

GST and beyond: unveiling the drivers of state-level indirect tax revenue in India

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Abstract

Purpose – This study investigates the impact of key determinants such as sectoral economic composition, government expenditure, implementation of the Goods and Services Tax (GST) and fiscal transfers from the central government on indirect tax revenue in Indian states.

Design/methodology/approach – The analysis employs a static panel data methodology and Generalized Least Squares (GLS) estimation to address heteroskedasticity and autocorrelation using a balanced panel dataset of 27 states. The timeframe for the research is considered from 2012–2013 to 2022–2023, capturing both the pre- and post-GST period.

Findings – The results indicate that sectoral composition, government expenditure and GST implementation are positively associated with indirect tax revenue, whereas greater fiscal reliance on central transfers is negatively associated with indirect tax generation.

Research limitations/implications – The study highlights the requirement for a diversified economic base, strategic public investment and fiscal autonomy at the state level. The findings offer policy recommendations that serve as a roadmap for enhancing sub-national tax performance and strengthening India's fiscal federalism.

Originality/value – This research provides new empirical evidence on the post-GST indirect tax regime in India and contributes to the literature on state-level fiscal dynamics and tax policy effectiveness.

Keywords GLS, GST, India, Indirect tax revenue, Panel data

Paper type Research article

1. Introduction

1.1 Evolution and structure of tax revenue in India

Tax revenue is a vital component of the economy, as it supplies the funds needed by the government to undertake public goods, infrastructure and social programs (Musgrave & Musgrave, 1989). Tax revenue has been equated to revenue obtained by a government from levying taxes on citizens, corporations and transactions to finance public infrastructure and services (OECD, 2021). The inception of taxation goes as far as ancient Mesopotamian and Egyptian civilizations, where the government imposed taxes on labor and agricultural commodities (Adams, 1992). The evolution of modern taxation occurred in the period from the 18th to the 19th century, when corporation and income taxation were instituted. The Industrial Revolution further intensified the role of taxation systems as drivers of economic growth and governance (Burg, 2004). Tax revenue continues to be a focal fiscal instrument and a driver of global economic stability (OECD, 2021). Economic stability and growth are critical dimensions of effective tax collection to attain public finance sustainability. A nation's capacity to finance resources domestically with an effective system of tax collection is one of the most significant determinants of its fiscal independence and economic path (Gupta, 2007).

JEL Classification — C33, H71, H72

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In India, tax revenue significantly facilitates infrastructure financing, financing of education and healthcare, and welfare programs, and is therefore central to macroeconomic stability, stifling fiscal deficit and imparting sustainable growth (Pattnaik, Bose, Bhattacharyya, & Chander, 2005). The Indian tax system comprises two major parts: direct taxes and indirect taxes. In recent times, the Indian tax revenues have witnessed major reforms to the taxation mechanism. One such reform was the induction of the Goods and Services Tax (GST) in 2017, where the consolidation of indirect tax and ease in revenue collection were the objectives (Rao & Rao, 2005). Evidence shows a significant expansion in both direct and indirect tax revenues over time after GST implementation. Combined tax revenues of the central and state governments increased from ₹29,78,134 crore in 2017–2018 to ₹54,56,913 crore in 2023–2024, indicating a substantial expansion in fiscal capacity. During the same period, direct tax revenues increased from ₹11,21,189 crore in 2017–2018 to ₹22,04,462 crore in 2023–2024, while indirect tax revenues rose from ₹18,56,945 crore to ₹32,52,451 crore in the same period. The growth trajectory shows a steady rise in total indirect tax collections, with indirect revenues reaching ₹20,32,864 crore in 2018–2019, ₹20,15,379 crore in 2019–2020, ₹20,78,585 crore in 2020–2021, ₹26,29,778 crore in 2021–2022, ₹28,69,493 crore in 2022–2023, and ₹32,52,451 crore in 2023–2024 (Reserve Bank of India, 2025). The increasing share of indirect taxes, largely driven by GST collections, alongside rising direct tax revenues, reflects the strengthening of India's fiscal system and the growing role of tax reforms in enhancing revenue mobilization across both central and state governments.

1.2 Determinants of tax revenue and existing research gaps

Despite the above-referred reform, there is still considerable variation in the tax revenue performance among the states of India. Extant literature has extensively explored the macroeconomic and structural factors influencing tax revenue performance among diverse economies. Tax revenue performance is influenced by a variety of factors, including economic growth rate, sector mix and institutional issues (Neog & Gaur, 2020). In the context of developing nations' economies, it has been found that tax revenue performance is favorable for economies with a significant portion of the manufacturing and service sector but remains poor for economies with a large percentage of the agricultural sector (Epaphra & Kaaya, 2020; Minh Ha, Tan Minh, & Binh, 2022; Jain & Singh, 2025). However, the bulk of the literature has concentrated on the relationship between the economic structure and tax revenue relative to GDP, whereas the sectoral contribution of the agricultural, industrial and service sectors to indirect tax revenue has been less investigated. Further, the majority of the literature on the subject suggests that the expenditure of the state and inter-governmental fiscal transfer stimulates the overall economic activity and hence influences the tax revenue performance (Panda, 2009; De Mello, 2000; Garg, Priyanka, Narwal, & Kumar, 2023; Garg, Priyanka, Narwal, & Kumar, 2023a). However, the majority of the literature on the subject has mainly examined the aforementioned determinants of revenue in isolation and not within the context of a comprehensive model to examine the association between the GST framework, economic structure, government expenditure and indirect tax revenue performance has been less explored. Studies exploring sectoral growth, government expenditure, inter-governmental fiscal transfer and tax revenue associations are few, and many issues remain to be unraveled.

1.3 Research questions and scope of the study

Against this backdrop, the present work tries to join the growing fraternity of literature through an exploration of determinants of tax revenue in India after the implementation of GST. The research questions that this empirical investigation aims to answer are: How do the structures of various economic sectors, government expenditure, intergovernmental transfers and GST reforms affect the composition of indirect taxes in Indian states? In order to answer the above research question properly, the following sub-research questions will also be explored in this study: What is the impact of the development of the agricultural sector on the mobilization of

indirect taxes in Indian states? Does the expansion of the industrial sector positively affect the performance of indirect taxes? What is the impact of the expansion of the service sector on the composition of indirect taxes? Does developmental expenditure improve the capacity of Indian states to mobilize indirect taxes? What is the impact of intergovernmental transfers on the mobilization of indirect taxes? What is the impact of GST reforms on the composition of indirect taxes?

1.4 Policy relevance of determinants of tax revenue

Addressing these research questions not only fills the identified empirical gaps but also provides a basis for understanding the broader policy relevance of these fiscal and structural determinants. Effectiveness and design of tax revenue systems are governed by a host of economic determinants like sectoral growth patterns, government spending policies and intergovernmental fiscal transfer arrangements (Gupta, 2007). Understanding the relation between various sectors of the economy, i.e. agriculture, industry and services, and their respective tax revenue can be very helpful in the formation of policies (Mawejje & Munyambonera, 2016). Moreover, public expenditure patterns and intergovernmental fiscal transfers significantly influence fiscal capacity and the allocation of tax revenues across different levels of government (Epaphra & Kaaya, 2020). With fluidity and dynamic changes in tax policies in India's economic growth, empirical examination of these determinants is critical to guarantee fiscal sustainability and enhance governance.

1.5 Organization of the study

Based on such background considerations, the current study uses a systematic approach to empirically examine such interlinkages and provide evidence-based policy design suggestions. The organization of the study shall be as follows: The second section shall provide existing literature on sectoral growth, public expenditure, inter-governmental fiscal transfer and tax revenue dynamics in developing economies. The third methodology section shall introduce the econometric models and data sources applied for empirical estimation. The fourth section displays empirical analysis and interpretation of findings. The fifth section will conclude the study with policy suggestions to improve tax revenue mobilization through target-based sectoral and fiscal interventions.

2. Literature review

The interrelations between public expenditure, intergovernmental fiscal transfer and sector growth in relation to tax-generating revenues have been thoroughly investigated in the academic community. This literature presents a theoretical framework that brings together different perspectives in relation to tax mobilization, sector growth, public expenditure effectiveness, intergovernmental transfer and revenues generated through indirect taxation.

2.1 Tax mobilization and sectoral growth

Tax revenues generated in different economies worldwide represent one of the main sources for financing public service delivery in different countries, especially in developing economies. The determinants of tax revenues in different countries are broadly structural and institutional, which include the level of economic development, sectoral growth and macroeconomic efficiency (Neog & Gaur, 2020). Growth in the industrial, service and agricultural sectors has a substantial impact on tax revenues collected by many countries throughout the world; however, the degree and manner of sector growth in connection to tax revenues fluctuate and depending on the circumstances (Gupta, 2007). The framework of optimal taxation theory states that highly structured industries with superior record-keeping and traceable transactions often provide more tax collections due to their ease of monitoring, while there is little scope for taxes in sectors that are defined by informality and subsistence

activities (Mirrlees, 1976; Kopczuk & Slemrod, 2006; Saez & Stantcheva, 2016). Governments' capacity to raise taxes can therefore be impacted by variations in the composition of the agricultural, industrial and service sectors.

2.1.1 Agriculture sector. The empirical analysis has confirmed that the agricultural sector is negatively related to tax revenue generation, as the subsistence nature of the sector's activities limits the scope of tax revenue generation (Neog & Gaur, 2020; Abu *et al.*, 2022). In India, the role of the sector in the economy's structure has confirmed that tax revenue generation in India has been limited due to exemptions provided to the sector (Jain & Singh, 2025; Rajak & Khan, 2025; Garg *et al.*, 2023). In other developing countries like Tanzania and Uganda, the role of the agriculture sector in the economy has resulted in limited tax revenue generation due to low administrative capacity, obstacles in income assessment and tax evasion (Mawejje & Munyambonera, 2016; Epaphra & Kaaya, 2020). Since the agricultural sector belongs to the informal sector, the capacity for the government to collect revenue from taxes in the agricultural sector is limited (Ul-Hassan & Mishra, 2018). According to the above discussion, the following hypothesis is formulated:

Ha. Higher levels of CONAGR are associated with a decrease in the indirect tax revenue of Indian states.

2.1.2 Industry sector. Industrialization increases tax revenue through employment, income tax and corporate tax (Neog & Gaur, 2020; Minh Ha *et al.*, 2022). Manufacturing value-added increases tax revenue through value-added output along with financial development (Gupta, 2007; Kwesi Ofori, Obeng, Armah, & Camarero, 2018; Garg, Narwal, & Kumar, 2024). Also, when economic production becomes more formalized and traceable, indirect taxes can be more readily levied. In that respect, states with more developed industrial bases can readily raise more indirect taxes (Castro & Camarillo, 2014). In conformity with the arguments of the theories highlighted above, the following hypotheses can be articulated:

Hb. Higher CONINDS levels are associated with growth in the indirect tax revenue of Indian states.

2.1.3 Service sector. Formalization in the service sector is relatively systematic, and this has a positive impact on revenue collection (Kwesi Ofori, 2018; Terefe and Teera, 2018; Epaphra & Kaaya, 2020). However, the coexistence of the informal portion of the service sector along with the formal sector poses a significant obstacle to tax collection expansion (Uko, Akpanoyoro, & Ekpe, 2020). The empirical data show a positive relationship between the expansion of the service sector and the rise of revenue collection, including indirect revenue collection, especially where service-driven growth is the main component of overall GDP (Garg *et al.*, 2023a; Jain & Singh, 2025). Accordingly, states with more developed service sectors can expect to experience better performance with respect to indirect taxes (Mawejje & Munyambonera, 2016). In conformity with the above theoretical arguments, the following hypothesis is formulated:

Hc. Higher levels of CONSERV are associated with increased indirect tax revenue across Indian states.

2.2 Government expenditure and taxation

Public expenditure has significant importance for economic growth and the mobilization of tax revenue. Developmental expenditure on infrastructure, education and healthcare can boost economic growth, thereby increasing the capacity for tax revenue mobilization (Mawejje & Munyambonera, 2016; Terefe & Teera, 2018; Epaphra & Kaaya, 2020; Jain & Singh, 2025). However, ineffective resource allocation, corruption and unnecessary spending might undermine fiscal results (Ul-Hassan & Mishra, 2018). Wagner's Law explains the link between public spending and revenue, which argues that economic progress raises demand for

public services and infrastructure expenditures that generate economic activity and expand the tax base (Lamartina & Zaghini, 2011). In addition, the Keynesian multiplier effect justifies public expenditure as a means to increase aggregate demand and economic output to improve the tax base (Ono, 2011). The above arguments form the basis for formulating the hypothesis as follows:

- Hd.* Higher levels of RDEVEXP are associated with an encouraging bearing on indirect tax revenue across Indian states.

2.3 Intergovernmental fiscal transfers

Fiscal transfers form a fundamental component of fiscal federalism and have been found to have profound implications for local revenue mobilization. Studies have found that unconditional transfers can create dependency on local tax mobilization, while conditional transfers improve local revenue mobilization efforts (Garg *et al.*, 2023, 2023a; Swaroop, Tibrewal, Sahil, & Yadav, 2025). In a federal system, such over-dependency can influence spending behavior and weaken fiscal autonomy (Panda, 2009). The Soft Budget Constraint Hypothesis argues that subnational governments may relax their tax effort if they expect the central government to provide financial assistance to their budgets (Kornai, Maskin, & Roland, 2003). In this view, more central government transfers to subnational governments are likely to reduce their incentives to seek their own tax revenues. The arguments presented above form the basis for formulating the hypothesis as follows:

- He.* Higher CTDS levels are associated with a reduction in indirect tax revenue across Indian states.

2.4 Goods and services tax (GST) reform and indirect tax revenue

India's indirect taxation system underwent a major structural transformation in 2017 with the introduction of the Goods and Services Tax (GST), which unified many indirect taxes (Jain & Singh, 2026). The economic logic of the GST introduction complies with the postulates of Value Added Taxation, which primarily addresses the problem of cascading effects and improves the efficiency of the tax system through a credit mechanism (Keen, 2013; Jain & Singh, 2025a). According to empirical research findings, while GST improves the long-run efficiency of the tax system, it can cause a realignment of revenues in the short run as a result of the changes in the reform process (Rao, 2019; Mukherjee, 2020; Dey, 2021; Jain & Singh, 2025). With reference to the Indian reform experience in the field of indirect taxation, the following hypothesis can be formulated:

- Hf.* The introduction of GST has contributed to a reduction in indirect tax revenue across Indian states.

The remaining major studies are presented in Table 1.

3. Research methodology

The intention of the current research is to explore the impact of sectoral composition, government spending, fiscal transfer and GST on indirect tax revenue in Indian states. This research aims to assess the effects, both positive and negative, of sectoral composition, government spending, fiscal transfer and GST on tax revenue in Indian states by employing a static panel data regression model. The dataset comprises cross-sectional units (27 Indian states) over a period (2012–2013 to 2022–2023). Thus, the panel data regression model is suitable as it handles unobserved heterogeneity across cross-sectional units over time effectively, and the static panel model is selected for assessing the immediate effects. For achieving the objective, the Indirect Tax Revenue Ratio (ITRRatio) is considered as the

Table 1. Literature review

Name(s) and year of study	Title of study	Methodology used	Results
<i>Indian studies</i> Panda (2009)	“Central Fiscal Transfers and States’ Own-Revenue Efforts in India: Panel Data Models”	Fixed and random effects panel regression	Central fiscal transfer weakens the motivation of states to generate their own revenues. As their dependency on central fiscal transfer increases, their motivation to generate their own revenues weakens. Also, revenue expenditure with a one-time-period lag is found to be highly significant, and positively affects the various components of states’ revenue
Garg <i>et al.</i> (2023a)	“Goods and Service Tax and its Implications on Revenue Efficiency of Sub-National Governments in India: An Empirical Analysis”	Panel regression model	The implementation of GST has also adversely affected the revenue efficiency of the Indian states. Further, it has been found that the service sector’s share of the state’s Net State Domestic Product, the credit-deposit ratio and the state’s outstanding net bank credit of scheduled commercial banks have a positive effect on revenue efficiency, whereas the dependence of states on central transfers negatively impacts the revenue effort of the states
Jain and Singh (2025)	“An Impact Analysis of Structural Changes and Government Expenditure on Indirect Taxes Post-GST in India: An ARDL Cointegration Approach”	ARDL cointegration model	The expansion of the service sector and the spending of the government have a positive impact on indirect tax revenue. On the contrary, trade openness and the adoption of the Goods and Services Tax have a negative impact on indirect tax revenue
Jain and Singh (2025a)	“From Traditional Tax to GST: Analysing the Tax Revenue and Economic Growth of Haryana”	Paired sample <i>t</i> -test and regression analysis	The adoption of GST has significantly increased the revenue receipts of the state of Haryana. A positive relationship is observed between GST revenue and the economic output of the state. The positive impact of GST revenue is a confirmation of the effectiveness of GST
Rajak and Khan (2025)	“An Analytical Study of Goods and Services Tax and Its Impact on Agricultural Industry”	Analytical and descriptive study	GST is expected to result in both positive and negative impacts on the agricultural sector. For instance, the introduction of the single rate of tax on services and goods is expected to ease the national sale of agricultural commodities by all farmers and traders. However, the imposition of different tax rates on various agricultural commodities is likely to present an obstacle

(continued)

Table 1. Continued

Name(s) and year of study	Title of study	Methodology used	Results
Swaroop <i>et al.</i> (2025)	“Fiscal Federalism in the GST Era: Challenges and the Road Ahead”	Conceptual and policy analysis	GST has led to the centralization of power, with the states becoming more dependent on the central government. This has created a situation where fiscal autonomy has been eroded, leading to the redefinition of fiscal federalism. Additionally, in the Indian context, GST has created disequilibrium in fiscal federalism by centralizing power in the hands of the central government
<i>Global studies</i> De Mello Jr (2000)	“Fiscal Decentralization and Intergovernmental Fiscal Relations: A Cross-Country Analysis”	Cross-country econometric analysis	Fiscal decentralization influences the efficiency of the government as well as the mobilization of revenues. The results are determined by the institutional arrangements that are in place and the relationship that exists between the central government and the local authorities
Gupta (2007)	“Determinants of Tax Revenue Efforts in Developing Countries”	Cross-country panel regression	The structural determinants, such as per capita GDP, the agricultural sector’s share in the country’s GDP and trade openness, have a significant impact on revenue mobilization in developing countries. Foreign aid has a positive effect on revenue mobilization. Corruption is an obstacle to revenue mobilization. Countries that depend mostly on income tax, profits tax, and capital gains tax have better revenue mobilization performance compared to those that depend mostly on indirect taxes, such as taxes paid on the supply of goods and services
Castro & Camarillo (2014)	“Determinants of Tax Revenue in OECD Countries Over the Period 2001–2011”	Static and dynamic panel data analysis	GDP per capita and the growth of the industrial sector are positively linked to the revenue generated. On the other hand, the share of the agricultural sector in the economy and foreign direct investment are negatively linked to the revenue generated

(continued)

Table 1. Continued

Name(s) and year of study	Title of study	Methodology used	Results
Mawejje and Munyambonera (2016)	“Tax Revenue Effects of Sectoral Growth and Public Expenditure in Uganda”	ARDL bounds testing	Agricultural dominance in the economy and the large informal sector negatively influence the revenue generated. On the other hand, the growth of the industrial sector and the level of expenditure are positively linked to the revenue generated
Epaphra and Kaaya (2020)	“Tax Revenue Effect of Sectoral Growth and Public Expenditure in Tanzania: An Application of Autoregressive Distributed Lag Model”	ARDL bounds testing	A strong and positive relationship is present between tax revenue and the major sectors of the economy in both the short-run and long-run. Recurring public expenditures and development public expenditures, together with trade openness, are likely to have a positive impact on the performance of the tax revenue in the short-run and long-run. Free trade is likely to have a negative impact on the tax revenue ratio

Source(s): Author

explained variable along with sectoral composition (agriculture, industry and service, such as CONAGR, CONINDS and CONSERV, respectively), government spending (RDEVEXP), fiscal transfer (CTDS) and GST implementation (GSTDum) as explanatory variables. The description of the variables used in the study is presented in Table 2.

Table 2. Description of variables

Variables acronym	Definition	Variable expression	Theoretical expected sign
ITRRatio	Indirect Tax Revenue	The ratio of Indirect Tax Revenue to the State’s NSDP	
CONAGR	Contribution of the Agriculture sector	The ratio of the agricultural sector contribution to the states’ NSDP	–
CONINDS	Contribution of the Industrial sector	The ratio of the industrial sector contribution to the states’ NSDP	+
CONSERV	Contribution of the Service sector	The ratio of the service sector contribution to the states’ NSDP	+
RDEVEXP	Ratio of Development expenditure	The ratio of development expenditure to the state’s NSDP	+
CTDS	Central Transfer Dependence of States	The central transfer dependence of states on the TRR of states	–
GSTDum	Dummy of GST	Takes the 1 value when there is GST, otherwise 0	–

Source(s): Author

3.1 Data source and timeframe

The sample comprises 27 states in the Indian economy. As there are 28 states in India, the formation of Telangana state in 2014 led to the exclusion of this state in the research. For collecting state finance's data, the research has used the data from Reserve Bank of India (RBI) publications on states for various issues, namely "*State Finances: A Study of Budgets and Handbooks of Statistics on Indian States.*" The timeframe for the research is considered from 2012–2013 to 2022–2023, keeping in mind the availability of data for all variables. The initial year, i.e. 2012–2013, is chosen as it is a base year of RBI for many statistical calculations and the finishing year, i.e. 2022–2023, is chosen for recent data inclusion in the study. Additionally, the timeframe divides the time into two phases, i.e. pre-GST and post-GST.

3.2 Statistical techniques

In the context of static panel regression, the available estimation models are pooled OLS (POLS), fixed effect (FE) and random effect (RE). The pooled OLS model fails to account for the time and individual characteristics of the cross-sectional units in the analysis. It overlooks unobserved variations between these units and assumes that the regression coefficients remain constant over time and across sections. In contrast to the pooled OLS method, the fixed effect and random effect models take into account the heterogeneity across individual cross-sections (states) by introducing a varying intercept for each state. Henceforth, the fixed effect and random effect models account for both time and cross-sectional aspects. In the fixed effect model, the unobserved heterogeneity across individual cross-section units is assumed to be represented by the individual cross-section elements, i.e. states whereas the random effect model assumes that the individual cross-section element is a random factor with 0 mean value and is uncorrelated with the explanatory variables in all periods.

The econometric equations for all three models (POLS, FE and RE) are given below:

$$ITRRatio_{it} = \alpha + \beta_1 CONAGR_{it} + \beta_2 CONINDS_{it} + \beta_3 CONSERV_{it} + \beta_4 RDEVEXP_{it} \\ + \beta_5 CTDS_{it} + \beta_6 GSTDum_{it} + \mu_{it}$$

$$ITRRatio_{it} = \alpha + \beta_1 CONAGR_{it} + \beta_2 CONINDS_{it} + \beta_3 CONSERV_{it} + \beta_4 RDEVEXP_{it} \\ + \beta_5 CTDS_{it} + \beta_6 GSTDum_{it} + \gamma_{it} + \mu_{it}$$

$$ITRRatio_{it} = \alpha + \beta_1 CONAGR_{it} + \beta_2 CONINDS_{it} + \beta_3 CONSERV_{it} + \beta_4 RDEVEXP_{it} \\ + \beta_5 CTDS_{it} + \beta_6 GSTDum_{it} + \delta_{it} + \mu_{it}$$

where α and β_x ($x = 0, \dots, 6$) is the vector of coefficients for estimation.

μ_{it} denotes the combined error component of both time-series and cross-section.

γ_{it} denotes an unmeasured variability among the individual cross-sections (states).

δ_{it} denotes a stochastic factor that captures the variation among cross-sectional units (states).

i represents the Indian States ($i = 1, \dots, 27$ is for the twenty-seven states of India).

t represents the time period (i.e. 11 years from 2012–2013 to 2022–2023).

In order to select the most appropriate econometric model, three model selection tests are performed. The Chow test is conducted to compare the POLS model against the FE model, where the null hypothesis favors POLS. The BPLM (Breusch and Pagan Lagrange Multiplier) test is used to evaluate whether the POLS model is a better fit compared to the RE model. Finally, the Hausman test is applied to distinguish between the FE and RE models, with the null hypothesis supporting the RE model as the superior choice. But before adopting the final model for the analysis, it is important to carry out diagnostic tests, which will show the model is

free from heteroskedasticity and autocorrelation problems using the modified Wald test and the Wooldridge test, respectively. However, the presence of both problems in the model calls for another model, which is Generalized Least Squares (GLS), which can handle both these issues as described by Babatunde, Ibukun, & Oyeyemi, 2017; Ho, Tran, & Nguyen, 2023.

4. Results and discussion

This section elaborates on the outcomes of various analyses, detailing the results from the descriptive statistics to ascertain the statistical properties of the variables, correlation structure with variance inflation factor (VIF) analysis to detect multicollinearity issues and the empirical results using the static panel regression.

4.1 Descriptive statistics and correlation matrix

The statistical properties such as mean, std. dev., minimum and maximum values of all the variables are presented in descriptive statistics part of Table 3. Further, the pairwise correlation matrix for the dependent and independent variables is illustrated in the bottom part of Table 3. With all correlation values below the 0.80 threshold, the table confirms the absence of significant multicollinearity issues. This means that the variables are sufficiently independent of each other, which enhances the credibility and reliability of the analysis.

4.1.1 Multicollinearity analysis. To further validate the results derived from the correlation matrix, we conducted a VIF analysis, the results of which are presented in Table 3. In regression analysis, VIF quantifies multicollinearity by comparing the variance of the full model with that of a model containing just a single explanatory variable. If the VIF surpasses 10, it implies that the corresponding explanatory variable exhibits a high degree of multicollinearity with other variables in the model. Though, the results illustrates that none of the variables have VIF values exceeding 10, which aligns with the commonly accepted guidelines for assessing multicollinearity, indicating that there are no significant multicollinearity issues among the variables.

4.2 Panel regression

Table 4 presents the panel data's results in POLS, FE and RE along with the distinctive tests for selecting the best model for analysis. Three different types of tests are performed for selecting the best model. The first test is performed, the Chow test, which is used to decide between the POLS and FE models. Hence, the Chow test reports a p -value of 0.000, indicating rejection of the null hypothesis and confirming that the FE model is preferred over the POLS model. Then, the next test is performed, the BPLM test, which is used to decide whether the POLS model is a better fit compared to the RE model. So, the BPLM test yields a p -value of 0.000, which clearly rejects the null hypothesis and confirms that the RE model is superior to the POLS model. Now, these two models suggest that the FE and RE models are the best fit for the analysis. To remove this confusion, another test is performed, the Hausman test, which is used to decide between FE and RE models. So, the Hausman test result with a p -value of 0.000 strongly rejects the null hypothesis, suggesting that the FE model is a superior model as compared to the RE model. After going through all tests, it is advisable to go ahead with the FE estimator.

4.2.1 Diagnostic testing. Before adopting the FE as the final model for the analysis, it is important to carry out diagnostic tests, which will show the model is free from heteroskedasticity and autocorrelation problems, which are common in panel datasets. Hence, the modified Wald test for heteroskedasticity and the Wooldridge test for autocorrelation are applied and presented in Table 4. The heteroskedasticity test works on the null hypothesis of constant variance, i.e. no heteroskedasticity, but the p -value of 0.000 implies the rejection of the null hypothesis, which means that there is a heteroskedasticity problem in the model. In addition, the autocorrelation test works on the null hypothesis of no first-order autocorrelation, but a similar p -value (0.000) implies the rejection of the null

Table 3. Descriptive statistics, variable correlation structure and VIF analysis

	ITRRatio	CONAGR	CONINDS	CONSERV	RDEVEXP	CTDS	GSTDum	VIF scores
<i>Descriptive statistics</i>								
Mean	7.740	10.248	30.294	43.307	19.401	54.575	0.545	–
Min	2.387	1.861	8.567	23.883	7.387	16.060	0	–
Max	16.366	29.056	62.868	65.900	77.253	96.460	1	–
Std. Dev	2.187	5.302	12.133	9.601	11.245	21.952	0.499	–
Obs	297	297	297	297	297	297	297	–
<i>Variable correlation structure and VIF analysis</i>								
ITRRatio	1.0000							–
CONAGR	–0.0878	1.0000						3.57
CONINDS	0.0414	–0.5046	1.0000					8.79
CONSERV	–0.1103	0.0340	–0.7924	1.0000				6.58
RDEVEXP	–0.0902	0.1848	–0.3179	0.2132	1.0000			2.37
CTDS	–0.4769	0.3048	–0.2944	0.2610	0.7050	1.0000		2.55
GSTDum	0.4203	–0.2034	0.0183	–0.0172	0.1906	0.0606	1.0000	1.17
Source(s): Author								

Table 4. Panel regression results

	POLS	FE	RE
CONAGR	0.1186*** (0.000)	−0.0940** (0.031)	−0.0072 (0.849)
CONINDS	0.0356* (0.098)	0.0116 (0.744)	0.0172 (0.550)
CONSERV	0.0420* (0.075)	0.1402*** (0.000)	0.0747** (0.015)
RDEVEXP	0.0789*** (0.000)	0.0800*** (0.000)	0.0916*** (0.000)
CTDS	−0.0865*** (0.000)	−0.0898*** (0.000)	−0.0875*** (0.000)
GSTDum	1.9887*** (0.000)	1.5762*** (0.000)	1.6839*** (0.000)
C	5.7289*** (0.002)	4.7671 (0.101)	6.1386** (0.012)
<i>Tests</i>			
Chow Test	H ₀ : POLS is more consistent than FE	241.21 (0.000)	FE is more consistent
BPLM Test	H ₀ : POLS is more consistent than RE	249.16 (0.000)	RE is more consistent
Hausman Test	H ₀ : RE is more consistent than FE	31.04 (0.000)	FE is more consistent
<i>Diagnostic tests</i>			
Modified Wald test for Heteroskedasticity	H ₀ : No heteroskedasticity (constant variance)	405.97 (0.000)	Heteroskedasticity
Wooldridge test for Autocorrelation	H ₀ : No first-order autocorrelation	65.865 (0.000)	Autocorrelation
Note(s): <i>p</i> -value in parentheses and the asterisks (***), (**) and * stands for 1%, 5% and 10% level of significance respectively			
Source(s): Author			

hypothesis, indicating the presence of autocorrelation in the model. Thus, there is evidence of the existence of both heteroskedasticity and autocorrelation in the FE model. So, to overcome these problems, this research has applied the GLS model, ensuring robust and efficient coefficient estimates.

4.3 GLS regression results and hypothesis testing

The GLS model elucidates that the CONAGR is positively related to the indirect tax revenue, being significant at 1% level, as presented in Table 5. This finding contradicts Ha, which predicted a negative relationship. As agriculture itself enjoys certain tax exemptions, but its indirect contributions to indirect tax revenue are significant due to its extensive forward and backward linkages, such as the strong agricultural sector, which encourages agro-based industries, including dairy, textiles, food processing and sugar industries, which contribute to the indirect tax collections through excise duties, custom duties and GST. Additionally, the expansion of agricultural trade demands increased transport and logistics services that lead to higher fuel consumption, which is heavily taxed through excise duties on petroleum products. Similarly, when agriculture prospers, rural income rises, which gives rise to increased demand for agricultural inputs, consumer goods and services, all of which attract GST and other indirect taxes. Thus, Ha is rejected. In a similar vein, the indirect tax revenue is positively impacted by CONINDS, supporting Hb. This finding is in line with Garg et al. (2024), Minh Ha et al. (2022), Epaphra & Kaaya (2020), Kwesi Ofori et al. (2018), Castro & Camarillo

Table 5. GLS results

	GLS	Theoretical verification of variables	
		Expected sign	Outcome sign
CONAGR	0.1186 *** (0.000)	–	+
CONINDS	0.0356* (0.093)	+	+
CONSERV	0.0420* (0.070)	+	+
RDEVEXP	0.0789*** (0.000)	+	+
CTDS	–0.0865*** (0.000)	–	–
GSTDum	1.9887*** (0.000)	–	+
C	5.7289*** (0.002)		

Note(s): *p*-value in parentheses and the asterisks (***), (**) and * stands for 1%, 5% and 10% level of significance respectively

Source(s): Author

(2014), and Gupta (2007), who report that the industrial sector is easier to tax and can generate larger taxable revenue. This can be possible via industrial expansion that leads to higher production and sales of manufactured goods, which attract indirect tax collections. Secondly, increased industrial production demands more raw materials and capital goods, which encourages various services such as transportation, logistics and warehousing that often lead to higher revenue collection through fuel taxes, toll taxes and GST. Hence, [Hb](#) is accepted in this case. Further, the analysis shows that the indirect tax revenue is favorably influenced by CONSERV, supporting [Hc](#). [Garg et al. \(2023a\)](#) reported the significant and favorable influence of the service sector on the GST efficiency ratio of the Indian states. Likewise, [Mawejje and Munyambonera \(2016\)](#), [Terefe and Teera \(2018\)](#), [Epaphra and Kaaya \(2020\)](#), and [Jain and Singh \(2025\)](#) showed that tax revenue is positively and significantly affected by the service sector. The main reason behind this positive influence is that the GST has incited the formalization of businesses by making mandatory GST registration for service providers earning over ₹20 lakh per year, enabling them to take benefits of input tax credit, resulting in more service providers being within the tax net, leading to higher GST tax revenue. Hence, [Hc](#) is supported.

Moreover, RDEVEXP represents the favorable impact on indirect tax revenue, which is also significant at 1% level, supporting [Hd](#). The similar kinds of findings are shown by [Mawejje and Munyambonera \(2016\)](#), [Epaphra and Kaaya \(2020\)](#), and [Jain and Singh \(2025\)](#). [Reserve Bank of India \(2023\)](#) also showed that development expenditure is positively associated with the tax effort, as optimum use of the tax base can create the fiscal space to enhance productive expenditures. When the government spends money, it circulates through the economy, helping in generating multiple rounds of taxable transactions. Besides, development expenditure often includes welfare programs, job creation and rural development schemes, which help in increasing the income of people, by which their consumption increases and ultimately tax revenue rises. Hence, [Hd](#) is supported. In contrast, the coefficient of CTDS has an unfavorable and significant influence, as per our expectation, supporting [He](#). [Swaroop et al. \(2025\)](#), [Garg et al. \(2023\)](#), [Garg et al. \(2023a\)](#) and [Panda \(2009\)](#) reported similar findings. They stated that the overdependence of states on central funds can result in weak economic self-sufficiency, as states may invest less in infrastructure, industrialization and business development, which are key drivers of taxable economic activity consequently, leading to a

decrease in tax revenue. There is an inverse relationship between the state's dependence on central transfer and tax revenue. More of the central transfer to the state, less will be the tax revenue. Consequently, [He](#) is supported. Furthermore, the implementation of GST had a favorable and significant impact on indirect tax revenue. This finding is in contradiction with [Hf](#). The positive impact of GST has broadened the tax base by including more businesses and sectors. In other words, by making mandatory GST registration, it has forced informal businesses to enter the formal economy, which helps in increasing revenue collection. The GST has also reduced the cascading effect by allowing input tax credit, which helps businesses to report transactions correctly for claiming the benefit of input tax credit. According to sec 16 of the CGST Act, 2017, firms will access tax credit only if their supplier has remitted GST. This creates a chain of keeping everybody in compliance, so that tax is remitted to the government at every stage, which helps in boosting indirect tax revenue. This finding is in contrast with [Jain & Singh \(2025\)](#), [Garg et al. \(2023a\)](#), [Dey \(2021\)](#) and [Mukherjee \(2020\)](#). Therefore, [Hf](#) is rejected.

5. Conclusion and policy implications

This study investigated the key determinants of indirect tax revenue in Indian states, focusing on the impact of sectoral economic composition, government expenditure, implementation of GST and fiscal transfers utilizing the time span of 2012–2013 to 2022–2023. The major findings of the study indicate the following:

- (1) Sectoral economic composition significantly influences the indirect tax revenue performance.
- (2) Agriculture, industry and the service sector positively contribute to the indirect tax revenue.
- (3) States with higher government expenditure enhance tax mobilization.
- (4) The introduction of GST has bolstered the indirect tax revenue performance of the states.
- (5) State's dependence on central government transfers has an adverse influence on the indirect tax revenue.

Overall, the findings suggest that the indirect tax revenue performance is shaped by structural composition, government spending and tax reforms.

5.1 Policy implications

The research has significant implications from a broad policy standpoint, which are outlined below.

- (1) As agricultural activities prosper, it leads to increased consumption, trade and industrial activity. Thus, policymakers should focus on strengthening agro-based industries such as textiles, food processing, dairy and sugar industries as well as improving rural logistics infrastructure, as these industries generate indirect tax revenue collection.
- (2) GST rates on industrial outputs such as raw materials, intermediate products and capital products should be optimized to ensure smooth industrial growth while maximizing revenue.
- (3) Policymakers should focus on those strategies in the service sector that will enhance growth, improve tax compliance and create a stable tax regime by ensuring simplified tax compliance for service-based businesses, especially MSMEs and small service providers, to improve tax collection efficiency.

- (4) The positive impact of government expenditure suggests that policymakers should prioritize infrastructure investments, such as digital connectivity, roads and power, which will boost industrial expansion and trade, leading to higher indirect tax revenue collections.
- (5) The adverse impact of central transfer suggests that it should be restructured to incentivize higher tax effort by linking a portion of grants to improvements in tax-to-GSDP ratios or GST growth.
- (6) As the GST system has helped in formalizing the informal sector, this momentum should be maintained. For this, policies should be framed in a way that promotes easy registration, financial literacy and digital payments.
- (7) The removal of interstate trade barriers under GST has facilitated the seamless movement of goods. To capitalize on this, policymakers should focus on improving logistics infrastructure, reducing transport bottlenecks and supporting supply chain integration, which indirectly contribute to higher tax revenue.

5.2 Limitations and future scope of the study

This research provides important insights about the determinants of indirect tax revenue in the GST framework, but it has certain limitations that open the door for future research.

- (1) This study investigated the impact of GST at the state-level panel data in India, which limits the broader generalization at national or international levels. Future studies could incorporate cross-country analysis to gain insights into the GST implementation and its revenue implications.
- (2) This study provides an inclusive interstate analysis. Future studies could incorporate region-wise analysis within the Indian economy, which could provide deeper insights across different zones.
- (3) This research employs static panel models. Future research could incorporate dynamic panel techniques to address issues like autocorrelation and heteroskedasticity more effectively.

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