Adoption of UPI Across Indian States: A Comparative Study

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Abstract-The research studies the UPI adoption and its performance by Indian states through the analysis of transaction volumes and other operational metrics. These metrics are related to transaction outcomes, and system performance reliability. The article used descriptive statistics to study the spread and variation of UPI usage. After that, association and correlation testing are done to study relationships between major performance indicators. A regression model helps identify which variables predict the amount of transactions. The results suggest that OUPI's usage is not homogenous, as the level of transaction volumes vary widely across the observations, implies that the intensity of adoption varies largely across states. There is a strong positive relationship between total transaction volume and total debit reversal count, as demonstrated in the correlation and regression results. It largely reflects a scale effect which is shown by areas with high activity. TD% exhibits a considerable negative correlation with transaction volume, indicating that elevated transaction friction or negative consequences are associated with diminished utilization levels.

Keywords: UPI, Digital Payments, Financial Inclusiveness, Indian States, Transaction Volume, Debit Reversal, Reliability of Transactions, Regression Analysis, Correlation Analysis, Adoption Pattern

I.Introduction

UPI is becoming more popular as a payment instrument for transfers, merchant payments, and day-to-day payments according to Gochhwal (2017) and BIS (2019). Further, major trends in India's payment ecosystem have shifted quickly towards digital modes. State-level patterns show that adoption is not uniform and national totals mask differences in transaction intensity and maturity across areas (IIM Bangalore, 2025; SBI Research, 2025). State-wise comparison is necessary since bigger states would usually reflect bigger totals merely as a result of bigger population and economic size. Per-capita indicators are useful to offer a more moderated view of adoption

intensity and actual penetration (NABARD, 2020; IIM Bangalore, 2025).

Through transaction volume and related operational indicators, this study investigates UPI adoption across states in India. The study concentrates on the variation in adoption, associations among key indicators, and the interpretation of reliability-related measures vis-a-vis transactions activity (ORF, 2024; ICRIER, 2024).

A perceptible transformation has taken place in the country's payment ideology, transitioning from the conventional cash-first to the new scan-and-pay. Today UPI has become part of our daily lexicon, whether it is sending money, paying local vendors or completing small-value payments quickly and conveniently. UPI's rapid growth can be attributed to the effective and effortless design of the system (QR codes, mobile numbers, and app-based system making it feasible not just for digital users, but also for the regular consumer and small merchants. Consequently, UPI is no longer merely a "fintech option" but a way of life, finding its place in India's overall digital payments ecosystem(NABARD, 2020).

While the recognition is certainly at the national level, adoption is not uniform. According to some existing studies and reports, it can easily be seen that UPI usage differs from state to state as per transaction volume, transaction value, and per-capita usage. This uneven pattern raises interesting questions: if UPI is growing rapidly in India overall, which states are benefitting

most, which states are still lagging behind(SBI Research, 2025).

A. Problem Statement

Despite several reports and studies indicating that UPI adoption varies between states, existing comparisons are more often than not fragmented (different regions, indicators, and time windows) and more descriptive than analytical, making it difficult to compare all states through a single common structure. Consequently, it is still difficult to confidently identify leading states, catching-up states and the underlying drivers of the gap, particularly when totals are distorted by population size.

The study specifically focuses on the following questions.

- Which Indian states use UPI the most in terms of transaction volume, value and per-capita indicators? Expansion of UPI Across Indian States.
- Which factors at the state level provide clarity about the differences in UPI adoption across states – (i) digital readiness; (ii) financial inclusion; (iii) literacy/socio-economic context?
- What is the relationship between adoption patterns – low versus high – and financial inclusion outcome and digital inequality across states?

B. Objectives of the Study

- To examine and compare the level of UPI adoption across Indian states.
- To identify the key socio-economic and digital factors influencing differences in UPI adoption among Indian states.
- To assess the implications of inter-state variation in UPI adoption for financial inclusion and digital inequality in India.

II. Literature Review

A. Adoption of UPI across Indian States

- According to OFR's report of 2024, the future growth of UPI is linked with macroeconomic conditions. In order to understand this growth, state-wise comparisons can be done as this would help in understanding the uneven expansion of UPI.
- According to the IIM Bangalore 2025 work, the patterns of 'volume' and 'value' of transactions differ across states, so adoption must be read using these two dimensions rather than just totals.
- According to SBI Research (2025), data-driven conclusions derived from UPI datasets make it possible to measure and compare state-level variation.
- According to PhonePe's Pulse reports (2021–2022), the use of high-end digital technology varies from state to state.
- According to a study by Jaiswal and Singh (2023) adoption of UPI varies by states with level of digitalization.
- NABARD's NAFINDEX (2020) is a framework that provides one way to measure financial inclusion by availability of inclusion-related indicators.
- The findings of Digital Business (ScienceDirect) (2022) reveal that UPI adoption can be explained using user-level acceptance drivers which are fundamental in defining UPI adoption.
- The paper cited from Nature's HSSC (2024) which uses UTAUT supports a behavioural acceptance reading of UPI use and helps justify connecting adoption gaps to technology acceptance.
- The GSJ paper (2024) makes a link between the adoption of UPI and financial inclusion outcomes, thus providing support for the interpretation of UPI that extends beyond usage totals to broad development impact.
- The state-wise adoption gaps associated with digital payments are aligned with ecosystem readiness according to ICRIER (2024).
- According to BIS (2019), differences in adoption can be understood through the lens of reliability and public infrastructure choices.
- According to Gochhwal (2017) UPI is a real-time payment system, inter-operable between banks, which provides a conceptual context.
- Fahad and Mohammad Shahid show that the adoption of the new technology depends on its perceived advantages and compatibility.
- According to a study conducted by Razi-ur-Rahim et al. (2024) utilizing an extended acceptance model showed quite a significant phenomenon. That phenomenon is adoption is multi-factor and cannot be solely explained with a single variable. Thus resulting in a richer interpretation of the state variation.
- In 2024, Jacob and his colleagues examine low-income consumers to identify factors behind adoption in resource-constrained settings. This study is relevant to understanding regions, which have lower rates of adoption.
- According to Haque (2023), UPI users who have adopted UPI for a long time would not have a high satiation discontinuance intention.
- According to Srinivasan, Diatha, and Singh (2024), with an application of a TOE-style perspective

in bottom-of-the-pyramid retail supply chains, ecosystem and organisational readiness influence adoption.

- Khanra et al. (2020) have pointed out that the barriers to adopting a cashless economy are largely due to trust/risk, awareness gap and digital divide. This explains to a large extent the lagging behind of certain regions even when there is an overall growth.
- Singh et al. (2024) draw attention to the accessibility/usability concerns for users apart from the sighted users, which indicate that through the influence of inclusive design some people are adopted and therefore creating unequal adoption.

B. Research Gap

Most studies still only describe these differences, and that's the problem. Amidst the noise of policy reforms and academic correspondence, economic trajectories often take the backseat. While they indicate a lack of economic convergence, economists do not always compare analogous states employing one common set of measures. This undermines a properly devised comparison which makes the task of judging fairly which states are leading and which are falling behind harder.

III. Research Methodology

A. *Research Design*

A descriptive and analytical comparative approach carried out study. It depicts the statewise adoption pattern using volume/value indicators and interprets the relationship between operational indicators using statistical testing and modelling.

B. *Source of Data*

The UPI study collects state-wise data related to UPI adoption to arrive at per-capita indicators to address size bias and facilitate fair comparison .

C. *Samples and Variables*

Dependent Variable: Total volume of UPI transactions (by state).

Supporting Adoption Measures: Parameters of transaction value and per capita indicator - adoption.

To test the operational indicators, the proportion of approved transactions, BD, TD, total debit reversals, success rate of debit reversals .

D. *Data Analysis Equipment*

Descriptive Analysis Through mean, minimum–maximum values, standard deviation, etc., used to summarise the data so that one can understand the overall level of UPI activity and how much it varies across observations/states.

Percentage Analysis is utilized to portray the distribution pattern in a simple form as it shows how the observations get distributed across categories/levels. Thus, it helps in identifying the major trends or patterns and how the adoptions are done unevenly.

Chi-square Test was applied to check association between the chosen variables through cross-tabulation however; the findings are interpreted with caution due to a very high number of missing cases and very low expected cell counts in several tables.

Correlation proves the necessity of correlation analysis to measure the strength and direction of relationships among key indicators (volume with reversal count and TD%). More precisely, do they move with each other in positive and negative directions.

Regression Analysis is used to find out which indicators can significantly predict transaction volume. Also, it estimates the explanatory power of multiple predictors through model fit and coefficient significance.

IV. Data Analysis and Result

A. *Descriptive outcomes*

The total transaction volume shows large variation across observations suggesting that UPI is not used uniformly, and adoption is not the same across states . The uptake of the use case is highly fragmented. This is in line with the understanding that adoption gets concentrated in regions of better infrastructure readiness and inclusion conditions . The variations in operational indicators like debit reversal count indicates that transaction outcomes and system events are context-dependent and are linked with scale of usage.

Descriptive Statistics						
	N	Minimum	Maximum	Mean	Std. Deviation	Variance
UPI Remitter Banks	998	1	51	2.28	6.436	41.420
Total Volume (In Mn)	50	1	50	25.50	14.577	212.500
Approved %	998	1	51	2.28	6.436	41.420
BD %	998	1	49	2.24	6.199	38.427
TD %	998	1	43	1.98	5.066	25.667
Total Debit Reversal Count (In Mn)	49	1	43	20.41	12.624	159.372
Debit Reversal Success %	998	1	51	2.28	6.436	41.420
Valid N (listwise)	49					

Table 1 Descriptive Statistis

B. Percentage Analysis

By looking at percentages we can see which patterns can dominate and whether the observation shows clustering in higher or lower activities. Regions with a greater concentration of distribution show that a lower number of higher-activity observations are contributing a lot, while lower-activity

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1295.000[a]	1260	.241
Likelihood Ratio	264.435	1260	1.000
Linear-by-Linear Association	2.694	1	.101
N of Valid Cases	37		

a. 1332 cells (100.0%) have expected count less than 5. The minimum expected count is .03.

observations are lagging behind, supporting the interpretation of uneven adoption across states. In percentage patterns where performance is looked at in terms of transactions, a higher proportion in positive-end transactions is associated with stability while a higher proportion in friction associated-end outcomes is related to reliability issues that hamper experience and adoption continuity. Thus, the percentage analysis provides evidence to support that the differences in adoption are directly linked not only to the transaction size but also to transaction experience and reliability conditions.

Statistics								
		UPI Remitter Banks	Total Volume (In Mn)	Approved %	BD %	TD %	Total Debit Reversal Count (In Mn)	Debit Reversal Success %
N	Valid	998	50	998	998	998	49	998
	Missing	0	948	0	0	0	949	0

Mean		2.28	25.50	2.28	2.24	1.98	20.41	2.28
Std. Deviation		6.436	14.577	6.436	6.199	5.066	12.624	6.436
Percentiles	100	51.00	50.00	51.00	49.00	43.00	43.00	51.00

Table 2 Statistics

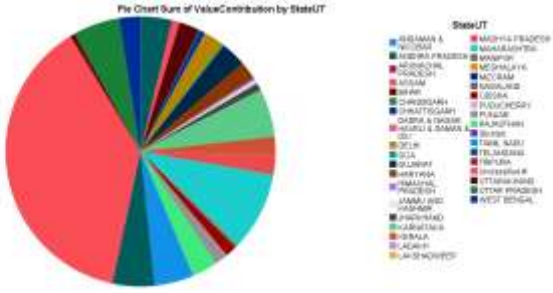

Figure 1: Frequency of state and UT

C. Chi-square Test .

The chi-square section has a lot of missing information in its cross-tabulations, and the expected cell counts are extremely low. This results in weak chi-square inference. As a result, interpretative conclusions from chi-square outcomes are seen to be exploratory rather than confirmatory and more robust interpretations are drawn from correlation and regression outputs which are more appropriate outcomes for continuous indicators and predictive explanation.

Table 3 chi square test

Chi-Square Tests			
	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	2450.000[a]	2401	.238
Likelihood Ratio	391.202	2401	1.000
Linear-by-Linear Association	.132	1	.717
N of Valid Cases	50		
a. 2500 cells (100.0%) have expected count less than 5. The minimum expected count is .02.			

Table 4 Chi- Square Test

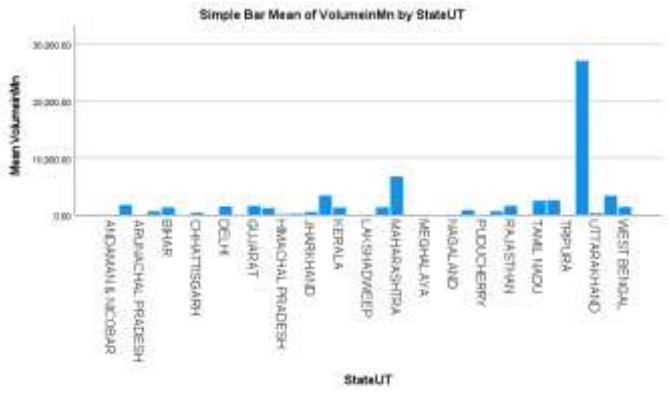

Table 5 Bar Chart

D. Regression Analysis

The model explains most of the variance in transaction volume as per regression analysis. The debit reversal count is a strong positive predictor of total volume in line with the scale interpretation. TD % is a significant negative predictor, indicating that higher TD % means lower volume after controlling for other predictors. This supports the conclusion that less friction in a transaction is related to the continuity of usage levels . The Approved% and BD% variables are not significant predictors, thus having little more explanatory power for volume variation than reversal count and TD% given the data structure.

Coefficients[a]								
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
		B	Std. Error	Beta			Lower Bound	Upper Bound
1	(Constant)	7.938	3.181		2.495	.016	1.526	14.349
	Approved %	.067	.050	.065	1.338	.188	-.034	.168
	BD %	.010	.048	.009	.206	.838	-.086	.106
	TD %	-.310	.062	-.254	-5.020	.000	-.434	-.185

	Total Debit Reversal Count (In Mn)	1.075	.049	.922	22.113	.000	.977	1.173
a. Dependent Variable: Total Volume (In Mn)								

Table 6 Coefficient

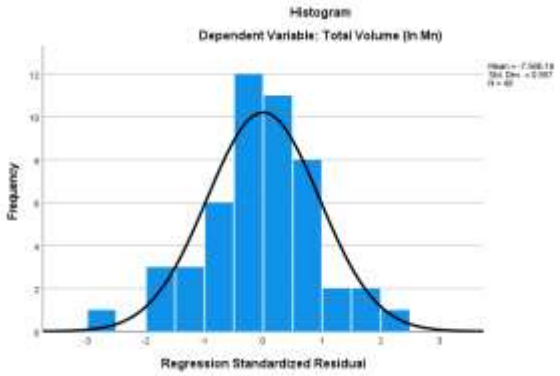

Figure 1 Histogram

E. Correlation

The correlation outcome gives a strong positive relationship between total transaction volume and total debit reversal count, which is interpreted as a scale effect: higher transaction activity results in a naturally higher count in absolute terms of events in operation like reversals . According to TD%, the total volume has a negative relationship with TD%. This indicates that higher adoption environments display earlier friction that is smaller proportionally than that captured by TD%. The link between total volume and Approved% and BD% is low, suggesting that the dataset did not have much explanatory power for differences in adoption through these measures .

Correlations						
		Total Volume (In Mn)	Approved %	BD %	TD %	Total Debit Reversal Count (In Mn)
Pearson Correlation	Total Volume (In Mn)	1.000	.060	.086	-.306	.916
	Approved %	.060	1.000	.166	-.518	-.150
	BD %	.086	.166	1.000	-.342	-.023
	TD %	-.306	-.518	-.342	1.000	-.016
	Total Debit Reversal Count (In Mn)	.916	-.150	-.023	-.016	1.000
Sig. (1-tailed)	Total Volume (In Mn)	.	.342	.279	.016	.000
	Approved %	.342	.	.127	.000	.151
	BD %	.279	.127	.	.008	.439
	TD %	.016	.000	.008	.	.455
	Total Debit Reversal Count (In Mn)	.000	.151	.439	.455	.
N	Total Volume (In Mn)	49	49	49	49	49
	Approved %	49	49	49	49	49
	BD %	49	49	49	49	49
	TD %	49	49	49	49	49
	Total Debit Reversal Count (In Mn)	49	49	49	49	49

Table 7 Correlation

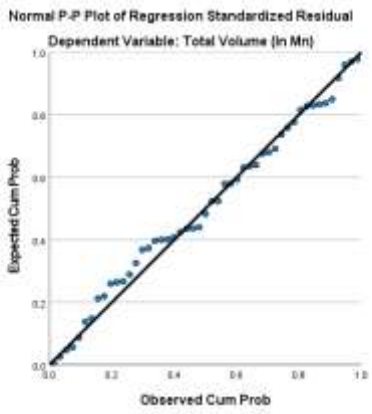

Figure 2 Correlation

V.Discussion

The findings indicate that the adoption of UPI in Indian states has been considerable but varies substantially in terms of volume. Similar reversals that occur with an increase in transaction volume are mainly attributable to scale and more absolute numbers. On the other hand, a measure of proportional reliability that can be captured through TD% is likely to be more correlated with longer usage (SBI Research, 2025; ICRIER, 2024). This strengthens the argument that the growth in adoption depends on quality and reliability of what lies beneath the digital payments framework and processing ecosystem, apart from access to it and awareness about it (BIS, 2019; ORF, 2024).

VI.Conclusion

The study recommends firm and prompt action by the Reserve Bank of India to improve UPI acceptance across all Indian states. A high volume of transactions leads to a large number of debit reversals due to scale effect and is not simply negative system performance (SBI Research, 2025). The key takeaway was the negative correlation between TD% and transaction volume implying reliability and lower transaction friction are consistent with higher usage levels (ICRIER, 2024; ORF, 2024). The approved percentage and the BD percentage explain considerably less variance in transaction volume in this dataset. This suggests that they do not carry as much predictive power compared to the numbers of reversals and the TD percentage. Strengthening infrastructure, improving quality of service, increasing merchant acceptance and enhancing reliability conditions will reduce state-wise adoption gaps and support a more equitable penetration of UPI.

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