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Tax structure and economic growth in general category states in India: A panel auto regressive distributed lag approach

Dillip Kumar MUDULI
University of Hyderabad, Hyderabad, India
dillipmuduli6@gmail.com
Nityasundar MANIK
University of Hyderabad, Hyderabad, India
nitya.baban@gmail.com

Abstract. *The study empirically investigates the impact of tax structure on economic growth in fourteen general category states in India using panel data covering the period from 1980 to 2016. The use of panel ARDL model and different residual cross dependence tests confirms the distortionary effect of State's Own Direct Tax Revenue on economic growth. And also the study finds positive relationship between State's Own Indirect Taxes and economic growth. Therefore, it is suggested that the states should collect more revenue from indirect taxes with due consideration to its regressive nature, and reduce revenue collection from direct taxes in order to achieve higher growth.*

Keywords: tax structure, state taxation, state expenditure, economic growth, panel ARDL.

JEL Classification: H21, H71, H72, O47, C23.

1. Introduction

Endeavour in examining the relationship between tax level and economic growth as well as tax structure and economic growth has grown in recent decades because of the potentiality of the taxation in influencing the economic growth in the eve of high fiscal deficit resulting from ever increasing public spending. Being an indispensable part of budgetary activities, the taxation may affect economic growth through many channels like labour supply, human capital, physical capital, total factor productivity, change in price ratios, crowding out of private investment through making financing costlier etc. Now question arises: how does taxation relate to economic growth? Economic theory finds the negative relationship between taxation and economic growth. The theory claims that a fall in tax rate would lead to higher economic growth. On the other hand, the reduction in tax rate would create income inequality by benefitting ricer more. Nevertheless, this would limit the government's potential to spend on the productive activities and to increase productive capacity of the economy. Hence the effect of change in tax rate or tax level, without having understanding of tax system or tax structure, on economic growth is inconclusive and incomplete.

The study of tax structure with respect to economic growth is essential if the goal is to find an overall relationship between taxation and economic growth. Because, distinct effect on economic growth may be noticed from different kinds of taxation. For Instance, personal income tax is supposed to have a negative association with economic growth. Because, a rise in personal income tax reduces individuals disposable income and savings. The increment of the tax rate would incentivize the people to prefer less work to leisure (Mendoza et al., 1997; Arnold et al., 2011), and to engage in tax malpractices like tax evasion and tax avoidance. Hence, the combined effect of fall in productivity and tax evasion reduce economic growth. Corporation income tax, further, has inverse impact on economic growth (Lee and Gordon, 2005; Arnold, 2008). A fall in corporate income tax rate boosts corporate incentives to invest in physical & human capital, research and development (R&D), increases firm's profitability and ability to compete in both domestic and overseas market. Nevertheless, it also attracts foreign companies to settle down in those countries where low corporate tax is prevalent. All these factors in together affect economic growth positively. Comparison between corporate tax rate and income tax rate explore a new dimension of the study of analysing risk taking appetite of the self-employed individual (Schumpeter, 1942; Cullen and Gordon, 2002). The lower the former to later would encourage self-employed persons to undertake entrepreneurial activities of innovation beneficial to economic growth. Besides, Consumption taxes like sales tax, customs duties etc. have mixed impact on economic growth. In short run, a rise in sales tax instantly raises the price of the product and acts as an incentive for the producers to produce more (Munir and Sulatn, 2016; Eugene and Abigail, 2016). But, in long run, it creates distortion in the factor prices and reduces returns to the factors of the production. Thus, the impact of tax composition on economic growth is ambiguous and inconclusive. Hence, the present study not only finds out the relationship between tax structure and economic growth, but also tries to calculate the extent of influence of different kinds of tax on growth both in short run and long run by employing Panel **Auto Regressive Distributed Lag** (PARDL) model proposed by, Pesaran, Shin, and Smith (1997, 1999).

In India, tax structure at union level is quite different from state level. The contribution of tax revenue collected from state's own taxes is very significant in shaping state's economy. So is in case of states' non tax revenue. Again, contribution of central tax to the state's treasury is though minimal rather significant. Available literatures confining the study to the union level do not explore the real picture of the state taxation system and their economic growth nexus. This study, according to our knowledge, is the first state level study in India in the context of tax structure and economic growth. The present study classifies tax structure of fourteen general category states into three categories like, state's own direct taxes, state's own indirect taxes, and central tax share and analyse the growth effects of these three categories with the help of PARDL model for a panel of fourteen general category states out of eighteen general category states in India during the period from 1980 to 2016.

The organisation of the paper is as follows. In the next section, the paper discusses both theoretical and empirical evidence on the link between tax and economic growth. Section 3 describes the data and methodology used in this study. Section 4 presents the empirical results. In section 5, the paper concludes with findings.

2. Literature review

In the context of tax and growth association, most of the studies are available form USA, European countries, and OECD countries. In comparison to those studies, the number is less in India. So, there is much scope for the researchers to do work on this topic for India and to add productive work to the existing literature.

2.1. Theoretical literatures

Many economic theories have diverse opinion on controversial relationship between tax structure and economic growth and have also put forwarded different mechanisms by which the former influences later. As per the neoclassical growth models advocated by Solow, 1956; Swan, 1956, the changes in the tax rates can bring changes in intercept of the steady state growth rate as the taxation is taken as the exogenous variable in the growth model. Hence its impact on the long run growth rate is transitory in nature. Oppose to the neoclassical model, Barro (1990) noticed the permanent and positive impact of the government expenditure on the marginal productivity of physical capital in his endogenous growth model where fiscal policy is incorporated in the production function endogenously. However, the model of Barro (1990) had little explanation for the nexus between tax structure and economic growth. The two sector endogenous growth model of Lucas (1990) where human capital and time is considered as internal factors concluded that growth rate is invariant to the changes in capital tax rates given fixed labour supply. By using one sector endogenous growth model with only human capital in the production function for US economy, Kim (1998) investigated the ascendancy of the several types of taxes and their rates on the long run economic growth rate. He advocated the removal of all kind of taxes as the removal would increase the growth rate by 0.85 percent. The endogenous growth model attributed by Mendoza et al., 1997 investigated the effect of the marginal tax rate of human capital, physical capital and consumption on economic growth. The model noticed indirect effect of consumption tax (for instance VAT) on growth with an alteration in capital to labour ratio through changes in labour-leisure choices. However, direct effect of taxation of physical and human capital on growth is predicted in the model. Supporting the predictive model of Mendoza et al. (1997), Arnold et al. (2011) were of opinion that the higher the consumption tax would make the consumer goods more expensive. This can reduce labour supply as the reward of the labours will be lesser. Cullen and Gordon (2002) incorporated the effect of tax structure on growth with help of the idea of Schumpeter (1942) which emphasized the entrepreneurial activities of innovation beneficial to economic growth. According to the literature of Cullen and Gordon (2002), there is a tax stimulus to being self-employed (risk taking behavior) when the effective tax rate on business income is less than the tax rate on wage and salary income. This would occur when the corporate tax rate is below marginal personal tax rates. Therefore, economic theory on the present context would conclude that tax structure including all kind of taxes and tax finances has the distortionary effect on growth. However, the extent of effect hinges on the many factors. But, one of the lacunas in these theoretical models is that the estimated long-run equation is actually a production function and not a long-run growth equation Rao (2006). Hence, the fundamental relationship between tax structure and economic growth has been neglected. That's why; our paper has addressed this issue by incorporating the growth variables (GSDP and PCGSDP) in the estimating equations and has analysed the said relationship empirically.

2.2. Empirical literatures

2.2.1. State level studies

Helms (1985) examines the impact of state and local taxes on economic growth by using a pooled cross-sectional data from 48 states. He finds that an increase in the state and local taxes significantly retard economic growth when the revenue is used for transfer payments. On the other hand, when the revenue is utilized for public services such as education, highways, public health, and law and administration, a favourable impact falls on location and production decisions which counterbalance the bad effects of associated taxes. Ferete and Dhalby (2012) examine the impact of the provincial government's tax rates on economic growth in Canada. The study uses panel data covering the period 1977-2006. The authors view that a higher provincial statutory corporate income tax rate lowers the private investment and then the economic growth. The study also finds that provincial investment and growth increase when the government switches over from a retail sales tax to a sales tax that is harmonized with the federal value-added sales tax.

2.2.2. Studies on developed countries

Widmalm (2001), studying 23 OECD countries during 1965-1990, remarks that revenue raised from taxing personal income is negatively related to growth, whereas consumption tax is growth-enhancing. Similarly, Lee and Gordon (2005) examine the link between statutory corporate tax and growth using cross-country data from 70 countries during the period 1970-1997 and find that there is a significant negative relationship between these two. Arnold (2008) uses panel growth regression for 21 OECD countries during 1971-2004 to investigate the relationship between tax structure and economic growth. He opines that corporate income tax has negative link with growth. He also documents a significant positive effect of consumption and property taxes on economic growth. By using AK model with public expenditure and elasticity of labour supply for US economy, Turnovsky (2000) noticed that an increase in capital and income tax rate of 12 percentage points could diminish growth by around 0.5 percentage points, while a reduction of capital and income tax rates each by 8 percentage points could increase the growth by 0.4 percentage points.

2.2.3. Studies on developing countries

Venkataraman and Urmi (2017) examine the impact of tax structure on economic growth in India by using disaggregated time series data during 1977-2015 and ARDL Bounds test approach. They find that, in the long run, personal income tax has no impact on economic growth, while there is significant positive effect of corporate income tax on economic growth. They further mention that excise duty has no statistically significant effect on economic growth in the long run, while customs duty has a significant positive impact on growth. Eugene and Abigail (2016) analyse the effect of tax policy on economic growth in Nigeria by using time series data spanning from 1994 to 2013 and view that there is significant positive relationship between indirect tax and economic growth. Ahmad et al. (2016) empirically investigate the relationship between total tax revenue and economic growth in Pakistan. They state that total tax revenue have significant negative effect on economic growth in long run, and direct taxes have positive effect on growth. Munir and Sulatn (2016) analyse the impact of taxes on economic growth in Pakistan during the period from 1976 to 2014. The results show that direct tax, sales tax, and tax on international trade are pro-growth taxes, while excise-duty negatively affects growth of Pakistan.

From the above studies on tax structure and economic growth, one difference is apparent between developed countries and developing countries and the difference is that, direct taxes such as corporation income tax exert positive impact on economic growth in developing countries, while they have negative effect on economic growth in developed countries. There is no empirical state level study available on the nexus between tax structure and economic growth in India. The present study is a preliminary attempt to address this issue.

3. Data and methodology

The present study uses panel data from fourteen general category states, namely Andhra Pradesh, Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamilnadu, Uttar Pradesh, and West Bengal in India covering the period 1980-2016. The data have been brought from Handbook of Statistics on Indian States published by Reserve Bank of India, Indian Public Finance Statistics published by Ministry of Finance under Government of India, and Economic and Political Weekly Research Foundation[1].Econometric techniques such as panel unit root test methods and panel ARDL model have been used for the estimation.

3.1. Depiction of the variables

Eight variables are used in the study, which are:

3.1.1 LNGSDP (Nominal Gross State Domestic Product) is dependent variable for the 1st model which plays as a proxy for economic growth.

3.1.2 LNPCGSDP (Per Capita Gross State Domestic Product) is dependent variable for the 2nd model which is taken as a proxy for economic growth.

3.1.3 LNPOP (Population) is the first independent variable. It is included in the model because of its plausible impact on economic growth. According to various finance commissions, population is a vital indicator for allocation of grants to the states which then influences economic growth of states. Population is positively related to growth.

3.1.4 LNCOTE (Capital Outlay) is the second independent variable which depicts how much proportion of total expenditure is devoted to asset creation of the state. It has positive impact on growth.

3.1.5 LNGFDR (Gross Fiscal Deficit) is the third independent variable. It has been incorporated in the model because of its use as a parameter in FRBM act, which is a milestone fiscal policy in India. Gross fiscal deficit is inversely related to economic growth.

To examine the impact of tax structure on economic growth, the paper has clubbed all direct and indirect taxes into three categories for the present study. These categories are:

3.1.6 LNSODTRR (State's Own Direct Tax Revenue) is the fourth independent variable of our model. It includes all the direct taxes under the state's jurisdiction. It has negative effect on economic growth.

3.1.7 LNSOITR (State's Own Indirect Tax Revenue) is taken as fifth independent variable of our model. It includes all the indirect taxes under the state's jurisdiction. It has positive effect on economic growth.

3.1.8 LNCTS (Central Tax Share) is the last independent variable which refers to the share that a state gets from the central taxes such as corporation tax and personal income tax. It has negative effect on economic growth.

3.2 . Model specification

With a view to finding out relationship between tax structure and economic growth of 14 states over the period from 1980-81 to 2016-17, a plethora of panel or longitudinal techniques have been applied in this paper. This paper uses cross-section dependency tests, panel unit root tests both for homogeneous and heterogeneous cross sections, and finally panel ARDL model.

3.2.1. Panel cross-section dependence test

It is evidenced that addition of cross section dimension to the time series dimension gives an advantage of testing for stationarity, spurious regression, and cointegration by increasing the number of observations applied to the tests and thereby, improving the power of the test. Even so, the cross section dimension, however, raises some issues such as presence of the cross section dependency, ignoring which could lead to serious statistical consequences such as biased estimation, estimator efficiency loss, and invalid test statistics (Pesaran, 2004).Though it is typically assumed that errors in panel data model are cross-sectionally independent, especially when the cross section dimension (N) is large. There is, however, considerable evidence that cross-sectional dependence is often present in panel regression settings (Pesaran, 2004).Therefore, checking of cross dependency among the disturbance terms is inevitable since this study has low cross-sectional dimension.

Suppose a panel model is given as

$y_{it} = \beta'_{it} x_{it} + u_{it}$ (3.1)

For i = 1, 2, …, N

t = 1, 2, …, T

Where:

x_{it} is K dimensional column vector of regressors. β_i is cross section specific vectors of parameters.

The general null hypothesis is the presence of no cross-sectional dependence in error terms. Symbolically,

H_0: ρ_{ij} = cor (u_{it}, u_{jt}) = 0 for i≠j (3.2)

Where ρ_{ij} = pairwise correlation coefficients of OLS residuals.

3.2.1.1. Breusch-Pagan (B-P) (1980) LM test

In the Seemingly Unrelated Regression Equation (SURE) with N fixed and as T→ ∞, B-P (1980) suggest the Lagrange Multiplier (LM) test statistic for testing the null hypothesis specified in equation-3.2. The LM test statistics is

$$\text{LM} = \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} T_{ij}\, \hat{\rho}_{ij}^2 \rightarrow \chi^2 \frac{N(N-1)}{2} \quad (3.3)$$

where ρ_{ij} is the vector of estimated correlation coefficient obtained from errors of the equation (3.1). The LM test follows asymptotic χ^2 distribution and does not require a particular ordering of cross section units. However, the test is not independent of shortcomings because the test is inappropriate in case of N→ ∞.

3.2.1.2. Pesaran (2004) scaled LM tests

Pesaran (2004) proposes a standardised version of the LM statistics which is applicable in large cross section dimension.

$$LM_S = \sqrt{\frac{1}{N(N-1)}} \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T_{ij}\, \hat{\rho}_{ij}^2 \text{ -1}) \quad (3.4)$$

LM_s is asymptotically standard normal as first T_{ij} →∞ and N→ ∞ irrespective of orders. But the major lacuna of the present test is that it has size distortion for small T_{ij}, and the distortion gets worse for larger N.

3.2.1.3. Pesaran (2004) CD test

In order to address the problems of size distortion, Pesaran (2004) put forwarded an alternative statistic namely Pesaran (2004) CD test. The CD test is applicable to a variety of panel models including stationarity and unit root dynamic heterogeneous panels with short T and large N. The proposed test is based on an average of pairwise correlation coefficients of OLS residuals from the individual regressions in the panel rather that their squares as in B-P (1980) LM test and Pesaran (2004) scaled LM test.

$$LM_{BC} = \sqrt{\frac{1}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}(T_{ij}\,\hat{\rho}_{ij}^2 \text{ -1}) - \frac{N}{2(T-1)} \rightarrow \text{N (0, 1)} \quad (3.5)$$

Further, Pesaran (2004) points out that for a wide array of panel data models, the mean of CD is exactly equal to zero for all $T_{ij} >$ K+1 and for all N. As a result, the CD test is supposed to have good properties for both small N and T_{ij}.

3.2.1.4. Baltagi, Feng, and Kao (2012)

Baltagi, Feng, and Kao (2012) offer a simple asymptotic bias correction for the scaled LM test statistic:

$$CD_P = \sqrt{\frac{2}{N(N-1)}}\sum_{i=1}^{N-1}\sum_{j=i+1}^{N} T_{ij}\,\hat{\rho}_{ij} \rightarrow \text{N (0, 1)} \quad (3.6)$$

For a fixed effects homogeneous panel data model with $T_{ij} \rightarrow \infty$, N $\rightarrow \infty$ and N / $T_{ij} \rightarrow C_{ij} \in (0, \infty)$, Baltagi et al. (2012) show that the scaled LM has an asymptotic bias term of N / (2(T-1)), resulting from the incidental parameters problem. Because, for small T_{ij}, the within residuals are estimated imprecisely.

3.3 . Panel unit root tests allowing for cross-sectional dependence

A vast number of panel unit root tests have been proposed in the literature in order to test unit root in the presence of cross section dependence. All these tests use orthogonalization kind procedure to do away with the cross dependency of the series asymptotically prior to the use of standard unit root tests to transferred series. However, Pesaran (2007) suggests a simpler way of eliminating cross-sectional dependence. He applies the usual Augmented Dickey Fuller (ADF) test with addition of the cross-section averages of lagged levels and first-differences of the individual series. The Pesaran CADF test can be written as

$$\Delta y_{it} = \alpha_i + \rho_i^* y_{i,t-1} + d_0\bar{y}_{t-1} + d_1\Delta\bar{y}_t + \epsilon_{it} \quad (3.7)$$

Where, $\bar{y}_t$ is the average at time t of all N observations. The cross-sectional dependence is justified through a factor structure by the presence of the lagged cross-sectional average and its first difference. The Pesaran CADF test is

$$\text{CADF} = t_i\text{ (N, T)} = \frac{\Delta y_i'\ \bar{M}_w y_{i,-1}}{\hat{\delta}_j\,(y_{i,-1}'\,\bar{M}_w y_{i,-1})} \quad (3.8)$$

Where

$\Delta y_i = (\Delta y_{i,1}, \Delta y_{i,2}, \ldots, \Delta y_{i,T})'$, $y_{i,-1} = (y_{i,0}, y_{i,1}, \ldots, y_{i,T-1})'$, τ_T = (1, 1,…, 1)

$M_w = I_T - \bar{W}\,(\bar{W}'\bar{W})^{-1}\bar{W}'$, $\bar{W} = (\tau, \Delta\bar{y}, \bar{y}_{-1})$

$\Delta\bar{y} = (\Delta\bar{y}_1, \Delta\bar{y}_2, \ldots, \Delta\bar{y}_T)'$, $\bar{y}_{-1} = (\bar{y}_0, \bar{y}_1, \ldots, \bar{y}_{T-1})'$

$\hat{\sigma}_i^2 = \frac{\Delta y_i'\ M_{i,w}\,\Delta y_i}{T-4}$

And $M_{i,w} = I_T - G_i\,(G_i'G_i)^{-1}G_i'$, and $G_i = (\bar{W}, y_{i-1})$.

3.3.2. Specification of Panel ARDL Model

This paper uses panel autoregressive distributed lag model (PARDL) for estimating long run as well as short run relationship between the variables of interest. The panel data analysis involves model having large time span (T) and large cross sections (N) for analysis, due to availability of data with greater frequency. However, the asymptotic large N and large T dynamics panel data are different from traditional asymptotic small T and large N panel data. Usually, panel data with small T and large N is contingent upon fixed and random effect estimation or generalised method of moments (GMM) for its estimation. These estimators involve pooling individual groups and allowing only the intercept to differ across the groups. If the slope coefficients are in fact not identical, these estimators produce inconsistent and potentially misleading results. With an increase in time series dimension T in cross section N, Pesaran, Shin, and Smith (1997, 1999) propose two important techniques to estimate non-stationary dynamic panels in which the parameters are heterogeneous across the groups. The techniques are the mean group (MG) and pooled mean-group (PGM) estimators.

An ARDL model with ARDL (p,q_s) approach, where P being lags of dependent variable and q being lags of independent variable can unrestrictedly be specified as

$$Y_{it} = \sum_{j=1}^{p} \lambda_{ij} Y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} X_{i,t-j} + \mu_i + \epsilon_{it} \tag{3.9}$$

Where i = 1, 2, 3..., N (no. of groups), T = 1, 2, 3,..., T (no. of periods)

X_{it} is a k×1 vector of explanatory variables. δ_{it} are the k×1 coefficients of vector λ_{ij} are the scalars, μ_i is group specific effect.

T must be large enough so that it can be fitted to each group separately. Moreover, time and other fixed regressors can be included. So far as the empirical analysis of the paper concerned here, LNGSDP and LNPCGSDP are used in place of Y separately. LNPOP, LNCOTE, LNGFDR are used as controlled variables. X_i represents LNSODTRR, LNSOITRR, and LNCTR that are used as explanatory variables. They are used individually in order to avoid multicollinearity effect among them.

If the variables in equation (3.7) are I (1) and cointegrated, the error term should follow I (0) order in all cross-sections to have long-run equilibrium relationship between the variables. The principal feature of cointegrated variables is that their time paths are influenced by the extent of any deviation from long-run equilibrium. This explains that an error correction model in the short-run dynamics of the variables in the system can be influenced by the deviation from equilibrium. Hence, it is necessary to reparametrize equation (3.7) into an error correction equation.

$$\Delta y_{it} = \phi_i(y_{i,t-1} - \theta_i' X_{it}) + \sum_{j=1}^{p-1} \lambda_{ij}^* \Delta y_{i,t-1} + \sum_{j=0}^{q-1} \delta_{ij}^{'*} \Delta X_{i,t-j} + \mu_i + \epsilon_{it} \tag{3.10}$$

The parameter ϕi is the coefficient of error-correcting term resembling the speed of adjustment from short run dynamics to long run equilibrium. If ϕi = 0, there would be no evidence for a long-run relationship. The term is supposed to be statistically negative.

3.3.2.1. Mean Group (MG) estimators

In case of dynamic heterogeneous panel estimation in which there is large N and large T, two extreme approaches have been used. One is fixed effect estimators in which the time series data for each group are pooled and only intercept terms are allowed to vary across N. However, the estimator seldom produces invalid estimation results. On the Other extreme, MG estimator proposed by Pesaran and Smith (1995) advocates that the model could be fitted separately for each group and simple arithmetic average of the coefficients could be calculated. Hence, MG removes any restriction and allows to vary in both short and long run coefficient. However, the necessary condition for the consistency and validity of this approach is to have large T.

3.3.2.2. Pooled Mean Group (PMG) estimator

The main feature of the PMG proposed by Pesaran, Smith, and Shin (1947, 1999)is that it allows short run coefficients, including the intercepts, the error correction term, and error variances to become heterogeneous across N. However, the long run coefficients are restricted to become homogeneous across countries. This approach is particularly used when there is the expectation of similar long run equilibrium between variables across N. The PMG combines both pooling and averaging. Since the equation is non-linear in the parameters, Pesaran, Shin, and Smith (1999) develop maximum likelihood method to estimate parameter.

However, in order to measure efficiency and consistency among the estimators (PMG and MG), Hausman Test would be followed. The null hypothesis of Hausman Test is that the PMG estimator is more efficient and consistent than that of MG estimator.

4. Empirical results

4.1. Preliminary analysis

Table 1. *Results of the compound annual growth rate (numbers are expressed in percentage)*

Variable	1980-1991 (1st period)	1992-2005 (2nd period)	2006-2016 (3rd period)
GSDP	13.09	10.87	13.50
PCGSDP	11.10	09.41	12.27
SODTR	1.83	2.02	-2.52
SOITR	0.42	0.07	-0.16
CTS	-1.20	-0.73	0.90

Source: Author's calculation.

In a view to have the preliminary understanding about tax composition and economic growth, this paper estimates compound annual growth rate of the concerned variables for three periods. One thing is to be noted here that the classification of the periods on the basis of economic reforms (1991) and Fiscal responsibility Act (2005) is for better preliminary analysis. Comparing 1st period (1980-1991) and 2nd period (1992-2005), the Table 1 shows that when the revenue collection from the state's own direct taxes increases from 1.83 to 2.02, the compound annual growth rate of both GSDP and per capita GSDP decline from 13.09 to 10.87 and from 11.10 to 09.41 respectively. Hence, it establishes an inverse relationship between direct taxes and GSDP and between direct taxes and per capita GSDP. Again, there exists a similar link between central tax share and GSDP and between central tax share and per capita GSDP because as the central tax share rise from -1.20 to -0.73, the compound annual growth rate of both GSDP and per capita GSDP decline. However, a direct relationship exists between indirect tax and both dependent variables i.e. GSDP and per capita GSDP. On the other hand, comparing 2nd period (1992-2005) and 3rd period (2006-2016) the study finds contrasting results between independent and dependent variable. When the revenue collection from state's indirect taxes drops from 0.07 to -0.16, the compound annual growth rate both GSDP and per capita GSDP increase from 10.87 to 13.50 and from 09.41 to 12.27 respectively. Similarly, there is a contrasting relationship between central tax share and two dependent variables because when central tax share rises, both GSDP and PCGSDP increase, which is theoretically invalid. Yet, relationship between direct tax and economic growth proxied as both GSDP and per capita GSDP remain intact. When the direct tax falls from 2.02 to -2.52, both GSDP and per capita GSDP increase. Therefore, the table finds that relationship between economic growth and three tax variables is theoretically consistent in the 2nd period (1992-2005). But, it is conflicting to some extent in the 3rd period (2006-2016). That's why the study goes for the further empirical investigation of relationship between tax structure and economic growth through panel ARDL technique.

4.2. Result of residual cross-section dependence tests

The Table 2 displaying the result of residual cross-section dependence test informs that the B-P LM statistics, Pesaran LM statistic, Bias-corrected statistics, and Pesaran CD test are statistically significant at 1% level of significance. As a result, the tests fail to accept the pairwise correlation coefficient of OLS residuals which are zero. Hence, the existence of cross sections dependency makes the relationship between the variables in question not independent across the states.

Table 2. *Result of residual cross-section dependence tests*

Test	Statistics	Probability
B-P LM	1064.149	0.000
Pesaran LM	71.096	0.000
Bias-Corrected	70.902	0.000
Pesaran CD	10.288	0.000

Note: The test employs centred correlations computed from pairwise samples. Total d.f is 91.
Source: Author's calculation.

4.3. Result of Pesaran CADF Test

Table 3. *Result of Pesaran CADF Test*

Variables	Constant		Constant + Trend	
	T bar	P value	T bar	P value
LNGSDP	-1.877	0.335	-1.979	0.937
ΔLNGSDP	-3.365***	0.000	-3.569***	0.000
LNPCGSDP	-1.835	0.397	-1.765	0.993
ΔLNPCGSDP	-3.309***	0.000	-3.581***	0.000
LNSODTRR	-2.882***	0.000	-2.860**	0.014
LNSOITRR	-1.956	0.230	-2.471	0.289
ΔLNSOITRR	-3.738***	0.000	-3.734***	0.000
LNCTSR	-1.926	0.268	-2.335	0.508
ΔLNCTSR	-4.025***	0.000	-3.996***	0.000

Variables	Constant		Constant + Trend	
	T bar	P value	T bar	P value
LNPOP	-1.459	0.892	-1.224	1.000
ΔLNPOP	-2.228**	0.034	-2.912***	0.007
LNCOTE	-2.162*	0.059	-2.407	0.338
ΔLNCOTE	-	-	-3.588***	0.000
LNGFDR	-2.762***	0.000	-2.947***	0.005

Note: CADF equation with constant has the critical value of -2.440, -2.250, and -2.140 at 1%, 5%, and 10% level of significance respectively. Again, CADF equation with constant and trend has the critical value of -2.930, -2.760, and -2.660 at 1%, 5%, and 10% level of significance respectively. ***, ** and * indicate 1%, 5%, and 10% level of significance respectively. Δ indicates first difference.
Source: Author's calculation.

The Table 3 shows that the null of existence of unit root in the series is not statistically accepted at the first difference for the variables of LNGSDP, LNPCGSDP, LNSOITRR, LNCTSR, and LNPOP. Hence, these said variables are integrated of order one i.e. I (1). On the other hand, the variables such as LNSODTRR and LNGFDR are stationary at level. LNCOTE is integrated at level in model with constant while it is stationary in its first difference in model with constant and trend. The major conclusion from Pesaran CADF test is that all the variables are either integrated at level or its first difference, and none of the variables is of order two or more. Hence, all the series satisfy the precondition of the Panel ARDL model.

4.4. Result of Panel ARDL model

The conclusion drawn from the panel unit root tests depicts that all the variables are stationary either at level or at first difference i.e. I (1). But none of the variables are integrated at either second difference or more than that. Hence, the variables included in the model satisfy the criteria of panel ARDL model. Endogenously, selection of optimal model with Hannan-Quinn criteria makes the ARDL model self-reliant to lag selection bias. The model which carries the lowest value of the H-Q criteria would be selected as the best model for the concerned test. In the present study, ARDL (2, 1, 1, 1, 1) is the optimal model for all the ARDL models.

4.4.1. The result of Panel ARDL model (economic growth and state own direct tax revenue)

In Table 4, it is noticed that the error correction term i.e. ECT(-1) is negative and significant with an amount of 0.042 in both the models. It connotes the convergence tendency of the model towards the long-run equilibrium with a speed of 4 percent correction in each year. In these models, all the variables bring out expected impact on economic growth. The population and capital outlay has positive association with economic growth in long run. Increase in population growth would add the labours in the productive supply chain and thereby create value addition for economic growth. The capital outlay creates asset which fetches regular income to the economy. Moreover, capital outlay to total expenditure shows the quality of public expenditure. A higher capital outlay would stimulate the tempo of economic growth. The relationship between gross fiscal deficit and economic growth is found negative and significant at 1%level of significance since high fiscal deficit would limit the loanable fund for private sector. Hence, this drives out private players out of the economic system without commensurate investment from public sector. Finally, the state-owned direct tax revenue has positive and negative impact on economic growth in short run and in long run respectively. This interesting result is due to the fact that, in short run, an increase in revenue from state-owned direct taxes can be invested for productive purposes. However, this revenue driven growth would not last for longer period because higher direct taxes create distortionary effects on labour supply, saving rate, and investment rate thereby impinging economic growth (Engen and Skinner, 1996; Kesner-Skreb, 2002). Hence, the models detect both positive and negative relation of the state-owned direct tax revenue with economic growth.

Table 4. *Result of panel ARDL Model (LNSODTR as independent variable)*

	Model-1: Dependent Variable: D(LNGSDP)		Model-2: Dependent Variable: D(LNPCGSDP)	
Regressors	Coefficient	Standard Error	Coefficient	Standard Error
Long Run Equation				
LNSODTR	-0.790***	0.141	-0.788***	0.143
LNPOP	9.672***	0.395	8.679***	0.398
LNCOTE	0.378***	0.066	0.382***	0.067
LNGFDR	-1.075***	0.156	-1.074***	0.158
Short Run Equation				
ECT (-1)	-0.042***	0.014	-0.042***	0.014
D(LNGSDP(-1))	-0.068	0.075	-0.067	0.075
D (LNSODTR)	0.069***	0.018	0.069***	0.018
D (LNPOP)	0.373	1.079	-0.638	1.080
D (LNCOTE)	-0.020	0.013	-0.020	0.013
D (LNGFDR)	0.009	0.012	0.009	0.012
C	-0.824**	0.322	-0.830**	0.321

Note: *** and ** show 1% and 5% level of significance respectively.
Source: Author's calculation.

4.4.2. The result of Panel ARDL model (economic growth and state own indirect tax revenue)

The negative and significant (-0.030) error correction term demonstrates that the short-run dynamics gets corrected at the rate of about 3% towards long-run equilibrium. In both the models, the impact of population, capital outlay, and fiscal deficit on economic growth is at par with the theoretical analysis and is found to be statistically significant at 1% level of significance in the long run. The impact of state-owned indirect tax revenue on economic growth is positive and significant with the value of 3.457 (in model-3) and of 3.488 (in model-4). It implies that responsiveness of state indirect tax to economic growth is elastic one because indirect taxes are non-distortionary taxes, which neither discourage saving rates nor investment in physical/ human capital (Jens Arnold, 2008). Moreover, being a major source of revenue for Indian states, the corpus is utilized for economic growth-enhancing factors. In short run, the coefficient of LNSOITRR is found to be insignificant.

Table 5. *Result of panel ARDL Model (LNSOITRR as independent variable)*

	Model-3 Dependent Variable: D(LNGSDP)		Model-4 Dependent Variable: D(LNPCGSDP)	
Regressors	Coefficient	Standard Error	Coefficient	Standard Error
Long Run Equation				
LNSOITRR	3.457***	1.333	3.488***	1.329
LNPOP	6.558***	0.668	5.612***	0.663
LNCOTE	0.495**	0.193	0.505***	0.193
LNGFDR	-1.920***	0.524	-1.921***	0.525

	Model-3 Dependent Variable: D(LNGSDP)		Model-4 Dependent Variable: D(LNPCGSDP)	
Regressors	Coefficient	Standard Error	Coefficient	Standard Error
Short Run Equation				
ECT (-1)	-0.030***	0.005	-0.030***	0.005
D(LNGSDP(-1))	-0.115	0.083	-0.113	0.083
D (LNSOITRR)	-0.027	0.035	-0.028	0.035
D (LNPOP)	-0.628	0.760	-1.641**	0.757
D (LNCOTE)	-0.017	0.013	-0.017	0.013
D (LNGFDR)	0.013	0.010	0.013	0.010
C	-0.622***	0.139	-0.638***	0.140

Note: *** and ** show 1% and 5% level of significance respectively.
Source: Author's calculation.

4.4.3. The result of Panel ARDL model (economic growth and central transfer to states)

The relationship between central tax share to the states and economic growth is found negative and insignificant both in short run and long run in both the models. The share that states receive from central taxes come from most of the direct taxes such as corporation tax, personal income tax, wealth tax, property tax, etc. which fetch distortionary and negative effect on labour supply and rate of investment in the economy. The impact is insignificant as it constitutes lesser share in total revenue of the concerned state (31.31% of total tax revenue).Other variables such as LNPOP and LNCOTE are significant and positive whereas the LNGFDR has negative significant impact on economic growth in the long run. The coefficient of ECT is negative and significant implying that the model converges to long run equilibrium.

Table 6. *Result of Panel ARDL model between growth and CTSR*

	Model-5 Dependent variable- D(LNGSDP)		Model-6 Dependent variable- D(LNPCGSDP)	
Regressors	Coefficient	Standard Error	Coefficient	Standard Error
Long-run Equation				
LNCTSR	-0.065	0.744	-0.062	0.743
LNPOP	6.204***	0.929	5.286***	0.917
LNCOTE	0.730**	0.288	0.732**	0.286
LNGFDR	-2.109	0.727	-2.102***	0.722
Short-run Equation				
ECT (-1)	-0.024***	0.004	-0.024***	0.004
D(LNGSDP(-1))	-0.108	0.078	-0.107	0.078
D (LNCTSR)	-0.048	0.032	-0.048	0.032
D (LNPOP)	-0.674	0.713	-1.684**	0.720
D (LNCOTE)	-0.019	0.013	-0.019	0.013
D (LNGFDR)	0.006	0.010	0.006	0.010
C	-0.091***	0.042	-0.103**	0.044

Note: *** and ** show 1% and 5% level of significance respectively.
Source: Author's calculation.

5. Conclusion

The present study examines the impact of tax structure on economic growth in fourteen general category states of India during 1980-81 to 2016-17. The study uses the panel ARDL model to investigate the short-run and long-run relationship between tax structure and economic growth. The study finds that different taxes have different growth effects. State's own direct taxes are negatively and significantly associated to economic growth. Due to distortionary nature of direct taxes, variables such as labour supply, saving rate, and investment rate were adversely affected and thereby reduced economic growth. State's own indirect taxes positively influence economic growth because of its non-distortionary effects on economic system and productive use on physical and human capital. Therefore, the results are consistent with some of the previous studies viz. Widmalm (2001), Arnold (2008), Ferete and Dhalby (2012), and Venkataraman and Urmi (2017). Further, no relationship between central tax share and economic growth has been revealed by the paper. The paper, therefore, concludes that the state governments should focus more on indirect taxes in lieu of direct taxes as far as economic growth is concerned. Further, the policymakers must be circumspect at the time of framing tax policies for long-term economic growth.

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Note

(1) The study has incorporated the latest actual data available on important macro and fiscal variables in India up to 2016-17. Information on the required data after 2016-17 is either revised estimates or provisional estimates and experience shows that they vary substantially from actual figures, and hence their incorporation will be misleading.

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