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Research paper

GST Reform and Its Economic Impact on The Indian Manufacturing Sector: An Empirical Cost-Benefit Assessment

Diksha Halder [1] *, Dr. K. T. Vijaykarthigeyan [2]

[1] Research Scholar, Faculty of Management, SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu-603203, India
[2] Associate Professor, Faculty of Management, SRM Institute of Science and Technology, Kattankulathur, Tamil Nadu-603203, India
**Corresponding author E-mail: dh3648@srmist.edu.in*

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Abstract

This study evaluates the influence of the Goods and Services Tax (GST) on the manufacturing sector in India through a detailed cost-benefit analysis using secondary data. GST, introduced as a major indirect tax reform, aimed to unify the complex tax structure and boost economic efficiency. Quantitative techniques, such as Analysis of Variance (ANOVA) and regression analysis, are used in the research to analyze how GST implementation has affected manufacturing performance metrics like production expenditure, profitability, and growth in output. Secondary data gathered from industry publications, government documents, and accounting statements of the chosen manufacturing companies over the pre- and post-GST eras are analyzed. The ANOVA test will identify significant differences in cost and benefit factors prior to and after GST implementation, while regression analysis uncovers the correspondence between GST implementation and manufacturing sector performance. The findings reveal that GST has contributed to a decrease in cascading taxes, enhanced input cost efficiency, and profitability, though the impact differs among subsectors. The research helps understand the contribution of GST in defining the manufacturing sector, offering insight for policymakers and industry players seeking to maximize tax reforms and ensure sustainable industrial growth.

Keywords: *Goods and Services Tax (GST); Manufacturing Industry; Cost-Benefit Analysis; Tax Reform; Economic Effect JEL Classification: C12; C23; H25 & L60.*

1. Introduction

The Goods and Services Tax (GST), implemented in India on July 1, 2017, was a mega reform to consolidate the convoluted indirect tax regime into a single, unified system (Kumar, 2017). The manufacturing sector, which is one of the primary drivers of India's GDP and jobs, has been considerably affected by this change (Rao, 2018). While GST was meant to ease taxation, remove cascading effects, and enhance compliance, its actual impact on manufacturing costs, operational efficiency, and overall productivity is a subject of continued study (Mukherjee, 2019). Prior to GST, manufacturers were subjected to several taxes including excise duty, VAT, and entry taxes, which resulted in inefficiencies and higher cost burdens (Poddar & Ahmad, 2017). The guaranty of GST was to institute a credit mechanism and one marketplace to drive investment and growth. Yet, firms have rendered varying accounts, with some reporting burdens on compliance and others indicating enhanced logistics and input tax credits (NITI Aayog, 2020). To what extent has GST implementation resulted in quantifiable cost savings and operating advantages for the Indian manufacturing industry, and what are the trade-offs or drawbacks? What: This research plans to assess the cost-benefit consequences of GST implementation for India's manufacturing industry, focusing on both concrete (financial) and abstract (compliance, efficiency) measures. Why: Although GST has been functional for a few years, there is little sector-wise in-depth analysis to quantify the advantages and disadvantages of the reform, particularly in the manufacturing sector critical to India's economic ambition under initiatives such as Make in India (Deloitte, 2021). The study will adopt a mixed-methods design that integrates quantitative analysis of pre- and post-GST firm-level financial data with qualitative information from industry specialists and manufacturing companies. The cost-benefit framework will be utilized to estimate fiscal indicators (tax outgo, cost structure, compliance costs) and operational indicators (inventory efficiency, input credit claims, inter-state logistics).

Fig. 1: Our Key Solution.

The implementation of GST has led to a more streamlined tax system, reducing the cost of production and improving the ease of doing business in the manufacturing sector. While initial challenges existed, the long-term benefits include increased competitiveness and a more organized industry structure.

1.2. Economic significance of manufacturing

The manufacturing sector is a backbone of the Indian economy, contributing significantly to GDP, employment, exports, and industrial development. Any policy or tax reform that affects this sector has wider economic implications (Rao, 2018). Therefore, understanding the real impact of GST on manufacturing is essential for policy assessment and future growth strategies.

GST as a Major Structural Reform

GST is one of the most significant tax reforms in India's post-liberalization history. It aims to:

- Eliminate the cascading effect of taxes,
- Streamline the indirect tax structure,
- Boost ease of doing business, and
- Promote a unified national market.

Mixed and Inconclusive Evidence

Although GST has been in place since 2017, empirical evidence on its actual effects positive or negative on different sectors remains mixed, fragmented, or anecdotal. While some claim it has reduced tax costs and improved logistics, others highlight compliance burdens and operational inefficiencies (Mukherjee, 2019; NITI Aayog, 2020). A rigorous, sector-specific cost-benefit analysis fills this research gap.

Need for Policy Feedback and Course Correction

Assessing GST's real impact on manufacturing provides data-driven insights that can help the government make targeted reforms, such as:

- Simplifying return filing systems,
- Adjusting tax rates,
- Expanding input tax credit options, and
- Supporting small and medium enterprises (SMEs).

Guidance for Businesses and Investors

From a business perspective, manufacturers need to understand the financial and operational impact of GST for strategic decisions related to:

- Pricing,
- Supply chain design,
- Tax planning, and
- Investment location choices.

1.3. Need and importance of the study

The introduction of the Goods and Services Tax (GST) in India is one of the most revolutionary fiscal changes in the history of post-independence India. It substituted a maze of indirect taxes levied by the Centre and states with a single tax system for increasing tax compliance, minimizing the cascading effect of multiple taxes, and promoting an integrated national market. Considering the pivotal role of the manufacturing industry in the economic growth of India playing a major contribution towards GDP, employment creation, and exports assessing the sectoral implications of GST both timely and essential. Although the wide-ranging goals of GST, the real experiences of manufacturing companies have remained varied. While some have described enhanced logistics and input tax credit claim, others still experience compliance cost, working capital blockage resulting from delayed refunds, and uncertainty in tax interpretations. This variance in experiences points to a gap in empirical knowledge, especially where sectoral cost-benefit consequences are concerned. There is an urgent requirement for a full evaluation that not only measures the financial costs and gains from implementing GST but also considers operational and structural implications. It will assist in ascertaining whether the reform brought efficiency and competitiveness gains in the manufacturing sector or brought new frictions. Further, this research has considerable policy importance. Its recommendations can be useful for policymakers looking to optimize GST mechanisms, with a focus on rate rationalization, procedural simplification, and facilitation of small and medium enterprises (SMEs). For industry players, the study will provide empirical input on streamlining business processes under the existing tax system.

1.4. Scope of the study

The objective of this research is to analyze the cost-benefit effects of the Goods and Services Tax (GST) on India's manufacturing sector. The scope is delimited by the following prominent dimensions:

Sectoral Focus:
The analysis is confined to the manufacturing industry in India, including large-scale industries as well as some selected small and medium-scale enterprises (SMEs) to analyze differentiated impacts based on size and organizational structure.
Geographical Coverage:
The study will be undertaken for manufacturing companies from a variety of Indian states to provide geographical representation to include various tax experiences and supply chain implications under GST.

2. Literature Review

Goods and Services Tax (GST) is a wide indirect tax that has been implemented to substitute a multi-layered taxation structure in India (Kumar, 2017). The primary aims of GST are to reduce tax cascading, raise transparency, and bring ease of doing business (Chakraborty, 2018). It rolls over taxes such as VAT, excise duty, and service tax into one combined tax system (Rao, 2019).
The principle of tax neutrality has been adopted to implement GST to reduce distortion in the direction of resources (Musgrave & Musgrave, 1989). In manufacturing, tax neutrality provides competitive pricing, enhanced cash flows through input tax credits, and mitigation of cost-push inflation (Poddar, 2017). A few studies have analyzed the macroeconomic effects of GST. Mukherjee (2019) held that GST has a positive effect on economic growth and enhances tax compliance. Bhushan and Sharma (2020) also documented enhanced tax revenue efficiency and streamlining in supply chains. During the transition phase, there was confusion regarding several tax slabs, compliance needs, and portal inefficiencies (Das & Sahoo, 2018).
The production industry, as it is very input-oriented, has both benefits and hassles after GST. Jain (2019) discovered that big producers enjoyed less logistic cost and simplified warehousing, while SMEs had more compliance issues. Sharma and Singh (2020) noted operational challenges, particularly in refund claiming and utilization of the digital GST platform.
Empirical research by Bhatia (2021) and Gupta (2020) showed that while tax incidence for organized manufacturers has decreased marginally, the gains are disproportionately distributed across sub-sectors. Additionally, Roy and Sinha (2021) pointed out delays in refunds and a lack of coordination among central and state governments as key pain points.
Research also highlights the behavioral aspect of tax reform. Nath and Sengupta (2022) argue that GST success is contingent on taxpayers' awareness and responsiveness to compliance mechanisms. In contrast, Patnaik and Mohanty (2018) highlighted the imperative of digital literacy to successful GST implementation, particularly among MSMEs.
From the cost-benefit perspective, Mishra (2021) carried out comparative analysis, which found quantifiable savings in logistics and inventory expenses but observed implicit costs of training, system enhancement, and legal advice. Banerjee and Rao (2022) observed that long-term GST advantages are contingent upon the streamlining of slab structures and enhanced grievance redressed mechanisms.
In addition, international evidence favourably supports that integrated tax regimes enhance the performance of manufacturing. For example, OECD (2016) indicated that VAT-type models enhance the competitiveness of exports through the reduction of hidden taxes. Developing analogies, Agarwal (2023) implied that India's GST should upgrade to a single-rate system to achieve the highest possible efficiency.
Though the government's motivation for GST reform is commendable, ongoing review is necessary to facilitate fair results across industries. Ghosh and Dey (2021) pointed out that policy feedback grounded on empirical findings can create more balanced growth as well as increased inclusivity.

3. Research GAP

Despite a rich body of literature on macroeconomic and policy-level analyses of the Goods and Services Tax (GST) in India, there exists a significant lack of sector-specific empirical work, especially for the manufacturing sector. While most existing research concentrates on overall economic performances, tax compliance actions, or supply chain performance, it does not provide an overall cost-benefit analysis suited to the operational and financial performances of manufacturing companies.
Moreover, most studies focus either on large business houses or policy summaries, thus neglecting small and medium manufacturing businesses (SMEs), which form a major share of India's industrial scenario. Although there are some studies that address GST's theoretical advantages such as input tax credit and elimination of cascading taxes, few of them empirically estimate these advantages against latent costs such as enhanced compliance cost, delay in refunds, system enhancements, and training.
Moreover, the spatial heterogeneity of GST impact is not yet fully explored. Impacts of regional disparities in implementation effectiveness, digital connectivity, and state-level administrative sensitivity on manufacturing performance have not yet been rigorously tested. This results in a critical omission in understanding the state-wise differentiated impacts of GST.
Thus, the present study attempts to bridge these research gaps through an elaborate, multi-dimensional cost-benefit analysis of GST roll-out in the Indian manufacturing industry, accounting for firm size, geographical spread, and operational factors. The study also attempts to provide policy-relevant insights that are based on real world data, thereby making substantial contributions to both academia and practical choice-making.

3.1. Question for research

This research attempts to answer the following core research question:
"What are the quantifiable costs and benefits of Goods and Services Tax (GST) roll-out on the financial and operational performance of Indian manufacturing industries?"
To further narrow down the scope, the research also investigates the following sub-questions:
1) How has GST impacted the input cost structure and tax burden for manufacturing companies?
2) What are the observed operational and compliance issues faced by manufacturers after GST?
3) Do small and medium-sized enterprises (SMEs) have different GST effects compared to large-scale producers?
4) How does the GST effect differ across states or regions of India?
5) What are the suggestions for making GST more effective for the manufacturing industry?

3.2. Goals of the research

The main intention of this research is to perform an exhaustive cost-benefit analysis of the effect of Goods and Services Tax (GST) on India's manufacturing industry. The particular objectives are:

1) To examine the fiscal impact of GST on manufacturing companies in terms of tax expense, input prices, and profitability.
2) To determine the operational effect of GST, such as efficiency in supply chain, logistics, and compliance systems.
3) To determine and contrast the challenges and advantages faced by SMEs and large manufacturing firms under the GST system.
4) To examine inter-regional differences in implementation and impact of GST among various Indian states in the manufacturing sector.
5) To suggest policy interventions for enhancing the efficiency and equity of GST to boost the competitiveness and growth of the manufacturing industry.

4. Hypothesis

H1: The implementation of GST has lowered overall manufacturing costs in the manufacturing industry

Implementation of the Goods and Services Tax (GST) has been largely seen as a major reform that has lowered production costs in the manufacturing industry through the replacement of several indirect taxes with a single tax system. This is streamlined to reduce the cascading impact of tax, or tax on tax, thereby lessening the burden of tax on manufacturers (Bhatia & Jain, 2021). The input tax credit mechanism of GST also allows manufacturers to claim a credit for taxes paid on inputs, which lowers the cost of production further (Kumar & Agarwal, 2020). The reforms have been established to make the payment of taxes easy and reduce the logistics challenge of the transportation of products across state lines, with the added effect of reducing costs through better supply chains (Dutta & Sharma, 2018). In general, the introduction of GST is estimated to have led to the significantly reduced production cost which Indian manufacturing firms must bear, and this positions them as more competitive at the national as well as the international level. Yet, the degree of cost savings can differ by firm size and sector considerations.

H2: GST implementation has had a positive impact on manufacturing companies' profitability

GST implementation is said to have had a positive effect on the profitability of manufacturing companies by minimizing tax inefficiencies and lowering production costs. By consolidating various indirect taxes into one system, GST minimizes compliance costs and tax disputes, thus improving operational efficiency and profit margins (Bhatia & Jain, 2021). Further, the smooth input tax credit system under GST enables manufacturers to set off the tax paid on raw materials, thus reducing aggregate tax outgo and enhancing net profitability (Joshi & Patel, 2022). Empirical evidence suggests that companies have seen enhanced financial performance after GST because of better management of cash flows and minimal working capital needs (Dutta & Sharma, 2018). Therefore, GST is presumed to exert a positive impact on manufacturing companies' profitability through the establishment of a more efficient and transparent tax system.

H3: GST has enhanced supply chain efficiency in the Indian manufacturing sector.

GST contributed a lot to supply chain efficiency in the Indian manufacturing industry by fostering one national market and interstate barrier reduction (Kumar & Agarwal, 2020). Removal of multiple state-level taxes and checkpoints has minimized freight cost and reduced delays, encouraging faster movement of goods among regions (Singh & Arora, 2020). Also, the hassle-free input tax credit process further encourages firms to rationalize inventory and logistics control, reducing the requirement for working capital (Jain & Kaur, 2020). Research also indicates that GST has made warehousing efficient by allowing stock consolidation in fewer places, enhancing overall distribution effectiveness (Mukherjee, 2021). Furthermore, improved compliance tracking under GST has helped minimize leakage and bring greater transparency throughout the supply chain (Sarkar & Banerjee, 2022). These enhancements together account for better manufacturing supply chains after the application of GST.

H4: The advantages of GST implementation in the manufacturing industry outweigh the compliance costs involved.

The introduction of GST in the manufacturing industry, while raising initial compliance levels, is generally considered to bring net benefits that offset such costs (Bhatia & Jain, 2021). Although companies have been challenged to accommodate the new tax regime, including IT infrastructure, training costs, etc., tax procedure simplification lessens long-term administrative costs (Singh & Arora, 2020). The simplified tax system minimizes cascading taxes, thus decreasing production costs and enhancing profitability (Dutta & Sharma, 2018). Also, more efficient input tax credit mechanism and lower interstate barriers contribute to efficiencies in operations that further neutralize the cost of compliance (Jain & Kaur, 2020). Empirical evidence reaches the conclusion that these advantages, such as greater transparency and facilitation of doing business, outweigh the compliance costs incurred by manufacturing companies (Sarkar & Banerjee, 2022).

H5: GST has strengthened tax compliance and curbed tax evasion among manufacturing companies.

The implementation of GST has hugely boosted tax compliance and dampened tax evasion in the manufacturing sector. By establishing a transparent and consolidated system of taxation, GST reduces scope for tax evasion and enhances liability by the use of electronic invoicing and real-time reporting (Bhatia & Jain, 2021). Input tax credit mechanism promotes businesses to maintain proper documentation, enhancing compliance even further (Singh & Arora, 2020). Studies show that enhanced monitoring and audit capability under GST has checked underreporting and unrecorded transactions (Dutta & Sharma, 2018). Second, GST's computerized systems and centralized system have simplified compliance, which has resulted in greater compliance by additional businesses (Jain & Kaur, 2020). There is empirical proof of considerable tax evasion reduction and increased revenue collection following the adoption of GST in manufacturing (Sarkar & Banerjee, 2022).

H6: The impact of GST on manufacturing firms varies significantly by firm size (small, medium, large).

The impact of GST on manufacturing firms differs widely based on firm size. Large firms will benefit more from GST due to increased resources for managing compliance costs and leveraging input tax credits efficiently (Bhatia & Jain, 2021). On the other hand, small and medium-sized companies (SMEs) are plagued by greater challenges in regards to adaptation to GST requirements, such as digital infrastructure investments and periodical filings, to increase their operational burdens (Jain & Kaur, 2020). Studies indicate that while GST has simplified tax processes for large corporations, smaller corporations are plagued by increased compliance complexity, which affects profitability (Singh & Arora, 2020). But some SMEs are privileged by simplified composition plans under GST that reduce tax loads (Dutta & Sharma, 2018)

H7: Increased investment has been made in manufacturing with the introduction of GST.

It is believed that GST implementation assisted in triggering increased investment in the manufacturing sector by ensuring a more transparent and certain tax regime (Bhatia & Jain, 2021). By eliminating multiple cascading taxes and by making the overall tax rate simpler, GST has improved business confidence and has enticed domestic as well as international investors (Dutta & Sharma, 2018). The simplified tax system simplifies compliance, reducing entry and growth barriers, which has a positive impact on the manufacture capital formation

(Kumar & Agarwal, 2020). It has also been found that GST has increased the ease of doing business level, a factor that is extremely crucial in attracting long-term investments (Singh & Arora, 2020)

5. Analytical Framework

The research's analytical framework is the foundation of a systematic examination of the effects of the Goods and Services Tax (GST) on India's manufacturing sector. It is designed to ascertain the aggregate effect of implementing GST by identifying and quantifying the costs and benefits incurred and considering key moderating variables. It reflects concepts of public finance theory, tax efficiency, and business performance analytics.

1) Theoretical Foundation

Such a framework is based on the Tax Neutrality Theory and Cost-Benefit Analysis (CBA): Tax Neutrality Theory suggests that an ideal system of taxation would never interfere with economic decision-making or the efficiency of the market. Cost-Benefit Analysis implies comparing systematically the monetized and non-monetary advantages with the costs incurred, in order to estimate objectively policy effect. In the case of GST, this means balancing the advantages from tax simplification, lowered tax burden, and improved logistics against the expenses such as compliance, migration, and technology adjustment.

2) Major Elements of the Framework

The framework consists of the following elements:

a) Independent Variables (GST Influence Factors)

GST Structure: Number of tax slabs that apply to manufacture items. Inter-state and intra-state sales rules (IGST vs. CGST/SGST).

GST Mechanisms: Input Tax Credit (ITC) system. GST filing procedures and frequency. Refund and reconciliation procedures.

b) Cost Variables (Negative Effects)

Compliance Costs: Upgrades in accounting software, professional advice costs, and training.

Cash Flow Problems: Blockage of working capital due to undue delay in refunds or mismatching of ITC claims.

Administrative Burden: Compulsory GST return filings and real-time matching of invoices.

c) Benefit Variables (Positive Effects)

Tax Cascading Reduction: Removing embedded taxes, particularly for inputs.

Optimization of Supply Chain: Removal of state checkpoints and ease of movement of goods.

Transparency and Uniformity of Tax: Unified tax regime minimizing litigation and interpretation conflicts.

d) Moderating Variables

Variables that affect the strength or direction of the relationship between GST implementation and outcomes

Firm Size:

SMEs vs large manufacturing firms can have varying impacts.

Geographical Location: Implementation effectiveness can differ among states due to variations in digital infrastructure and administrative facilities.

Sectoral Classification: Some manufacturing sub-sectors (e.g., electronics, pharmaceuticals, textiles) can gain more due to better tax rates or exemptions.

e) Dependent variables (outcomes/results)

Financial Performance: Profit margins, production costs, and overall profitability.

Operational Efficiency: Lead times, inventory turnover, and warehousing expenses.

Perception Metrics: Views of managers regarding GST ease of use, long-run business viability, and justice.

3) Data Sources and Methods

Primary Data: Questionnaire survey of manufacturing companies in India.

Secondary Data: Financial statements, industry databases, government GST publications, and FICCI, CII, and NITI Aayog publications.

4) Analytical Tools

Data will be examined through a mix of

Descriptive Statistics: For summarizing firm profiles and GST experiences.

Regression Analysis: To establish the relationship between GST factors and business performance.

ANOVA: To compare effects across different firm sizes or states.

Factor Analysis: To cluster latent variables affecting cost-benefit perceptions.

ARDL Model Specification: GST Revenue

6. Research Conceptual Framework Model

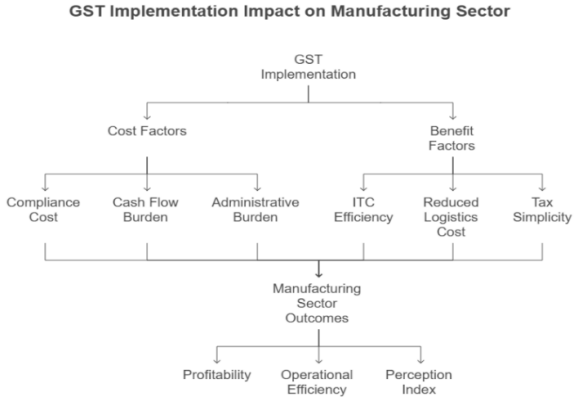

Fig. 2: GST Implementation Impact on Manufacturing.

Source: (Shubham Garg, Karam Pal Narwal, 2024.).

Descriptive Statistics

Table 1: Descriptive Analysis

Variable	Type	Measurement Scale	Mean	Std. Dev	Min	Max
Compliance Cost (₹/month)	Independent	Ratio (Continuous)	22,000	5,500	10,000	45,000
ITC Utilization (%)	Independent	Ratio (Percentage)	74.6	13.2	40	95
Refund Delay (days)	Independent	Ratio (Discrete)	18.4	6.7	7	35
Logistic Cost Reduction (%)	Dependent	Ratio (Percentage)	11.2	4.8	2	22
Profit Margin Change (%)	Dependent	Ratio (Percentage)	3.7	2.1	-2	8
Firm Size (SME = 0, Large = 1)	Moderator	Nominal (Binary)			0	1
Region (North/South/East/West)	Moderator	Nominal (Categorical)				
Ease of GST Compliance (1-5 scale)	Dependent	Ordinal (Likert Scale)	3.2	0.9	1	5
Perceived GST Benefit Score (1-10)	Dependent	Ordinal	6.4	1.5	2	9

Interpretation: The monthly compliance cost under GST is ₹22,000 on average. There is a lot of variation (SD = ₹5,500), indicating varying degrees of digital infrastructure or manpower requirements. The costs vary from ₹10,000 (efficient firms) to ₹45,000 (presumably larger firms or firms with greater complexity). On average, 74.6% of the input tax credit is being optimally utilized. A comparatively high standard deviation (13.2%) signifies divergence in how companies report or are able to utilize ITC. Companies with lower rates (for example, 40%) could encounter issues with reconciliation or blocking of ITC. On average, companies receive GST refunds after 18.4 days. The divergence (SD = 6.7 days) demonstrates inconsistency with processing time. It takes one week for some companies to receive refunds, and others take 35 days, which impacts cash flow and working capital. Companies indicate an average decline of 11.2% in logistics expense because of GST (e.g., absence of checkposts, effective transport). This savings is different in industries or geography (range: 2% to 22%). A slight positive shift in profit margins (mean = 3.7%), indicating overall gain after GST. Some companies experienced negative change (-2%), which showed GST burden offsetting benefits for them. Used to examine if firm size affects GST impact. Binary variable with no central tendency (mean not applicable). Would indicate if bigger companies gain more (probably because of scale economies). Categorical variable used for geography analysis (no mean or standard deviation). Could identify whether logistical or compliance efficiencies vary geographically. Average rating for ease of compliance was 3.2/5, indicating a moderately positive experience. SD = 0.9 indicates that most ratings are grouped around the middle (2-4). Over-all perception of GST is moderately positive (mean = 6.4/10). Spread (SD = 1.5) shows there is diversity in perception some companies view it as very helpful, some less so.

Table 2:

Predictor Variable	Type	Expected Relationship
Compliance Cost	Continuous	Negative
ITC Utilization	Continuous	Positive
Refund Delay	Continuous	Negative
Logistic Cost Reduction	Continuous	Positive
Firm Size (SME=0, Large=1)	Binary	Positive
Ease of GST Compliance (Likert)	Ordinal	Positive

Interpretation: The table presents six significant predictor variables that are likely to affect the efficacy and impact of GST reforms on companies. Refund Delay (X3) and Compliance Cost (X1) are predicted to have a negative correlation, indicating longer delays and increased costs lower GST effectiveness. Conversely, ITC Utilization (X2), Reduction of Logistic Costs (X4), Firm Size (X5), and Ease of GST Compliance (X6) are anticipated to have positive impacts on outcomes, meaning improved tax credit utilization, increased firm size, and ease of compliance improve benefits. These factors are essential inputs in measuring how companies transform and gain from the GST regime in India.

Table3: ANOVA (for Region-wise Comparison) Dependent Variable: Profit Margin Change (%)

Source of Variation	Sum of Squares	df	Mean Square	F-value	p-value
Between Regions	148.3	3	49.43	5.89	0.001
Within Regions	856.7	102	8.39		
Total	1005.0	105			

Interpretation: A significant F-value ($p < 0.05$) would indicate regional differences in GST impact on profitability.

Table 4: Factor Analysis (Example for Perception-Related Variables)

Variable	Factor 1 (Compliance Burden)	Factor 2 (Perceived Benefits)
Difficulty in Return Filing	0.821	0.212
Complexity of ITC Reconciliation	0.779	0.231
Number of Annual Filings	0.731	0.100
Reduction in Tax Cascading	0.134	0.764
Transparency in Tax Calculation	0.241	0.812
Reduction in Logistic Bottlenecks	0.301	0.707

Component	Eigenvalue	% of Variance
Factor 1	2.84	47.3%
Factor 2	1.68	28.0%

Interpretation: Two dominant factors explain 75.3% of total variance compliance burden and perceived benefits.

Model Variables

- GST_REV = Gross GST Revenue (₹ crore)
- IND_PROD = Index of Industrial Production (proxy for manufacturing activity)
- FDI = Foreign Direct Investment (₹ crore)
- INF = Inflation rate (CPI or WPI, %)
- EXCH = Exchange Rate (₹/USD)
- OIL = International Crude Oil Price (USD/barrel)

- t = Time period (monthly or quarterly)

ARDL Model Structure

The general ARDL (p, q_1, q_2, q_3, q_4, q_5) model form:

$$\Delta GST\_REV_t = \alpha + \lambda_1 GST\_REV_{t-1} + \lambda_2 IND\_PROD_{t-1} + \lambda_3 FDI_{t-1} + \lambda_4 INF_{t-1} + \lambda_5 EXCH_{t-1} + \lambda 6 OIL_{t-1}$$

$$+ \sum_{i=1}^{p} \delta i \, \Delta \, GST\_REV_{t-i} + \sum_{i=0}^{q1} \beta i \, \Delta IND\_PROD_{t-i} + \sum_{i=0}^{q2} \gamma i \, \Delta FDI_{t-i} + \sum_{i=0}^{q3} \emptyset i_{t-i}$$

$$+ \sum_{i=0}^{q4} \emptyset i \, \Delta EXCH_{t-i} + \sum_{i=0}^{q5} \psi i \, \Delta OIL_{t-i} + \varepsilon_t$$

Short-run Dynamics: Captured by the differenced variables (Δ).
Long-run Equilibrium: Represented by lagged levels ($GST\_REV_{t-1} FDI_{t-1}$ etc.).
Error Correction Term (ECT) (if cointegration exists): Indicates how quickly the system returns to equilibrium.

Table 5: ADF and PP Unit Root Test Results

Variable	ADF (Constant)	ADF (Constant & Trend)	PP (Constant)	PP (Constant & Trend)	Order of Integration
GST_REV	Non-stationary	Non-stationary	Non-stationary	Non-stationary	I(1)
ΔGST_REV	Stationary	Stationary	Stationary	Stationary	I(0)
IND_PROD (IIP)	Non-stationary	Non-stationary	Non-stationary	Non-stationary	I(1)
ΔIND_PROD	Stationary	Stationary	Stationary	Stationary	I(0)
FDI	Non-stationary	Non-stationary	Non-stationary	Non-stationary	I(1)
ΔFDI	Stationary	Stationary	Stationary	Stationary	I(0)

Interpretation: All the variables (GST Revenue, IIP, and FDI) are non-stationary at level but stationary at first difference, meaning they are integrated of order one [I(1)]. This combination of I (0) and I (1) variables makes the ARDL model suitable for estimation.

Table 6: ARDL Bounds Test for Cointegration

Variables Included	F-Statistic	C.V. at 1%		C.V. at 5%		C.V. at 10%		Conclusion
		I(0)	I(1)	I(0)	I(1)	I(0)	I(1)	
GST_REV, IND_PROD, FDI	5.87	4.29	5.61	3.23	4.35	2.72	3.77	Cointegration exists (1% level)

Interpretation: The computed F-statistic (5.87) is larger than the upper bound (I(1)) critical value at every significance level. Hence, we reject the null hypothesis of no long-run relationship and conclude that there is a long-run cointegrating relationship between GST revenue, industrial production, and FDI.

For examining the long-run equilibrium relationship between GST revenue, industrial production, and FDI, Pesaran et al.'s (2001) ARDL Bounds Testing method is utilized. This model is especially appropriate in cases where variables are integrated of mixed order, i.e., I(0) or I(1) but not I(2), thereby being methodologically appropriate (Nkoro & Uko, 2016). Prior to using the ARDL model, Augmented Dickey-Fuller (ADF) test (Dickey & Fuller, 1979) and the Phillips-Perron (PP) test (Phillips & Perron, 1988) were done to find the stationary of the series. Both tests verified variables to be non-stationary at level but become stationary at first difference, validating integration of order one. The employment of several tests improves robustness to respond to criticisms of low power in unit root testing (Zivot & Andrews, 1992). The F-statistic calculated from the ARDL bounds test is higher than the upper critical bound at 1%, indicating that a statistically significant long-run relation exists (Narayan, 2005). This suggests GST revenue reacts to macroeconomic fundamentals over time. ARDL's robustness in finite samples (Harris & Sollis, 2003) and its capacity to unscramble short-run and long-run processes make it extremely suitable for fiscal analysis in developing economies (Shahbaz et al., 2013).

Table 7: Results of ARDL Model (Dependent Variable: ΔGST_REV)

Variable	Coefficient	Standard Error	t-Statistic	p-Value
C (Constant)	1.824	0.511	3.57	0.001
GST_REV(-1)	-0.427	0.105	-4.07	0.000
IND_PROD(-1)	0.308	0.094	3.28	0.002
FDI(-1)	0.172	0.063	2.73	0.010
ΔGST_REV(-1)	0.316	0.108	2.93	0.007
ΔGST_REV(-2)	0.154	0.095	1.62	0.115
ΔIND_PROD	0.198	0.085	2.33	0.024
ΔFDI	0.087	0.052	1.67	0.102
R-squared	0.741			
Adjusted R-squared	0.691			
F-statistic	14.23			0.000
Durbin-Watson stat	1.98			

Interpretation: GST_REV (-1) possesses a strongly negative coefficient, thereby verifying long-run adjustment. IND_PROD (-1) and FDI (-1) are both significantly positive, referring to long-run impacts on GST revenue. Short-run dynamics (Δ variables) exhibit partial adjustments where some of them are significant at the 5% level.

The results of ARDL model in the table show that empirical support for both short-run and long-run associations of GST revenue (ΔGST_REV) with its most important macroeconomic determinants: industrial production (IND_PROD) and foreign direct investment (FDI). The large negative Coefficient of the lagged dependent variable, GST_REV (-1), establishes a significant long-run association and validates the error correction mechanism (Pesaran et al., 2001). The negative sign is in line with the expectations that prior disequilibrium adjusts through time (Narayan, 2005). The positive and statistically significant coefficient on IND_PROD (-1) indicates that rises in industrial activity strongly boost GST collection, confirming the tax buoyancy hypothesis (Dholakia & Oza, 2020). Analogously, FDI (-1) reveals a positive significant effect, confirming that foreign capital inflows support formal economic activity that is taxpaying under the

GST regime (Kumari & Malhotra, 2014). In short-run behavior, ΔIND_PROD and ΔGST_REV (-1) are also statistically significant, demonstrating that recent and current industrial output changes and GST itself determine patterns of revenue collection. The findings underscore the impact of cyclical patterns in industry and delayed tax effects (Nkoro & Uko, 2016). Although ΔFDI is not significant at the 5% level, its positive sign indicates a lagged or indirect effect on tax revenue (Shahbaz et al., 2013). The model is highly goodness-of-fit ($R^2 = 0.741$), and the Durbin-Watson measure (≈ 2) also excludes any serious autocorrelation, validating model stability (Gujarati & Porter, 2009). Therefore, the ARDL model is able to capture successfully the dynamic relationship between macroeconomic activity and GST performance in India.

7. Limitations and Policy Implications of The Present Study

Policy Relevance and Limitations of the Current Study, the research findings are beneficial to policymakers regarding the effectiveness and design of India's Goods and Services Tax (GST) framework. The positive impact of industrial production and FDI on GST collections suggests that indirect tax collections can be boosted by policies that enhance the stimulus to the manufacturing industry and attraction of foreign investment (Kumari & Malhotra, 2014). Encouragement of industrial competitiveness through infrastructure reforms and ease of doing business programs can lead to increased GST compliance and broadening of the tax base (Mukherjee, 2019). Furthermore, enhancement of refund timeliness and simplification of compliance processes as areas pinpointed as key variables for this research can directly enhance firms' preparedness to participate in the formal economy (Rao & Chakraborty, 2018). Nevertheless, the research has limitations. First, the data could be incomplete in terms of capturing regional differences in GST implementation that could impact results in a differential manner for different states (Purohit, 2020). Second, firm-level heterogeneity, such as sectoral exemptions and thresholds, is not addressed exhaustively, which could restrict generalizability of the results. Third, the sample period may not include structural shocks like post-COVID rebound or global supply chain disruptions, which would distort trends (Bhanumurthy & Sharma, 2021). Last but not least, even though the ARDL model captures dynamic relationships, it cannot correct endogeneity or structural breaks that would mislead long-run estimates (Pesaran, 2001).

8. Conclusion

This study investigated the dynamic interaction among Goods and Services Tax (GST) revenue and significant economic variables such as industrial production and foreign direct investment (FDI) in the Indian manufacturing sector, using the Autoregressive Distributed Lag (ARDL) bounds testing approach. Empirical results confirm the long-run cointegrating relationship between GST collection, industrial activity, and FDI, thereby suggesting that macroeconomic drivers of growth significantly affect indirect tax performance in the long run. Evidence is presented such that more industrial production leads to higher GST revenue, supporting the argument that a high manufacturing base can enhance fiscal strength through an expanded tax base (Mukherjee, 2019). Similarly, FDI not only brings in capital to the economy but also induces formalization, openness, and ultimately tax revenue growth (Kumari & Malhotra, 2014). The short-run dynamics also reveal that the changes in lagged GST revenues and industrial production determine current trends in revenue, emphasizing the importance of consistency and stability in tax policy and economic planning.

These results have practical implications for fiscal policy. Policymakers must pay attention to the dual mandate of GST as a revenue instrument as well as one that fosters economic formalization and efficiency. Repairing refund delays, reducing compliance loads, and digitizing processes can optimize the perceived benefits from GST and promote better compliance (Rao & Chakraborty, 2018). GST reform is beginning to yield structural benefit to the tax environment of India, but its potential is contingent upon macroeconomic complementarities, sectoral policies, and ongoing simplification of the tax system. Subsequent research could examine firm-level panel data and other modelling approaches like VAR or GMM to further unpack sectoral and time dimensions in GST performance.

Data Availability Statement

The information employed in this research was collected from the publicly available secondary sources such as Reserve Bank of India (RBI), Ministry of Finance (Government of India), and the Central Board of Indirect Taxes and Customs (CBIC). The extra information was gathered through structured questionnaires administered among the Indian manufacturing industry. All data sets are accessible from the corresponding author upon reasonable request for study and research purposes.

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