

Digital Payment System Maturity and Macroeconomic Foundations: An Empirical Analysis of GST Determinants in India (2017-2024)

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Abstract—This study examines the role of digital payment system maturity alongside macroeconomic fundamentals as determinants of India's GST revenue. It moves beyond transaction volumes to examine how systemic digitalization affects the tax base. The study aims to (1) quantify the elasticity of GST revenue with respect to GDP growth, (2) assess the relationship between the maturity of the digital payment ecosystem (RBI's Digital Payments Index) and GST revenue, and (3) evaluate the impact of inflation. Using annual data (2017-2024), a regression model analyzes GST revenue against GDP, the RBI Digital Payments Index, and the inflation rate. GDP growth is the primary determinant ($\beta = 0.34^*$). The Digital Payments Index shows a significant positive association ($\beta = 5,176^*$), indicating its role as a compliance and formalization factor. Policy should prioritize GDP stability while leveraging digital infrastructure to enhance tax compliance. Digital payments should be viewed as a transparency tool, not a direct revenue source.

Index Terms—Digital Payments, GST Revenue, Digital Payment Index, Economic Indicators

I. INTRODUCTION

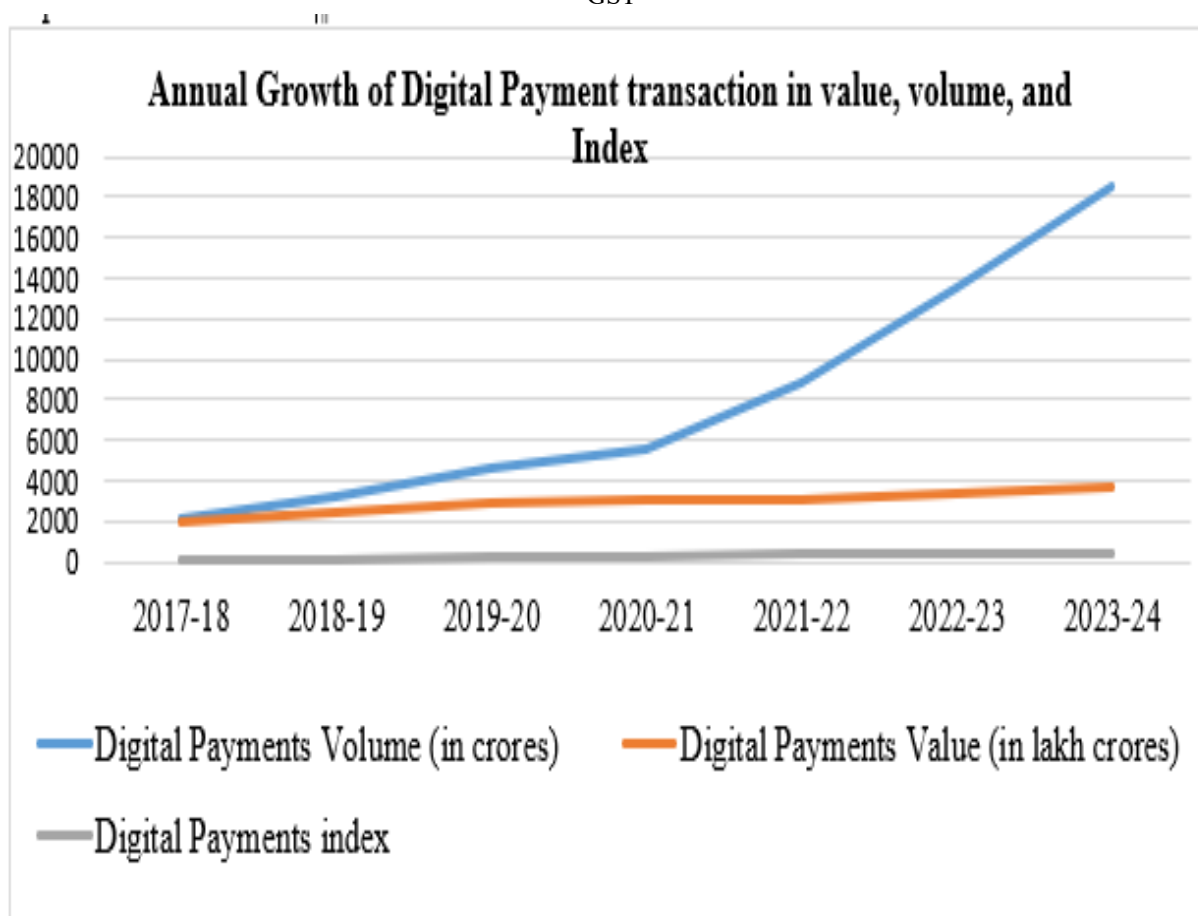
This study investigates the determinants of India's Goods and Services Tax (GST) revenue, focusing on the distinct roles of traditional macroeconomic drivers and modern digital payment infrastructure. Although the transactional value of digital payments remains a minor share of GST collections (<1%) precluding a direct causal impact on revenue their systemic maturation is theorized to enhance tax compliance and formalization. The study posits that GDP growth is the fundamental engine of revenue, while the maturity of the digital payment ecosystem, proxied by the Reserve

Bank of India's (RBI) Digital Payments Index, serves as a critical compass that improves administrative efficiency and broadens the tax base. Using a dual-path empirical framework, this analysis moves beyond transaction volumes to assess how the depth and adoption of digital infrastructure interact with GDP and shape GST outcomes during the post-implementation period (2017-2024). The COVID-19 pandemic has accelerated the adoption of digital payments, reshaped non-cash payments and affected GST revenue (Joseph & Ramalingam, 2021). Digital payments have eased compliance, improved logistics, reduced tax incidence, and contributed to revenue growth and buoyancy in GST collections (Anantha Nageswaran & Devi Prasad Misra, 2024). The impact of digital payments on tax revenue and the informal economy is a topic of global interest, with many countries implementing VAT or GST on cross-border online sales (Cristina, 2024).

II. THE EVOLVING LANDSCAPE OF DIGITAL PAYMENT INFRASTRUCTURE IN INDIA

The DIGIDHAN Mission surpassed its 25 billion digital payment transaction targets in 2017-18 through digital payment modes, including UPI, USSD, IMPS, and BAP. It empowered public and private providers to drive innovation, improve service delivery, and deliver a user-centric experience across digital payment services. Overall, the mission helped the country reach 116 billion digital transactions in FY23-24 as of December 11, 2023. Total Digital Payment Transaction Volume grew from 2,071 crores in FY 2017-18 to 18,592 crores in FY 2023-24, at a CAGR of 44% (Ministry of Finance and PIB 2024).

Figure 1 illustrates the growth of digital payments in terms of value, volume, and index since the implementation of GST



(Source: Author calculation sources from PIB, MOSPI, RBI)

Note: Digital payment modes considered are BHIM-UPI, IMPS, NACH, AePS, NETC, debit cards, credit cards, NEFT, RTGS, PPI, and others.

India's digital payments ecosystem has seen substantial growth in both volume and value. The volume of digital payments has risen sharply since the financial year 2020-21, while the value has also grown, though at a slightly slower rate. The digital payments index, a composite measure of volume and value, has shown consistent growth, indicating a robust upward trend expected to continue. The linear trend line for digital payment volume suggests sustained growth in the future (Figure 1).

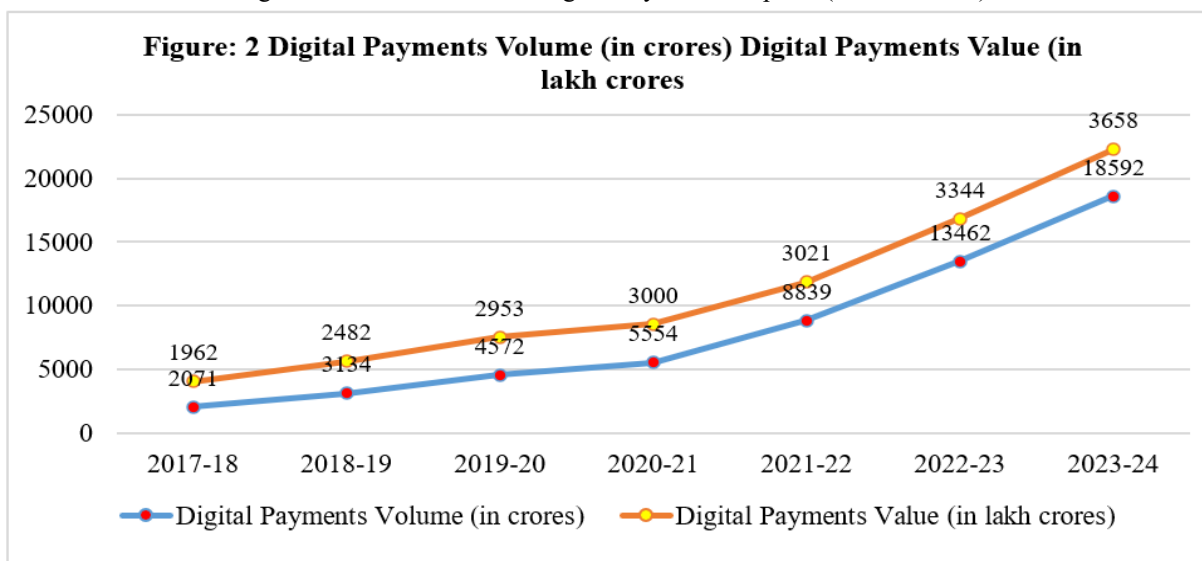
III. BENCHMARKING DIGITAL PAYMENT ADOPTION AND SYSTEM MATURITY

Digital payments have grown significantly in recent years, largely due to coordinated efforts by

the government and key stakeholders. Transaction volumes have surged, particularly after FY 2013-14, rising from 220 crores in FY 2013-14 to 18,592 crores in FY 2023-24. During the same period, the total transaction value rose from 952 lakh crore to 3,658 lakh crore (Financialservices.gov.in 2024). Currently, more than 30 crore individuals and 5 crore merchants in India use digital payment systems, with over 40% of transactions occurring digitally.

The adoption of advanced technologies such as 5G/6G networks, the Internet of Things (IoT), and central bank digital currencies (CBDC) is expected to accelerate growth in digital payments in India further (PIB, 2023).

Figure 2: Growth Trends in Digital Payment Adoption (in lakh crores)



Source: Author compiled from RBI, NPCI

The figure above shows a rapid rise in digital payment adoption in India, with transaction volumes increasing faster than values, especially after the pandemic. Across both volume and value, the data highlight the growing role of digital payments in the economy,

underscoring the importance of growth and inclusion. There is a noticeable spike in both the value and volume of digital payments in 2022-23 and 2023-24, indicating a significant shift.

Figure 3: Banks linked to top Digital payments in India as of May 2024

Sl. No.	Payment System	Number of Banks Linked
1	Unified Payments Interface (UPI)	598
2	RuPay	1254
3	Immediate Payment Service (IMPS)	871
4	National Automated Clearing House (NACH)	1360
5	National Financial Switch (NFS)	1304
6	Aadhaar Enabled Payment Systems (AePS)	149
7	National Electronic Toll Collection (NETC)	38

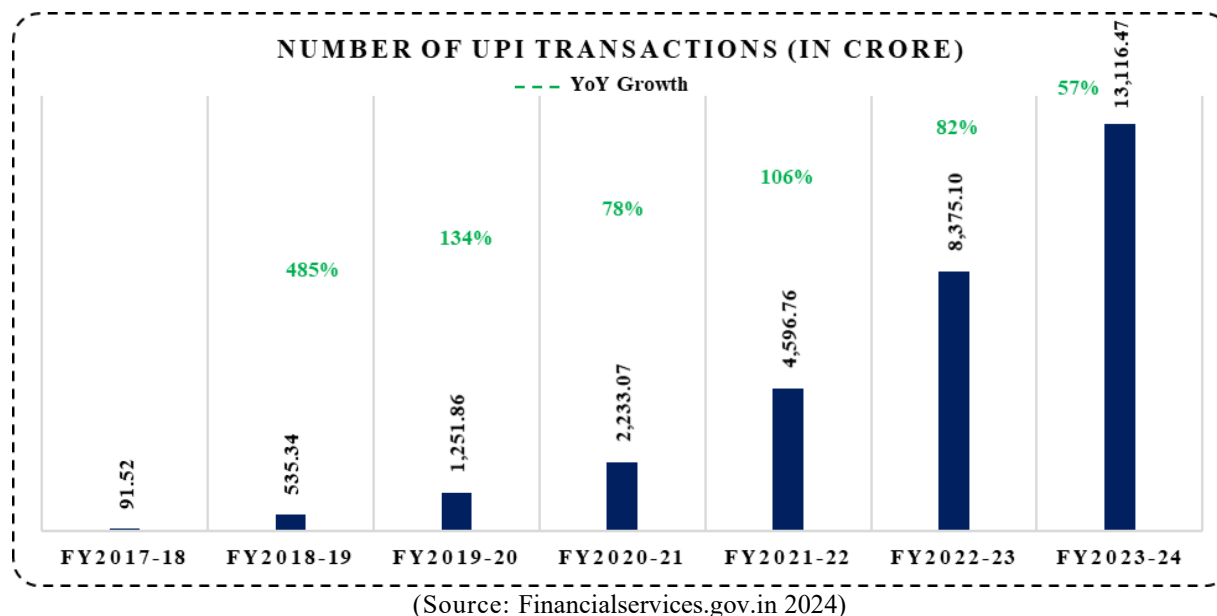
(Source: vifindia.org)

Figure 3: The National Automated Clearing House (NACH) and National Financial Switch (NFS) are India's most widely linked payment systems, connected to 1,360 and 1,304 banks, respectively. RuPay follows closely with 1,254 linked banks.

A. Unified Payments Interface (UPI): UPI is an indigenous digital payment system that enables quick, easy payments from multiple bank accounts through a single mobile application. UPI has transformed digital payments in the country,

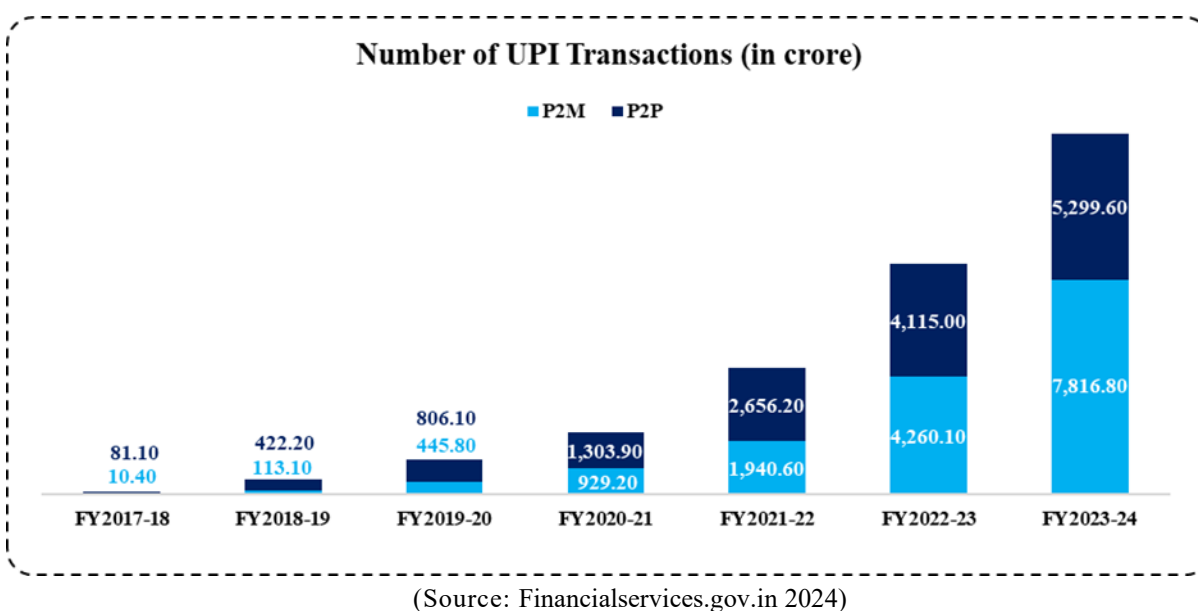
with transactions rising from 92 crores in FY 2017-18 to 13,116 crores in FY 2023-24, at a CAGR of 129%. The number of UPI transactions is projected to surpass 20,000 crores in FY 2024-25. In May 2024, UPI achieved a new milestone, recording over 1,403 crore transactions in a single month. Its global relevance is also growing, with

adoption in countries such as the UAE, Bhutan, and Singapore, and pilot tests completed in Nepal, Mauritius, France, and Sri Lanka. According to the ACI Worldwide Report 2023, approximately 46% of global real-time payment transactions now occur in India (Financialservices.gov.in 2024).



The graph above shows a significant and stable rise in UPI transactions in India from FY 2017-18 to FY 2023-24. Total transactions rose sharply to 13,116.4 crores in FY 2023-24, with P2P (Person-

to-Person) and P2M (Person-to-Merchant) transactions growing exponentially, particularly in the most recent fiscal years.



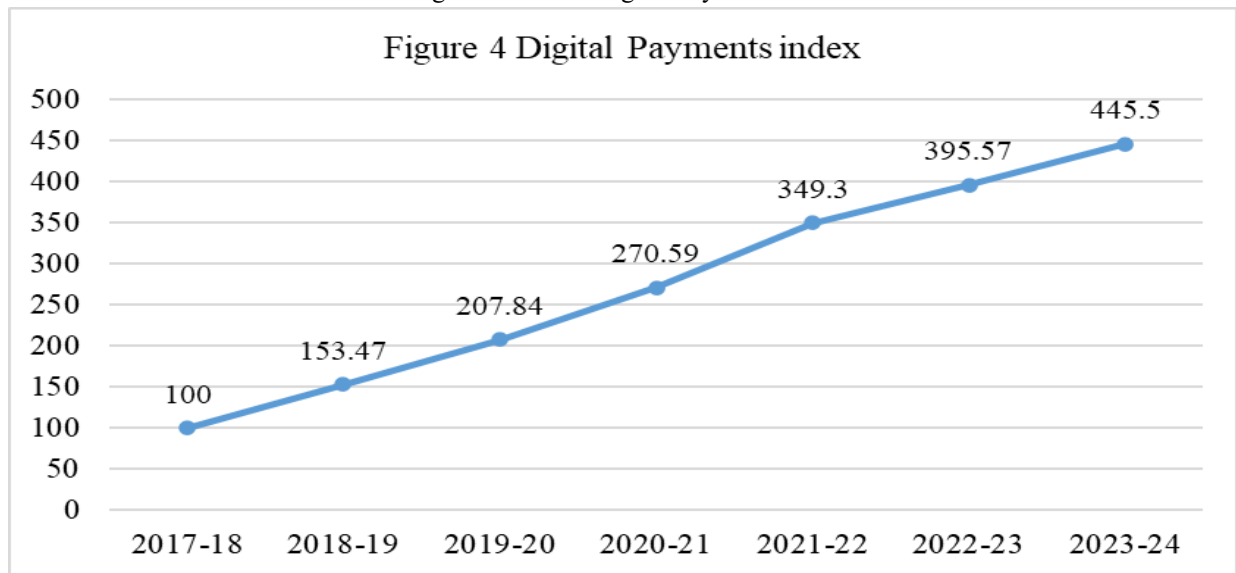
B. Global Integration of India's Digital Payment Platforms:

India's indigenously developed UPI and RuPay cards are world-class platforms for digital payments. The government is working to promote these products globally. UPI is fully operational in the UAE, Bhutan, and Singapore. It is technically live, with pilot tests completed in Nepal, Mauritius, France, and Sri Lanka. Commercial deployment of the payment method is

expected soon. RuPay card acceptance is live in Nepal, Bhutan, Singapore, and the UAE, and is technically live in the Maldives (Financialservices.gov.in 2024).

Figure 4: The index has shown a steady upward trend, rising from a base value of 100 in 2017-18 to 445.5 in 2023-24. This represents a more than fourfold increase over the past seven years, reflecting sustained growth in the adoption and use of digital payments.

Figure 4: India's Digital Payment Index



(Source: Author Compiled)

C. Scaling the Digital Payment Acceptance Network: The coordinated efforts of ecosystem partners have driven exponential growth in the country's digital payment acceptance infrastructure, increasing from 0.31 crore in FY 2017-18 to 26.95 crore in FY 2022-23. According to RBI data as of March 31, 2024, the total payment acceptance infrastructure stands at 36.14 crore (Financialservices.gov.in 2024).

IV. REVIEW OF LITERATURE

Digital payments significantly impact economic growth in the short term but not in the long term (Ravi Kumar et al., 2019). The GST Council may impose an 18% GST on payment aggregators' income from transactions under ₹2,000. This proposal is based on the idea that payment aggregators serve as intermediaries for card transactions and should

therefore be subject to GST (Business Today 2024). The effect of digital payment regression on GST revenue is an area of interest in financial studies. Various studies have examined factors influencing consumers' perceptions of electronic payment systems, emphasizing usefulness, ease of use, security, trust, and risk (Saini et al., 2017). Additionally, the impact of digital innovation on economic growth has been studied, focusing on technology infrastructure, digital lending, and digital payments, and their effects on real per capita income, public health, and education levels (Sirait et al., 2023). Broader adoption of digital payments greatly promotes financial inclusion among disadvantaged groups (Leora & Dorothe, 2014). "If financial inclusion is the road to bring people into the formal economy, then digital payments are the vehicle that makes the journey possible" (Alim, 2017). A study of Europe's shadow economy found that increasing digital payments by an average of ten

percent annually over four years can reduce the shadow economy by five percent and influence merchant behavior that underreports sales (Schneider, 2013). Income taxes are also affected by how transactions are paid; sales made through electronic payments significantly increase the reported income of US sole proprietors (Slemrod et al., 2017). The least squares method showed that growth in electronic payments has positively impacted Greece's tax compliance (Danchev et al., 2020). There is a consistently negative impact of cash on VAT payments. It is also notable that POS (Point of Sale) terminals tend to positively influence the VAT-to-consumption ratio in nearly all regressions (Madzharova, 2014). While these studies offer valuable insights into digital payments and financial services, a gap remains in the literature regarding the specific relationship between digital payments and GST revenue.

V. RESEARCH GAP

While extensive literature examines the impact of digital payments on financial inclusion and economic growth, a significant gap remains in empirical research on how the maturity of a digital payment ecosystem, distinct from mere transaction volume, affects the efficiency and stability of a consumption tax system such as the GST. Furthermore, few studies in the Indian context have simultaneously modeled this digital system maturity alongside traditional macroeconomic determinants to isolate its specific contribution to revenue outcomes. This study addresses this gap by investigating the RBI's Digital Payments Index as a proxy for systemic formalization and its relationship with GST revenue.

VI. OBJECTIVES

1. To quantify the relationship between GDP growth and GST revenue in post-GST India.

2. To analyze the association between the maturity of the digital payment ecosystem (as measured by the RBI Digital Payments Index) and GST revenue collection

VII. HYPOTHESES

H1: GDP growth has a significant positive relationship with GST revenue.

H2: The RBI Digital Payments Index has a significant positive relationship with GST revenue.

VIII. DATA AND METHODS

An empirical study employing quantitative analysis and desk research was conducted. Secondary data from the Ministry of Finance, PIB, RBI, the Indian budget, the Digi Pay dashboard, and the Economic Survey were utilized. The study aims to identify the relationship between the independent variables (Digital Payments Volume, Inflation rate, GDP, Digital Payments Index, Industrial Production Indices) and the dependent variable (GST Revenue). Excel was used for regression analysis and correlation tests. The data covers fiscal years 2017-18 through 2023-24, providing a comprehensive analysis over seven years.

$$\text{GST Collection} = \beta_0 + \beta_1 (\text{Digital Payments Volume}) + \beta_2 (\text{Inflation rate}) + \beta_3 (\text{GDP}) + \beta_4 (\text{Digital Payments Index}) + \beta_5 (\text{Industrial Production Indices}) + \epsilon$$

Where:

- β_0 is the intercept,
- $\beta_1, \beta_2, \beta_3, \beta_4,$ and β_5 are the coefficients of Digital Payments Volume, Inflation rate, GDP, Digital Payments Index, and Industrial Production Indices, respectively.
- ϵ is the error term.

Sample Size: The study utilizes a sample size of 7 annual observations from 2017 to 2024

IX. RESULTS AND DISCUSSIONS

Table 3: Annual Data of the dependent variable and the Independent variables

Year	GST Collection (Domestic + Import) in Crores	Digital Payments Volume (in crores)	Inflation rate %	GDP in Crores	Digital Payments Index	Index of Industrial Production Indices (%)
2017-18	719078	2071	3.39	13144582	100	4.6

2018-19	1177370	3134	3.41	13992914	153.47	3.9
2019-20	1222117	4572	6.2	14534641	207.84	1.4
2020-21	1136805	5554	5.5	13694869	270.59	9.6
2021-22	1483291	8839	6.7	15021846	349.3	11.8
2022-23	1807680	13462	5.4	16071429	395.57	4.7
2023-24	2018000	18592	4.83	1738122	445.5	5.5

(Source: MOSPI, PIB, RBI, Indian budget, digipay dashboard, and Economic Survey)

The above table on GST collection shows a generally increasing trend from 2017-18 to 2023-24, with a slight dip in 2020-21 (likely due to the COVID-19 pandemic). Digital payments volume has consistently increased year over year. The Digital Payments Index

also shows a steady increase. GDP has grown over the years, with a dip in 2020-21. The inflation rate and the Index of Industrial Production show fluctuations (Table 3).

Table 4, Correlation Matrix

Independent Variables	Digital Payments Volume (in crores)	Inflation rate %	GDP in Crores	Digital Payments Index	Index of Industrial Production Indices (%)
Digital Payments Volume (in crores)	1	0.295	0.970	0.943	0.201
Inflation rate %	0.295	1	0.309	0.544	0.414
GDP in Crores	0.970	0.309	1	0.899	0.251
Digital Payments Index	0.943	0.544	0.899	1	0.358
Industrial Production Indices (%)	0.201	0.414	0.251	0.358	1

(Source: Author Compiled)

Based on the above Multicollinearity table, there appears to be a strong positive correlation between GST Collection and Digital Payments Volume. GDP also seems to be positively correlated with GST

Collection. The relationship between GST Collection and other variables (inflation rate, IIP) is less clear and may require more sophisticated analysis

Table 5, Regression Statistics

Multiple R	R Square	Adjusted R-Square	Standard Error	Observations	Significance F
0.965	0.956	0.945	5248.197	7	0.00826
Independent variables	Digital Payments Volume (in crores)	Inflation rate%	GDP in Crores	Digital Payments Index	Index of Industrial Production Indices (%)
P-value	0.0193	0.0227	0.0164	0.0162	0.0604
Coefficients	-106.2465	-106346.6	0.336588	5176.0306	-12109.49

(Source: Author Compiled)

The Regression analysis confirms the primacy of macroeconomic fundamentals in determining GST revenue. However, it also reveals a significant independent role for the maturity of digital payment infrastructure. This finding supports the conceptual

shift from viewing digital payments as a direct revenue contributor to understanding them as a mechanism for compliance and formalization. The positive coefficient for the Digital Payments Index suggests that a more robust, widely adopted digital ecosystem

is associated with a more efficient GST collection system, likely by enhancing transaction visibility and reducing the size of the informal, cash-based economy. A one-standard-deviation increase in digital transactions can raise GST revenue by approximately INR 62 billion. This suggests that increasing digital transactions is an effective way to boost tax revenue (Surender Kumar 2024). There is a long-term relationship between digital payments and GST revenue, and a positive link between the growth in electronic transactions and tax compliance (Joseph 2021).

X. SCOPE AND LIMITATIONS

This study investigates the determinants of India's GST revenue, focusing on the distinct roles of macroeconomic growth and digital payment system maturity. It analyzes data from FY 2017-18 to FY 2023-24, a period that captures the full post-implementation phase and the anomalous effects of the COVID-19 pandemic on economic activity and digital adoption. Limitations include the constrained seven-year timeframe, which may not reflect long-term equilibrium relationships, and the use of secondary data with potential measurement inaccuracies. Furthermore, high correlations among key independent variables (e.g., GDP and the Digital Payments Index) necessitate caution in interpreting isolated coefficients, and unobserved structural factors (e.g., GST rate rationalizations, global commodity shocks) could influence the results.

XI. FINDINGS AND SUGGESTIONS

GDP Dominance: GDP was the dominant determinant of GST revenue variation ($\beta=0.34^*$), confirming macroeconomic fundamentals as the primary driver. **Digital Ecosystem Maturity:** The RBI's Digital Payments Index showed a significant positive association with GST revenue ($\beta=5,176^*$). This supports the hypothesis that a mature digital payment infrastructure facilitates compliance by enhancing transaction visibility and formalization. **Other Factors:** Inflation had a negative effect ($\beta=-106,346.6^*$), while the Index of Industrial Production was not significant. **Suggestions:** **Policy:** Integrate digital payment adoption with compliance incentives, such as expedited GST input tax credit for MSMEs with high digital transaction ratios. **Methodological:** Future

compliance studies should adopt the RBI's Digital Payments Index or similar composite measures of ecosystem maturity.

XII. IMPLICATIONS OF THE STUDY

Policy Implication: Fiscal strategy must prioritize GDP stability while explicitly leveraging digital payment infrastructure to improve compliance, for example, through UPI analytics for targeted audits. **Theoretical Implication:** This study provides empirical evidence for reframing digital payments in the public finance literature as primarily a tax administration and compliance-enhancing technology rather than a direct fiscal revenue instrument.

XIII. CONCLUSION

This analysis confirms that India's GST revenue remains fundamentally tied to GDP growth. However, the positive relationship with the Digital Payments Index reveals a secondary channel: systemic digitization strengthens the tax administration ecosystem. Therefore, fiscal strategy should prioritize robust macroeconomic management while concurrently investing in digital public infrastructure to improve compliance efficiency and formalize the tax base.

XIV. SCOPE FOR FUTURE RESEARCH

Explore sectoral heterogeneity in how digital payment adoption affects GST compliance and revenue. Investigate causal mechanisms linking specific digital payment infrastructures (e.g., UPI, e-invoicing) to tax gap reduction using granular, firm-level data. Conduct comparative studies with other large federations (e.g., Brazil, Indonesia) to identify effective models for leveraging digitalization in GST/VAT systems.

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