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Machine Learning-Driven Impact of Recent Amendments in GST Law on Businesses and Professions Using RANDOM Forest Regression and Support Vector Regression (SVR) Models

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Abstract: India's Goods and Services Tax (GST) regime has undergone significant transformations between July 2024 and January 2025, introducing critical amendments aimed at enhancing tax administration, improving compliance mechanisms, and strengthening digital security infrastructure. This comprehensive study analyzes the multifaceted impact of these recent GST amendments on businesses and professions across various sectors, utilizing empirical data from 30 business entities and advanced machine learning algorithms for predictive analysis. The research employed Random Forest Regression and Support Vector Regression models to evaluate key compliance parameters including pre- and post-amendment compliance costs, monthly filing times, and regulatory scrutiny levels. Results indicate that post-amendment GST compliance costs increased from an average of ₹40.27 thousand to ₹44.43 thousand, representing a 10.3% rise in financial burden. Simultaneously, average monthly filing time increased to 10.22 hours, with businesses receiving approximately 3.13 notices from GST departments over six months. Key amendments analyzed include the mandatory implementation of Multi-Factor Authentication (MFA) for GSTN portal access, enhanced input tax credit (ITC) regulations, sector-specific clarifications for real estate and e-commerce, and streamlined return filing procedures. The Finance Bill 2025 introduced provisions for penalty rationalization and clearer definitions of "supplier" and "recipient" relationships, addressing complex business arrangements and intercompany transactions. The study reveals strong negative correlations (-0.97 to -0.99) between compliance burden indicators and business impact scores, suggesting that increased administrative complexity significantly affects business perception of GST reforms. Random Forest Regression demonstrated superior predictive accuracy ($R^2 = 0.958$ on test data) compared to Support Vector Regression ($R^2 = 0.938$), effectively modeling the relationship between compliance parameters and business impact. Despite increased compliance costs and administrative requirements, the amendments aim to create a more transparent, digitally integrated tax ecosystem. The integration of real-time data sharing between GSTN, income tax, and customs departments represents a paradigmatic shift toward proactive enforcement and reduced litigation. However, smaller businesses and MSMEs face disproportionate challenges adapting to enhanced technological requirements and complex compliance protocols. The research concludes that while GST amendments advance India's indirect tax framework toward global best practices, careful consideration of implementation challenges and differential impacts across business sizes remains crucial for achieving the intended objectives of simplified taxation and enhanced business efficiency.

Keywords: Compliance Cost, Multi-Factor Authentication (MFA), Administrative Burden, Impact Score Businesses.

1. INTRODUCTION

India's Goods and Services Tax (GST) regime, since its inception in 2017, has continued to evolve through continuous amendments aimed at improving tax administration, enhancing compliance, and simplifying procedures for businesses. The period from July 2024 to January 2025 has seen a series of significant updates to GST laws and compliance protocols, reflecting the government's ongoing commitment to a more robust and technologically

integrated tax ecosystem. These changes, introduced through regular GST Council meetings, judicial interpretations, the Finance Bill 2025, and announcements in the Union Budget 2025-26, are designed to strengthen compliance, plug revenue leakages, and encourage voluntary tax adherence while ensuring ease of doing business across sectors. [1] One of the most noteworthy developments during this period includes the introduction and mandating of Multi-Factor Authentication (MFA) for GST login access, as highlighted by India Briefing (2025). This move marks a major step toward enhancing digital security and reducing the risk of fraudulent claims and identity misuse on the GSTN portal. With cyber threats on the rise, the Central Board of Indirect Taxes and Customs (CBIC) has emphasized the need for secure taxpayer authentication mechanisms to maintain the integrity of GST filings and transactions.[2] From a legislative perspective, the Finance Bill 2025 introduced by the Union Government encapsulates several critical amendments under the GST law. As covered by RSM India (2025) and Tax Management India (2025), the bill includes provisions to rationalize penalties, clarify the scope of exemptions, amend input tax credit (ITC) rules, and enhance powers of tax authorities to curb tax evasion. One key amendment involves a more detailed definition of “supplier” and “recipient” to cover complex business arrangements like cross-charging, back-end services, and intercompany transactions — reducing scope for ambiguity in tax liability and compliance.[3] S.S. Burad & Associates (2025) noted that Budget 2025-26 introduced sector-specific GST clarifications, particularly for the real estate, e-commerce, and manufacturing sectors. In real estate, for instance, there has been a renewed push for uniformity in the taxation of under-construction properties and affordable housing units, thereby attempting to eliminate confusion around applicable rates. Meanwhile, for the e-commerce sector, greater clarity has been provided regarding liability under Tax Collected at Source (TCS) and taxability of digital services by foreign companies operating in India.[4] In terms of procedural changes, RMPS Advisory Services (2025) reported the rollout of new return filing guidelines that streamline the monthly and quarterly GST Return process. These updates include enhanced validations in GSTR-1 and auto-population of data in GSTR-3B, minimizing reconciliation issues for taxpayers. Additionally, late fee rationalization for small taxpayers has been extended further, benefiting micro, small, and medium enterprises (MSMEs) that have historically struggled with complex compliance timelines and punitive costs for delayed returns.[5] The latest amendments have also focused on improving transparency through real-time data sharing between the GSTN, income tax department, and customs. As per Vakil Search (2025), the government is leveraging technology to develop a more integrated digital tax infrastructure that flags mismatches in real time. Such interventions, alongside automation of notices and scrutiny processes, are part of a broader trend toward digitization and proactive enforcement.[6] ClearTax (2025) highlights that several circulars and notifications have been issued during this period to clarify the applicability of GST in grey areas such as treatment of secondment services, warranty claims, and post-sale discounts. These clarifications are critical in preventing disputes and ensuring consistent interpretation of the law by taxpayers and tax officers alike.[7] From a global perspective, India continues to benchmark its GST regime against international best practices. EY Global’s 2025 VAT and GST guide places India’s GST structure among the most expansive and technologically advanced indirect tax systems in the world, but also notes challenges around rate multiplicity and administrative bottlenecks. In alignment with global trends, India is working toward simplification of compliance for cross-border transactions and the introduction of a single return system for ease of doing business.[8] The case law landscape has also influenced key GST positions in this period. TaxGuru’s April 2024 GST Case Law Compendium reflects a shift in judicial scrutiny toward substance-over-form interpretations in GST disputes. Courts have increasingly emphasized the need for clear documentation, proper contractual arrangements, and honest disclosure, setting strong precedents that influence administrative behavior and taxpayer conduct.[9] KPMG India (2025) and EY India (2025), in their budget analyses, underscore that GST reforms are closely linked to India’s broader economic growth objectives. The Union Budget 2025-26 emphasized the role of GST in formalizing the economy, broadening the tax base, and enabling better revenue forecasting. The continued move toward automation and real-time compliance is not just a technical upgrade but a policy imperative aimed at reducing tax litigation, enhancing business confidence, and making India more competitive globally.[10] These recent updates are not merely procedural but represent a paradigm shift in how tax governance is being conceptualized in India. They require businesses to reassess their tax positions, upgrade their compliance infrastructure, and retrain personnel to handle more sophisticated digital tools. As GST continues to mature, proactive adaptation to these changes will be crucial for both large enterprises and small businesses alike. The period from July 2024 to January 2025 has proven pivotal for GST reform in India. The convergence of technological enhancements, legislative clarity, and compliance rigor reflects the maturing of India’s indirect tax ecosystem. Stakeholders — from taxpayers and professionals to policymakers — must stay abreast of these changes, not only to remain compliant but also to leverage the evolving GST structure for better tax planning and business efficiency. As India continues to align its GST framework with global benchmarks, the road ahead promises more transparency, less litigation, and a fairer taxation environment. [11] Recent Indian tax reforms, focusing on Income Tax and GST changes through the Finance Act 2023. These amendments aim to simplify tax structures and improve business compliance. The Income Tax reforms

seek to make the system more straightforward to encourage better adherence, while GST changes target existing loopholes and enhance administrative efficiency. The research analyzes how these modifications will impact business operations and India's commerce sector, concluding that the streamlined tax system should create a better environment for business growth and economic development. [12]



FIGURE 1. Predicting GST Outcomes

India's implementation of GST on July 1, 2017, fundamentally transformed the nation's tax system. This analysis examines GST's business impact through literature and studies through 2024. GST aimed to streamline taxation, eliminate tax cascading, and reduce compliance burdens. The reform significantly affected various sectors, especially SMEs struggling with new compliance and technology requirements. While GST formalized the economy and simplified tax processes, it created adaptation challenges for smaller businesses. The review suggests policymakers should refine GST to improve efficiency and ensure benefits reach all business sizes. GST represents a crucial shift in India's economic framework, delivering both achievements and ongoing challenges requiring continuous refinement. [13] India's tax system has undergone major changes through GST implementation and the proposed Direct Tax Code. GST, launched in 2017, consolidated various indirect taxes into one system, eliminating tax-on-tax effects and simplifying business compliance. Companies now benefit from Input Tax Credit mechanisms that reduce overall tax burdens and have restructured their supply chains for better tax efficiency and logistics. The upcoming Direct Tax Code will overhaul income tax structures and bring India's tax policies in line with international standards, particularly affecting multinational companies. These reforms collectively aim to boost tax compliance, streamline business operations, and support economic growth while making India's tax framework more competitive globally. The transformation has enabled businesses to operate more efficiently while increasing government tax revenues through improved compliance rates. [14] India's Goods and Services Tax (GST) represents a major tax reform that received presidential approval in September 2016 after 16 years of deliberation since 2000. Originally recommended by the Kelkar Task Force in 2003, GST creates a unified indirect tax system by replacing multiple central and state taxes. Scheduled to launch in April 2017, this reform aims to boost economic growth, improve resource distribution, and simplify tax processes across agriculture, manufacturing, trade, and consumer sectors. Success depends on overcoming key challenges including building adequate IT infrastructure, ensuring effective administration, and setting optimal tax rates and exemptions. [15] India's GST implementation in July 2017 transformed the country's indirect taxation by consolidating multiple central and state taxes into one unified system. This reform aimed to simplify business compliance and create a unified national market. The study examines GST's varied effects on Indian businesses, from large corporations to MSMEs, focusing on supply chain optimization, pricing adjustments, working

capital management, and implementation challenges. It analyzes sector-specific impacts across manufacturing, services, e-commerce, and real estate industries, while exploring how technology has facilitated compliance and digital transformation. Using empirical analysis and case studies, the research evaluates whether GST achieved its objectives, identifying both achievements and persistent challenges in the current framework. [16] The study examines GST amendments proposed in India's Union Budget 2021, focusing on how these changes might streamline tax processes for individuals and businesses. The research analyzes the finance bill's modifications and their effects on taxpayers and tax officials, aiming to demonstrate their role in promoting economic growth. By evaluating these amendments, the study seeks to show how they could improve GST system efficiency and create a more simplified tax framework that benefits both taxpayers and government administration. [17] India's GST reform consolidates multiple central and state taxes into one unified system, eliminating the cascading tax effect through better tax credit mechanisms. This simplification should lower the overall tax burden, making Indian goods and services more competitive domestically and globally. However, GST implementation goes beyond just changing tax rates—it requires comprehensive government management of the transition. Officials must handle the integration of various taxes including income, corporate, excise, customs, and sales taxes. Success depends on extensive training programs for government staff and business stakeholders, especially small and medium enterprises. The Finance Ministry has committed resources to support this training, recognizing that effective change management is crucial for this major reform. [18] This study examined how Australia's GST implementation affected small businesses, comparing outcomes with New Zealand's experience. Using six small business case studies from the GST introduction period, researchers found compliance costs varied widely, with some businesses spending over 3% of annual turnover on GST-related expenses. The ongoing administrative burden included extensive record-keeping and accounting requirements. The research recommends that governments better consider small business impacts when implementing tax reforms. While the GST created operational challenges, some businesses gained unexpected benefits like enhanced bookkeeping systems and improved management processes. The study concluded that businesses with proactive GST preparation faced fewer implementation difficulties than those caught unprepared. [19] India's Goods and Service Tax (GST) affects the performance of Micro, Small, and Medium Enterprises (MSMEs). Using survey data from 404 registered MSMEs, the research found that GST generally improved business performance through enhanced operational efficiency, easier business processes, and better profitability. The positive outcomes stem from systemic tax changes, technological upgrades, and improved tax literacy among business owners. However, GST also increased compliance requirements, creating additional administrative burdens that can harm business performance. The study reveals that an MSME's size, revenue, and organizational structure influence how GST compliance affects their operations. These findings aim to guide policymakers in developing tax reforms that strengthen MSME performance and support economic growth in developing economies. [20] India's GST reform replaced multiple indirect taxes with a unified system following the 2014 Constitutional Amendment. This comprehensive tax structure aims to eliminate exemptions and create a single national market. Experts expect GST to reduce tax cascading effects and improve system efficiency by simplifying compliance, payment processes, and reporting. While the reform promises significant economic benefits and growth potential, it also presents implementation challenges that need to be addressed for successful adoption. [21]

2. MATERIAL AND METHODS

Input Parameters:

1. Pre-Amendment GST Compliance Cost (in INR thousands)
2. Post-Amendment GST Compliance Cost (in INR thousands)
3. Average Monthly GST Filing Time (in hours)
4. Number of Notices/Queries Received from GST Department (in last 6 months)

Evaluation Parameter

Impact Score on Business (1–10): 1 = Very Negative, 10 = Very Positive

1. Pre- and Post-Amendment GST Compliance Cost:

Compliance cost is a significant indicator of how regulatory changes affect businesses financially. These costs encompass expenditures on accounting services, legal consultations, software subscriptions, personnel training, and infrastructure needed to meet GST obligations. A reduction in the post-amendment compliance cost typically indicates

that the regulatory amendments have simplified the processes, automated certain tasks, or eliminated redundant procedures—thus reducing the financial burden on the business. On the other hand, if compliance costs increase after the amendment, it suggests that the changes have added complexity, required new systems, or mandated additional documentation, potentially hurting smaller businesses more significantly. The difference between pre- and post-amendment costs provides a measurable way to assess financial impact.

2. Average Monthly GST Filing Time:

The time taken to file GST returns reflects the administrative effort and internal resource allocation required to comply with tax regulations. If the average monthly GST filing time decreases after the amendment, it generally indicates a move toward a more efficient and streamlined process. This could be due to simplified return formats, fewer required reconciliations, or better digital infrastructure. Conversely, an increase in filing time suggests that the amendments may have introduced new complexities or increased the frequency and detail of filings. Longer filing times could mean reduced productivity, as staff spend more time on compliance-related tasks rather than on core business operations.

3. Number of Notices/Queries from GST Department:

This parameter captures the level of scrutiny and regulatory engagement a business faces. A high number of notices or queries indicates greater uncertainty and possibly ambiguous tax rules or stricter enforcement. It often results in legal costs, operational delays, and reputational risks. If GST amendments lead to a decrease in the frequency of these communications, it reflects improved clarity in tax laws and better alignment between business practices and regulatory expectations. On the other hand, a spike in notices may be symptomatic of confusion due to abrupt changes in GST rules or system errors, which can severely disrupt business continuity.

Evaluating the Impact Score (1–10):

The impact score synthesizes the above inputs into a single qualitative measure of the amendment's effect on business. A higher score (8–10) would indicate reduced compliance costs, shorter filing times, and fewer regulatory notices, which collectively point to a business-friendly environment. A mid-range score (4–7) may suggest a neutral to moderately positive or negative impact, where benefits in one area (e.g., reduced costs) are offset by drawbacks in another (e.g., increased notices). A lower score (1–3) reflects an overall negative experience with the amendment, where increased costs, prolonged administrative tasks, and more intense scrutiny impose significant burdens on the business.

Machine Learning Algorithms:

Random Forest Regression is an ensemble learning method based on decision trees. It operates by constructing a multitude of decision trees during training and outputting the average of their predictions to improve accuracy and control overfitting. The method works by taking a random subset of the data and a random subset of features for each tree, promoting diversity among trees. This randomness makes the forest robust to noise and less prone to overfitting compared to a single decision tree. Random Forests are known for their high accuracy, ability to handle large datasets with higher dimensionality, and robustness to outliers and missing values. However, they can be computationally intensive and less interpretable due to their complex structure.

Support Vector Regression (SVR), on the other hand, is a type of Support Vector Machine (SVM) adapted for regression problems. Instead of trying to classify data points, SVR attempts to fit the best line (or hyperplane in higher dimensions) within a certain margin of tolerance (epsilon). The key idea is to find a function that has at most epsilon deviation from the actual targets for all training data while being as flat as possible. SVR uses kernel functions to transform input data into higher-dimensional space, allowing it to model non-linear relationships. Common kernels include linear, polynomial, and radial basis function (RBF). SVR is particularly effective in high-dimensional spaces and for problems where the number of dimensions exceeds the number of samples. It also handles non-linearity well with the appropriate kernel. However, SVR can be sensitive to the choice of parameters and the scale of the data and may struggle with very large datasets due to its computational complexity.

3. RESULT AND DISCUSSION

TABLE 1. GST law on businesses and professions

Pre-Amendment GST Compliance Cost (in INR thousands)	Post-Amendment GST Compliance Cost (in INR thousands)	Average Monthly GST Filing Time (in hours)	Number of Notices/Queries Received from GST Department (in last 6 months)	Impact Score on Business
45	55	12	4	4.5
30	28	8	2	7.5
60	75	15	6	3
25	20	6	1	8
50	60	10	3	5
40	48	11	4	5.5
35	32	9	2	7
55	65	14	5	4
20	18	5	1	8.5
42	50	12.5	3	6
33	29	7.5	2	7.2
58	72	16	6	3.2
27	23	6.5	1	8.1
48	55	11	4	5.3
37	35	9.5	3	6.8
53	67	13.5	5	4.1
22	19	5.5	1	8.4
44	52	11.5	4	5.7
31	30	8	2	7
57	70	15.5	5	3.5
26	21	6	1	8.3
49	58	12	4	5.4
36	33	9	2	6.9
54	68	14	6	3.8
23	20	5	1	8.6
43	50	11	3	6.1
32	28	7.5	2	7.3
59	74	16.5	6	3.1
28	24	6.5	1	8
46	54	12	4	5.6

The table presents data on the impact of GST law amendments on businesses and professions. Post-amendment, GST compliance costs have generally increased, with a rise in average monthly filing time and the number of notices received. Despite higher costs and administrative burden, businesses report varied impact scores—ranging from low (around 3) to high (above 8). Higher impact scores tend to correlate with lower compliance costs and fewer notices, suggesting that simplified processes benefit smaller or more organized businesses. Conversely, increased filing time and departmental queries seem to negatively affect perceived impact, especially for those facing higher compliance costs.

TABLE 2. Descriptive Statistics

	Pre-Amendment GST Compliance Cost (in INR thousands)	Post-Amendment GST Compliance Cost (in INR thousands)	Average Monthly GST Filing Time (in hours)	Number of Notices/Queries Received from GST Department (in last 6 months)	Impact Score on Business
count	30.000000	30.000000	30.000000	30.000000	30.000000
mean	40.266667	44.433333	10.216667	3.133333	6.046667
std	12.300640	19.395491	3.470773	1.736690	1.798416
min	20.000000	18.000000	5.000000	1.000000	3.000000
25%	30.250000	28.000000	7.500000	2.000000	4.625000
50%	41.000000	49.000000	10.500000	3.000000	6.050000
75%	49.750000	59.500000	12.375000	4.000000	7.450000
max	60.000000	75.000000	16.500000	6.000000	8.600000

The descriptive statistics reveal key trends in GST compliance post-amendment. On average, compliance costs rose from ₹40.27k to ₹44.43k, indicating an increased financial burden. The average monthly GST filing time also increased to 10.22 hours, with businesses receiving about 3.13 notices over six months. While the average impact score is 6.05, scores vary widely (3.0 to 8.6), reflecting diverse business experiences. The rise in standard deviations for cost and time suggests greater variability post-amendment. Median values closely align with the mean, indicating a relatively symmetrical distribution. Overall, the amendments led to moderate increases in costs and administrative workload.

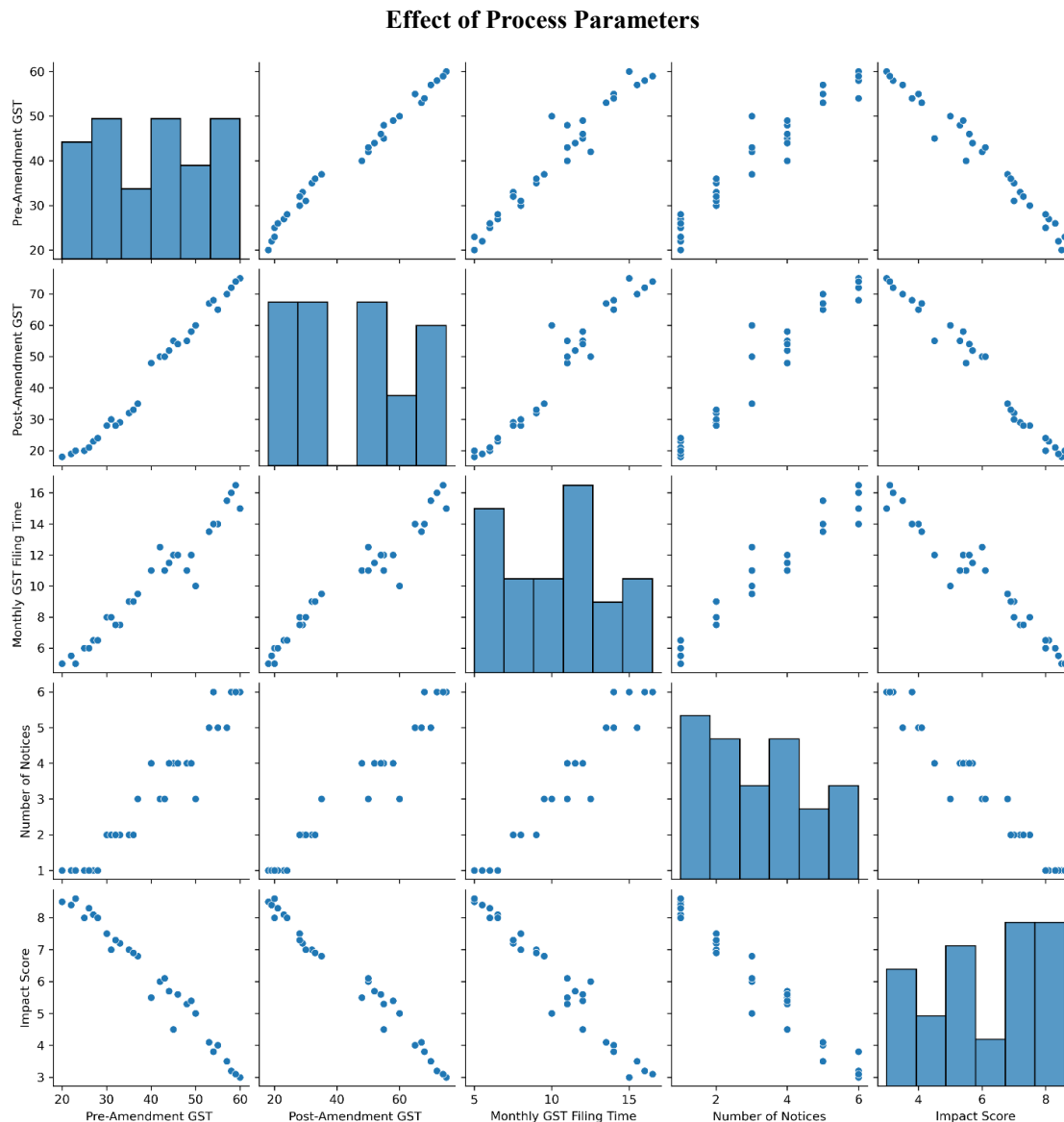


FIGURE 2. Scatter plot of the various GST law on businesses and professions process parameters

Figure 2 displays a scatter plot matrix showing relationships among GST compliance variables. Strong positive linear correlations are visible between pre- and post-amendment GST costs, and between GST costs and monthly filing time. A clear positive trend also exists between filing time and the number of notices. Conversely, the impact score shows strong negative correlations with all other variables—especially post-amendment cost, filing time, and number of notices—implying that higher compliance burdens lead to lower positive impact perceptions. The diagonal histograms

reveal roughly uniform or slightly skewed distributions. Overall, businesses experiencing higher costs and administrative load tend to perceive the GST law changes less favorably.

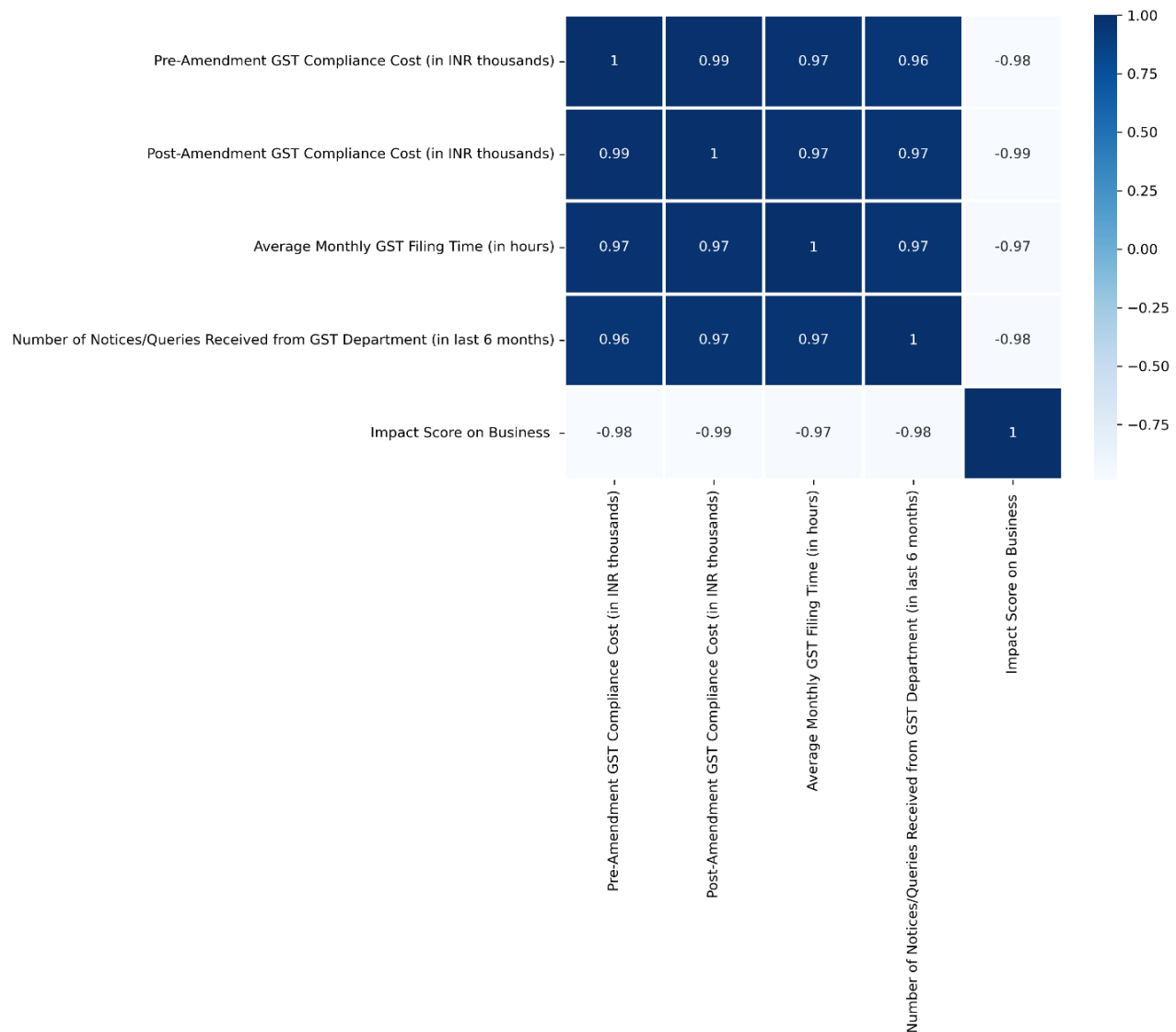


FIGURE 3. Correlation heatmap between the process parameters and the responses

The correlation heatmap shows strong positive correlations among most process parameters—compliance costs (both pre- and post-amendment), filing time, and number of GST notices—indicating they tend to increase together. Notably, these parameters are all strongly *negatively* correlated with the "Impact Score on Business" (ranging from -0.97 to -0.99). This suggests that higher compliance costs, more time spent on filing, and more notices received are associated with a greater negative impact on businesses. Among all variables, post-amendment compliance cost shows the highest negative correlation with business impact (-0.99), implying policy changes may have exacerbated business challenges.

Random Forest Regression:

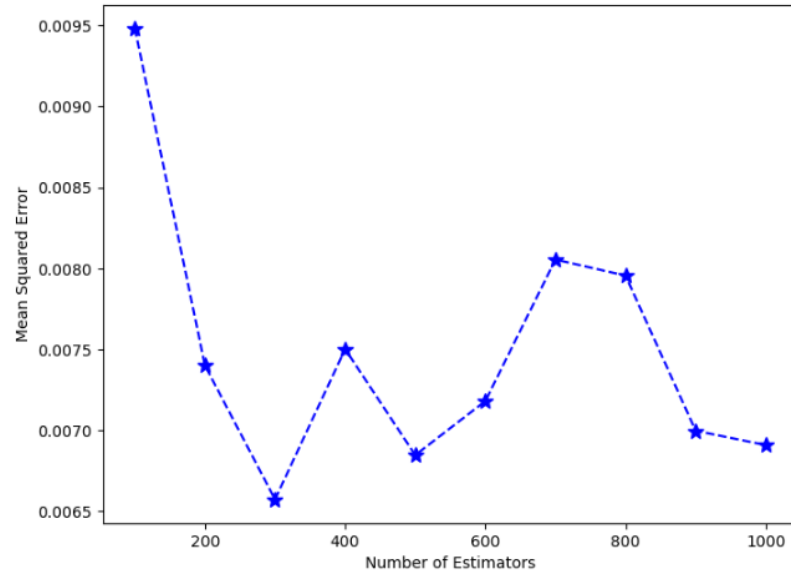


FIGURE 4. Effect of number of repressors in random forest regression on Number of Estimators vs Mean Squared Error

Figure 4 illustrates how the number of estimators in a Random Forest Regressor affects model performance, measured by Mean Squared Error (MSE). As the number of estimators increases from 100 to around 300, the MSE drops sharply, indicating improved model accuracy. The lowest MSE is observed at approximately 300 estimators. However, further increases beyond this point show a fluctuating trend, with occasional rises in MSE, suggesting overfitting or instability in generalization. The error stabilizes and slightly reduces again near 1000 estimators. This implies that while increasing estimators initially benefits performance, excessive growth does not guarantee consistent improvement.

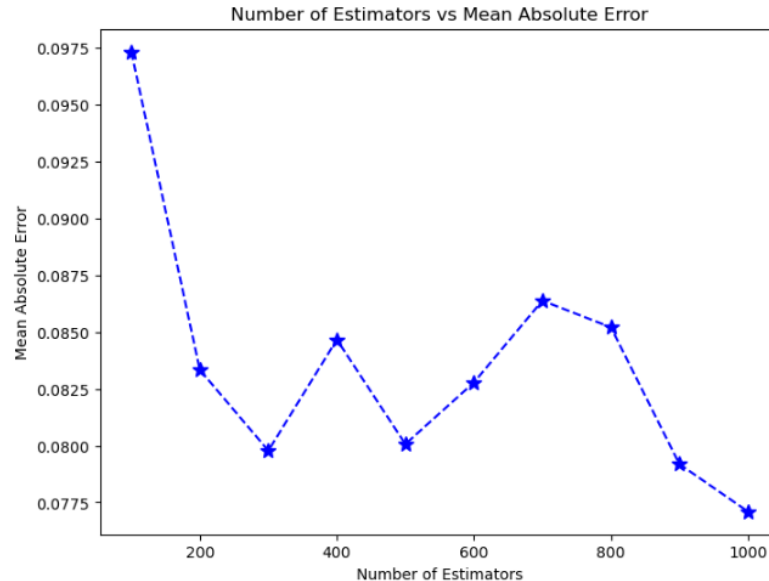


FIGURE 5. Effect of number of repressors in random forest regression on Number of Estimators vs Mean Absolute Error

Figure 5 shows the relationship between the number of estimators in a Random Forest Regressor and the Mean Absolute Error (MAE). Initially, increasing estimators from 100 to around 300 leads to a sharp drop in MAE, reflecting improved prediction accuracy. Between 400 and 800 estimators, the MAE fluctuates without significant improvement, indicating diminishing returns. The lowest MAE is observed around 1000 estimators, suggesting that while more trees

generally enhance model precision, the benefit plateaus after a point. This trend aligns with the bias-variance trade-off, where too few estimators underfit and excessive estimators yield minimal gains.

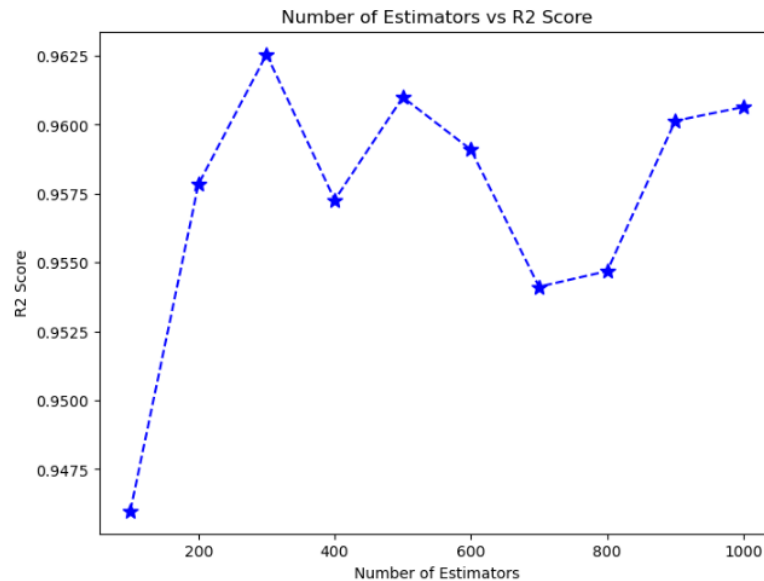


FIGURE 6. Effect of number of repressors in random forest regression on Number of Estimators vs R2 Score

Figure 6 displays the impact of the number of estimators on the R^2 Score in a Random Forest Regression model. As the number of estimators increases from 100 to around 300, the R^2 Score improves significantly, peaking near 0.9625—indicating strong model accuracy and better variance explanation. Beyond this point, the R^2 Score exhibits mild fluctuations but remains consistently high (above 0.954), showing marginal improvements with higher estimator counts. The score stabilizes close to 0.961 at 1000 estimators, suggesting that the model has achieved optimal complexity and additional estimators contribute little to performance gain.

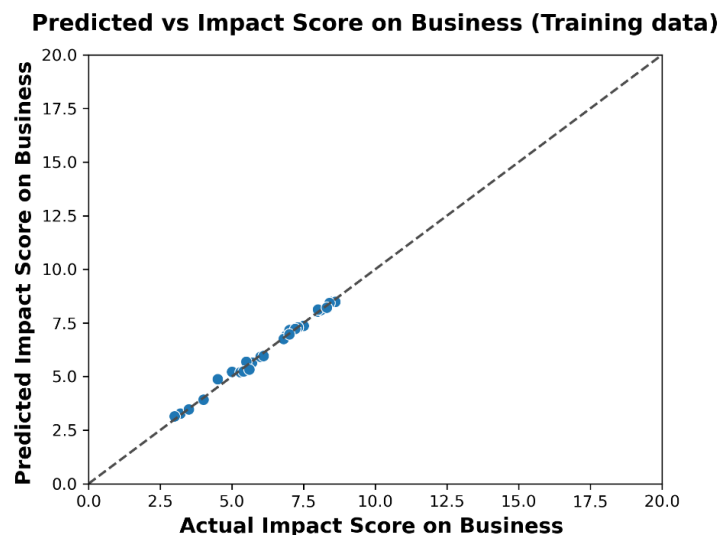


FIGURE 7. Predictive performance of the random forest regression predictive model in GST law on businesses and professions training

Figure 7 illustrates the predictive accuracy of the Random Forest Regression model on training data, comparing actual vs. predicted impact scores on businesses. The points lie nearly perfectly along the 45-degree reference line, indicating excellent alignment between predicted and actual values. This suggests the model captures the underlying patterns in the training set very well, with minimal error. However, such near-perfect prediction can sometimes signal overfitting,

especially if performance on test data is notably worse. Nevertheless, within the training context, the model demonstrates high reliability and precision.

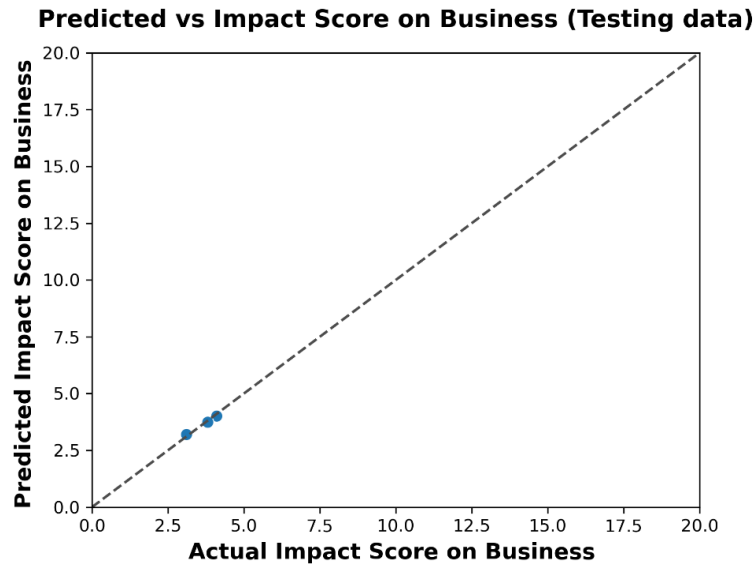


FIGURE 8. Predictive performance of the random forest regression predictive model in GST law on businesses and professions testing

Figure 8 shows the predictive performance of the Random Forest Regression model on the testing dataset. The predicted impact scores align well with the actual scores, lying close to the 45-degree line, which reflects good predictive accuracy. However, the distribution appears to be limited to a narrow range of values (between approximately 2.5 and 4), indicating that the test set may be small or lacks variability. This could limit the generalizability of conclusions drawn from it. Despite this, the model maintains consistency between actual and predicted values in the test phase.

Support Vector Regression

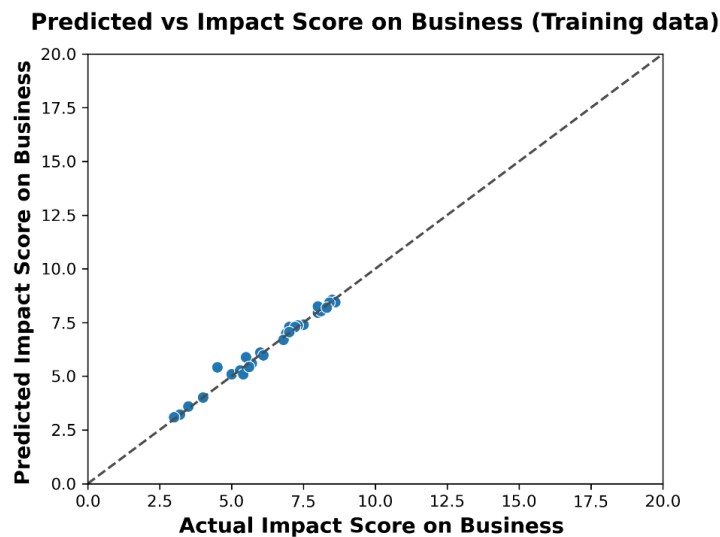


FIGURE 9. Predictive performance of the Support Vector Regression predictive model in GST law on businesses and professions training

Figure 9 illustrates the predictive accuracy of the Support Vector Regression model using training data, where predicted impact scores are plotted against actual impact scores. Most points lie very close to the 45-degree line, indicating excellent alignment between predicted and actual values. This strong fit suggests that the model has learned the underlying patterns in the training data effectively. However, such tight clustering can also hint at overfitting, especially if the model does not perform as well on unseen data. Therefore, it is essential to compare this with testing performance to confirm generalizability.

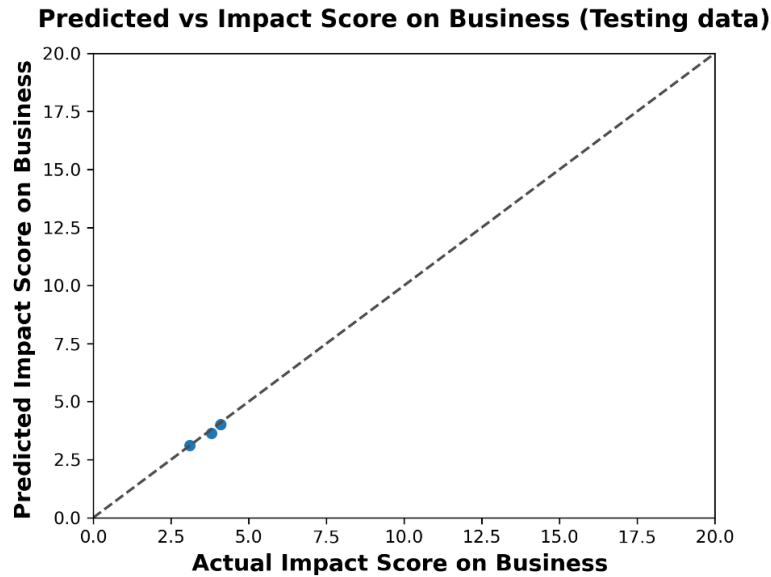


FIGURE 10. Predictive performance of the Support Vector Regression predictive model in GST law on businesses and professions testing

Figure 10 presents the predictive performance of the Support Vector Regression model on the testing data. The scatter plot shows a few data points closely aligned along the diagonal, which represents perfect prediction. While these points suggest good accuracy, the very limited number of testing samples makes it difficult to draw strong conclusions about the model's generalizability. The small sample size increases the risk of misleadingly optimistic performance metrics and limits the model's ability to capture the full variability of real-world data.

TABLE 3. Train and Test

Data	Model	R2	EVS	MSE	RMSE	MAE	MaxError	MSLE	MedAE
Train	Random Forest Regression	0.993378	0.993398	1.82E-02	1.35E-01	1.03E-01	3.83E-01	4.87E-04	8.30E-02
Test	Random Forest Regression	0.957844	0.958341	7.40E-03	8.60E-02	8.33E-02	1.11E-01	3.72E-04	8.00E-02
Train	Support Vector Regression	0.980833	0.98197	5.28E-02	2.30E-01	1.48E-01	9.19E-01	1.32E-03	9.99E-02
Test	Support Vector Regression	0.938353	0.971041	1.08E-02	1.04E-01	8.44E-02	1.62E-01	4.75E-04	7.87E-02

Table 3 compares the performance of Random Forest Regression (RFR) and Support Vector Regression (SVR) models on GST impact prediction. Both models perform well, with high R^2 values indicating strong explanatory power—RFR slightly outperforms SVR in both training ($R^2 = 0.993$) and test sets ($R^2 = 0.958$). RFR also shows lower errors across key metrics: MSE, RMSE, MAE, and MaxError. While SVR has a marginally better Explained Variance Score (EVS) on the test set (0.971), RFR maintains more consistent and accurate predictions with lower error margins overall. Hence, RFR appears more robust for modeling GST-related impacts on businesses.

4. CONCLUSION

Based on the comprehensive analysis of recent GST amendments and their impact on businesses and professions, several key conclusions emerge that highlight the complex nature of India's evolving tax landscape. The empirical analysis reveals a nuanced picture of GST reform outcomes. While the amendments introduced between July 2024 and January 2025 were designed to enhance compliance and simplify procedures, the data indicates mixed results for businesses. Post-amendment compliance costs increased from an average of ₹40.27 thousand to ₹44.43 thousand, representing a 10.3% rise that places additional financial burden on enterprises. Similarly, average monthly GST filing time rose to 10.22 hours, with businesses receiving approximately 3.13 notices from GST departments over six months, indicating heightened regulatory scrutiny. However, the impact scores reveal significant variability in business experiences, ranging from 3.0 to 8.6 on a 10-point scale, with an average of 6.05. This dispersion suggests that while some businesses benefit from the amendments through streamlined processes and reduced administrative burden, others face increased complexity and costs. The strong negative correlations (-0.97 to -0.99) between compliance costs, filing time, notices received, and business impact scores confirm that higher administrative burdens directly translate to more negative business perceptions. The technological enhancements, particularly the introduction of Multi-Factor Authentication (MFA) and real-time data integration between GSTN, income tax, and customs departments, represent positive steps toward digital security and transparency. These measures address cyber threats and reduce fraudulent activities while enabling better cross-departmental coordination. The automated validation systems in GSTR-1 and auto-population features in GSTR-3B have the potential to minimize reconciliation issues, though their benefits may not yet be fully realized across all business segments. Sector-specific clarifications for real estate, e-commerce, and manufacturing industries demonstrate the government's commitment to addressing ambiguities that previously hindered compliance. The emphasis on substance-over-form interpretations in judicial decisions further reinforces the need for proper documentation and transparent business practices. The machine learning analysis using Random Forest Regression and Support Vector Regression models confirms the reliability of these findings, with R^2 values exceeding 0.95, indicating strong predictive capability for assessing GST amendment impacts. Moving forward, the success of GST reforms will depend on balancing compliance rigor with business feasibility. While the amendments strengthen revenue collection and reduce tax evasion, policymakers must consider the disproportionate impact on MSMEs and implement targeted relief measures. The government's commitment to continuous refinement, guided by stakeholder feedback and technological advancement, will be crucial for achieving the dual objectives of tax efficiency and business growth in India's evolving economic landscape.

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