Rajasthan efficiency is stagnate at 90.2 % in 2001 and 91.3% in 2014.

What explains the variation in efficacy over time? It is the policy changes and all the potential determinants of the model may play a role in improving efficiency. There may be some state specific and tax administrative measure too, which may be causing the inefficiency.

Tax Revenue Prediction till 2022:

After estimating the efficiency levels of the states, total stamp duty and registration tax revenues are predicted till 2015 to 2022. **Table-8** below presents these estimates for all the states across the time till 2022. These projections are true under certain conditions. First, all the independent variables grow at linear growth. Second, monsoon and FRBM are two dummies used in the model. Good monsoon is assumed throughout the prediction period and FRBM is followed by the states throughout the period. We have also experimented with different alternative scenarios but the linier prediction found to be more appropriate.

The gap between predicted tax revenue and frontier tax revenue is more the case of Gujrat, Rajasthan, Tamil Nadu, Punjab and West Bengal.

State wise gap between Predicted and Frontier Tax Revenue till 2022:

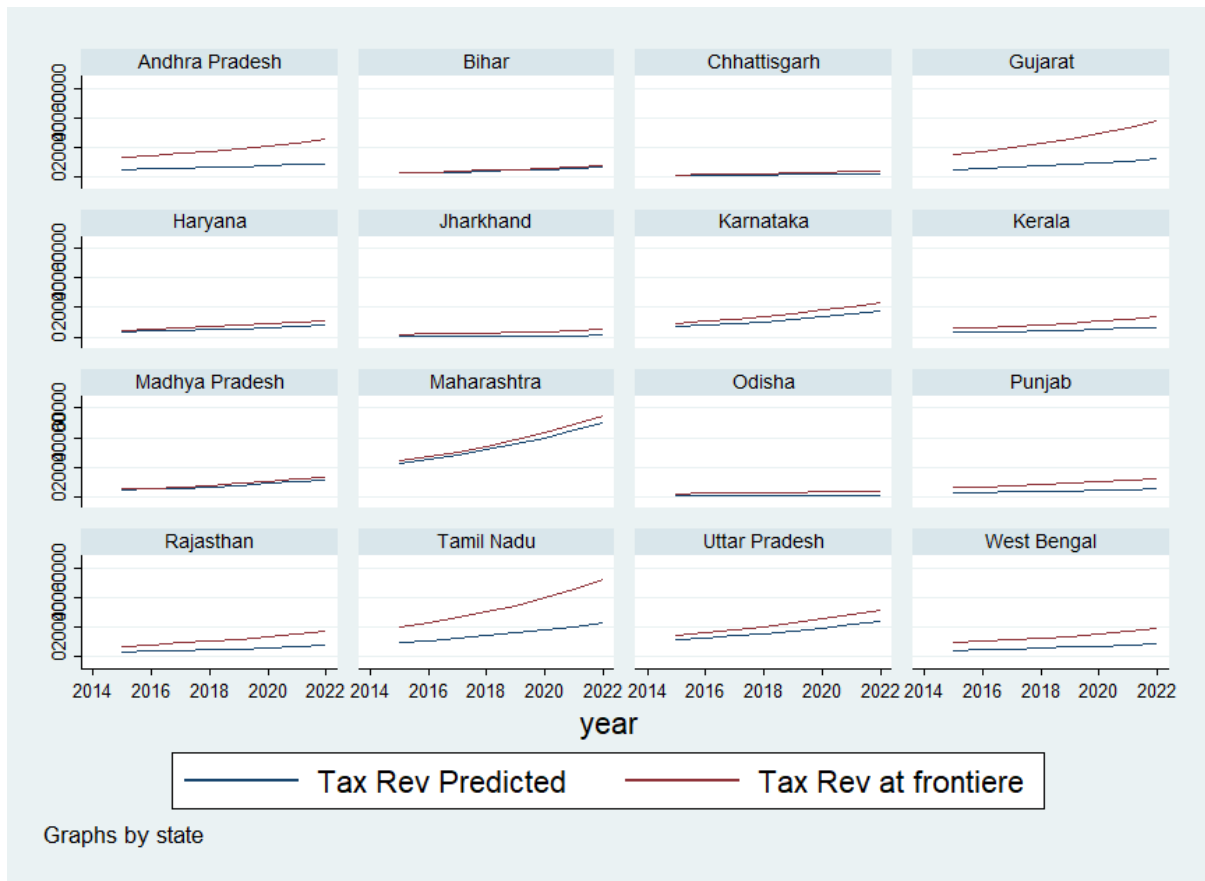


Table-6: Stochastic Frontier Model Estimations

VARIABLES	(1) Fixed Effects	(2) Random Effects	(3) TFE	(4) BC95
Capital Expenditure	0.113*** (0.0392)	0.123*** (0.0385)	0.113*** (0.0371)	0.205*** (0.0466)
Interest Payments	0.207*** (0.0673)	0.222*** (0.0640)	0.207*** (0.0638)	0.332*** (0.0763)
GSDP	0.329*** (0.0450)	0.333*** (0.0436)	0.329*** (0.0426)	0.240*** (0.0586)
Power Consumption	0.314*** (0.0721)	0.296*** (0.0655)	0.314*** (0.0683)	0.153*** (0.0490)
Industries	0.531*** (0.108)	0.495*** (0.0906)	0.531*** (0.102)	0.367*** (0.0585)
FRBM Dummy	0.349*** (0.0369)	0.351*** (0.0367)	0.349*** (0.0350)	0.528*** (0.0694)
Monsoon	-0.0187 (0.0279)	-0.0181 (0.0276)	-0.0187 (0.0264)	-0.0953* (0.0503)
Constant	-5.932*** (0.706)	-5.792*** (0.599)	0.113*** (0.0371)	-4.029*** (0.260)
Sigma_u	0.4364	0.4481	-10.93	0.535***
Sigma_v	0.1539	0.1539	-3.852***	0.0484***
Log likelihood Ratio	---	---	113.496	-98.6916
Prob > chi2	0.000	0.0000	0.0000	0.0000
Observations	224	224	224	224
R-squared	0.8519	0.8576	---	----
Number of States	16	16	16	16

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table-7: Trends in the tax frontier inefficiencies across states 2001-2013

State	Fixed Effects				Random Effects				True Fixed Effects(TFE)				Battese and Coelli (1995)			
	2001	2005	2010	2014	2001	2005	2010	2014	2001	2005	2010	2014	2001	2005	2010	2014
Andhra Pradesh	0.286	0.286	0.286	0.286	0.311	0.311	0.311	0.311	0.996	0.996	0.996	0.996	0.877	0.881	0.887	0.889
Bihar	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	0.996	0.996	0.996	0.996	0.979	0.990	0.930	0.982
Chhattisgarh	0.568	0.568	0.568	0.568	0.599	0.599	0.599	0.599	0.996	0.996	0.996	0.996	0.919	0.911	0.959	0.935
Gujarat	0.280	0.280	0.280	0.280	0.304	0.304	0.304	0.304	0.996	0.996	0.996	0.996	0.854	0.834	0.902	0.905
Haryana	0.590	0.590	0.590	0.590	0.633	0.633	0.633	0.633	0.996	0.996	0.996	0.995	0.959	0.994	0.972	0.949
Jharkhand	0.262	0.262	0.262	0.262	0.272	0.272	0.272	0.272	0.996	0.996	0.996	0.996	0.750	0.793	0.806	0.832
Karnataka	0.585	0.585	0.585	0.585	0.624	0.624	0.624	0.624	0.996	0.996	0.996	0.996	0.982	0.969	0.955	0.979
Kerala	0.475	0.475	0.475	0.475	0.510	0.510	0.510	0.510	0.996	0.996	0.996	0.995	0.901	0.919	0.955	0.916
Madhya Pradesh	0.846	0.846	0.846	0.846	0.870	0.870	0.870	0.870	0.996	0.996	0.996	0.996	0.987	0.931	0.975	0.988
Maharashtra	0.653	0.653	0.653	0.653	0.709	0.709	0.709	0.709	0.996	0.996	0.996	0.996	0.984	0.950	0.989	0.995
Odisha	0.288	0.288	0.288	0.288	0.297	0.297	0.297	0.297	0.996	0.996	0.996	0.996	0.767	0.789	0.809	0.869
Punjab	0.331	0.331	0.331	0.331	0.367	0.367	0.367	0.367	0.996		0.996	0.995	0.865	0.961	0.926	0.899
Rajasthan	0.430	0.430	0.430	0.430	0.453	0.453	0.453	0.453	0.996	0.996	0.996	0.996	0.902	0.893	0.904	0.913
Tamil Nadu	0.295	0.295	0.295	0.295	0.330	0.330	0.330	0.330	0.996	0.996	0.996	0.996	0.932	0.897	0.901	0.927
Uttar Pradesh	0.674	0.674	0.674	0.674	0.707	0.707	0.707	0.707	0.996	0.996	0.996	0.996	0.951	0.940	0.952	0.985
West Bengal	0.448	0.448	0.448	0.448	0.468	0.468	0.468	0.468	0.996	0.996	0.996	0.996	0.864	0.917	0.950	0.914

Source: Author Compilation

Table-8: Trends in the tax revenues across states 2015-2022

State	Predicted and Frontier Tax Revenue	2015	2016	2017	2018	2019	2020	2021	2022
Andhra Pradesh	Tax Rev Predicted	5191.23	5646.71	6142.16	6681.08	7267.29	7904.93	8598.56	9352.99
	Tax Rev at Frontier	13367.00	14675.67	16112.44	17689.90	19421.79	21323.24	23410.97	25702.92
Bihar	Tax Rev Predicted	2875.90	3271.74	3722.06	4234.36	4817.18	5480.22	6234.51	7092.64
	Tax Rev at Frontier	3195.86	3641.95	4150.30	4729.62	5389.81	6142.14	6999.49	7976.52
Chhattisgarh	Tax Rev Predicted	1196.56	1346.78	1515.85	1706.15	1920.33	2161.41	2432.74	2738.15
	Tax Rev at Frontier	1839.62	2085.47	2364.19	2680.15	3038.34	3444.40	3904.72	4426.57
Gujarat	Tax Rev Predicted	5616.49	6294.84	7055.13	7907.27	8862.26	9932.68	11132.28	12476.88
	Tax Rev at Frontier	15528.46	17639.31	20037.10	22760.91	25854.76	29369.44	33361.57	37896.73
Haryana	Tax Rev Predicted	3641.44	4097.85	4611.47	5189.47	5839.91	6571.88	7395.59	8322.56
	Tax Rev at Frontier	4862.86	5495.20	6209.78	7017.29	7929.78	8960.95	10126.19	11442.97
Jharkhand	Tax Rev Predicted	594.27	660.19	733.43	814.80	905.19	1005.61	1117.16	1241.10
	Tax Rev at Frontier	2114.39	2398.57	2720.95	3086.66	3501.52	3972.14	4506.01	5111.64
Karnataka	Tax Rev Predicted	7245.42	8211.06	9305.40	10545.59	11951.07	13543.88	15348.95	17394.62
	Tax Rev at Frontier	9562.08	10878.88	12377.02	14081.48	16020.65	18226.89	20736.92	23592.64
Kerala	Tax Rev Predicted	3104.32	3455.38	3846.13	4281.08	4765.22	5304.10	5903.92	6571.58
	Tax Rev at Frontier	6073.43	6820.97	7660.53	8603.43	9662.39	10851.68	12187.35	13687.46
Madhya Pradesh	Tax Rev Predicted	4727.87	5386.77	6137.51	6992.86	7967.44	9077.82	10342.97	11784.42
	Tax Rev at Frontier	5357.86	6116.35	6982.21	7970.65	9099.03	10387.13	11857.61	13536.23
Maharashtra	Tax Rev Predicted	22330.54	25083.17	28175.11	31648.18	35549.37	39931.85	44854.15	50383.22
	Tax Rev at Frontier	24126.84	27125.24	30496.28	34286.26	38547.25	43338.21	48724.15	54779.43
Odisha	Tax Rev Predicted	691.26	742.79	798.15	857.65	921.58	990.27	1064.09	1143.40
	Tax Rev at Frontier	2347.01	2556.08	2783.77	3031.75	3301.82	3595.94	3916.27	4265.13
Punjab	Tax Rev Predicted	2877.59	3138.56	3423.20	3733.65	4072.25	4441.57	4844.37	5283.71
	Tax Rev at Frontier	6282.88	6911.24	7602.46	8362.80	9199.18	10119.22	11131.26	12244.54
Rajasthan	Tax Rev Predicted	3604.75	4015.06	4472.08	4981.11	5548.08	6179.59	6882.99	7666.44
	Tax Rev at Frontier	7429.22	8353.99	9393.87	10563.19	11878.08	13356.63	15019.24	16888.80
Tamil Nadu	Tax Rev Predicted	9716.36	11013.14	12483.00	14149.04	16037.42	18177.85	20603.75	23353.61
	Tax Rev at Frontier	20148.80	23066.35	26406.36	30230.00	34607.30	39618.44	45354.74	51922.11
Uttar Pradesh	Tax Rev Predicted	11445.20	12732.50	14164.58	15757.76	17530.14	19501.75	21695.31	24135.37
	Tax Rev at Frontier	14730.23	16434.24	18335.37	20456.44	22822.91	25462.96	28408.68	31694.87
West Bengal	Tax Rev Predicted	4521.09	4962.82	5447.71	5979.97	6564.24	7205.60	7909.62	8682.43
	Tax Rev at Frontier	9332.28	10326.65	11426.97	12644.53	13991.82	15482.66	17132.37	18957.84

Conclusion:

Due to the issues with taxation powers under constitution, the new GST regime, now, states need to focus on the other existing taxes to improve its own tax revenues, like excise tax and stamp duty and registration fees. This study analysed stamp duty and registration fees, which contributes a reasonably large share to a state's own tax revenues. The empirical estimations identified the potential determinants and measured tax capacity and tax effort for 16 major Indian states from 2001 to 2014 using stochastic frontier analysis. It is found that for given panel dataset, the model BC 1995 gives better results. It is found that Bihar is operating at high efficient levels with efficiency and Odisha and Jharkhand are operating with low efficiency. State government's needs to focus on the relevant stamp duty policy changes and potential determinants of the model, which will help them improve their efficiency. This will reduce the gap between their actual and potential tax revenues. There may be some state specific and tax administrative measure too, which may be causing the inefficiency. The gap between predicted tax revenue and frontier tax revenue is more the case of Gujrat, Rajasthan, Tamil Nadu, Punjab and West Bengal.

Limitations of the Study:

This study can be extended by incorporating the exact stamp duty rates in different states. Unfortunately, there is also not much information on the policy changes that were initiated in various states. This constrains to build a data set for empirical analysis. The studies like Das-Gupta (2002), Alm et al. (2004) and Mukherjee (2013) tried to construct their own dataset through various approximations. Future studies can construct a longer data set by extending these studies.

One of the main loophole in the stamp duty revenue collection is the corruption (through the undervaluation of assets etc. The study could not able to include corruption due to lack of acceptable efficient proxy for measuring corruption.

Appendix-1: List of all state taxes revenue categorisation

No	Budget code	Budget description	GST or Non-GST Tax
1	A	Total Tax Revenue	
2	(a)	Taxes on Income and Expenditure	This entire tax amount comes as part of central transfers.
3	0020	Corporation Tax	
4	0021	Taxes on Income other than Corporation Tax	
5	0023	Hotel Receipts Tax	
6	0028	Other Taxes on Income and Expenditure	
7	(b)	Taxes on Property and Capital Transactions	
8	0029	Land Revenue	Non-GST Tax
9	0030	Stamps and Registration Fees	Non-GST Tax
10	0031	Estate Duty	Non-GST Tax
11	0032	Taxes on Wealth (Non Agri Land)	Non-GST Tax
12	0035	Taxes on Immovable Property other than Agricultural Land	Non-GST Tax
13	(c)	Taxes on Commodities and Services	
14	0037	Customs	GST Tax
15	0038	Union Excise Duties	Non-GST Tax
16	0039	State Excise	Non-GST Tax
17	0040	Sales Tax	GST Tax
18	0041	Taxes on Vehicles	Non-GST Tax
19	0042	Taxes on Goods and Passengers	GST Tax
20	0043	Taxes and Duties on Electricity	Non-GST Tax
21	0044	Service Tax	GST Tax
22	0045	Other Taxes and Duties on Commodities and Services	GST Tax
22.a	101	Entertainment Tax	GST Tax
22.b	102	Betting Tax	GST Tax
22.c	103	Tax on Railway Passenger Fares	GST Tax
22.d	105	Luxury Tax	GST Tax

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