International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 10 Issue: 01 | Jan - 2026 SJIF Rating: 8.586 ISSN: 2582-3930

Impact of Application and Time on UPI Transaction Volumes: A Two-Way ANOVA Analysis of Major UPI Platforms in India

Tirthankar Sutradhar
MBA (Marketing), Christ University, India
Email: tirthnkr@gmail.com

Abstract

The Unified Payments Interface (UPI) has become the backbone of India's digital payment ecosystem, processing billions of transactions monthly. Despite rapid adoption, transaction volumes remain unevenly distributed across applications, raising concerns related to market concentration and competition. This paper empirically examines whether UPI transaction volumes differ significantly across applications and time periods using monthly data from January 2020 to July 2025 published by the National Payments Corporation of India (NPCI). A Two-Way Analysis of Variance (ANOVA) without replication was employed, supported by regression analysis, independent samples t-tests, and chi-square tests. Results indicate that application choice has a highly significant effect on transaction volumes, while month-wise variation is statistically significant but comparatively weaker.

Keywords: UPI, Digital Payments, ANOVA, FinTech, NPCI, Market Concentration

1. Introduction

The Unified Payments Interface (UPI) is among the most successful real-time payment systems globally, enabling instant bank-to-bank transfers via mobile applications. Introduced by the National Payments Corporation of India (NPCI) in 2016, UPI integrates multiple bank accounts into a single platform, simplifying peer-to-peer and peer-to-merchant transactions. India now leads the world in real-time digital payments, with UPI processing over ten billion transactions per month.

Despite this growth, UPI participation across applications is highly unequal. Google Pay and PhonePe together control more than 80 percent of total transaction volumes, while Paytm and Amazon Pay hold relatively smaller shares. This concentration raises concerns regarding competition, innovation, and systemic risk.

This study applies statistical techniques to examine whether transaction volumes vary significantly across applications and months. Using a Two-Way ANOVA framework supplemented by regression and hypothesis testing, the research provides a quantitative assessment of platform dominance versus temporal variation in India's UPI ecosystem.

2. Industry Background

India's retail payment infrastructure is governed by NPCI, established in 2008 under the guidance of the Reserve Bank of India and the Indian Banks' Association. NPCI operates major payment systems including IMPS, RuPay, FASTag, and UPI.

UPI adoption has been driven by demonetization, rising smartphone penetration, affordable internet access, and policy initiatives promoting financial inclusion. While adoption is widespread, market concentration has increased, with a small number of applications accounting for most transactions. This structural imbalance motivates the need for empirical investigation into transaction volume disparities.

3. Literature Review

Existing literature identifies trust, security, ease of use, and performance expectancy as major determinants of UPI adoption. Studies have also emphasized the impact of promotional incentives and merchant acceptance on app preference. Several researchers have documented the emergence of a duopoly dominated by Google Pay and PhonePe.

However, few studies apply formal statistical models such as ANOVA to compare application-level transaction volumes while accounting for temporal variation. This study addresses this gap by employing multi-year transaction data and a quantitative analytical framework.

4. Data Description

The dataset was compiled from publicly available monthly UPI transaction reports published by NPCI. It covers the period from January 2020 to July 2025 and includes four major applications: Google Pay, PhonePe, Paytm, and Amazon Pay.

The primary variable analyzed is transaction volume (number of transactions). Transaction value was treated as a secondary variable and excluded from the ANOVA model.

Application	Count	Mean	Std	Min	Max
Amazon Pay	56	66.54	16.02	40.53	111.06
Google Pay	56	3412.47	1953.07	827.86	6922.92
Paytm	58	907.95	396.19	0.03	1442.58
PhonePe	56	4478.95	2516.86	902.03	8931.24

Table 1. Descriptive Statistics of Monthly UPI Transaction Volumes by Application

(Source: NPCI Monthly UPI Reports, 2020–2025)

5. Methodology

5.1 Two-Way ANOVA

A Two-Way ANOVA without replication was used to examine the effects of application and month on transaction volumes.

Model:

$$Y_{ij} = \mu + \alpha_i + \beta_j + \varepsilon_{ij}$$

where Y_{ij} denotes transaction volume, μ is the overall mean, α_i represents the application effect, β_j represents the month effect, and ε_{ij} is the error term. The significance level was set at 5%.

5.2 Additional Statistical Tests

To strengthen the analysis, the following tests were conducted:

- Multiple linear regression using log-transformed transaction volumes
- Independent samples t-test comparing Google Pay and PhonePe

- Chi-square test of independence to assess association between application and transaction volume categories

All analyses were performed using Microsoft Excel.

6. Results and Discussion

6.1 ANOVA Results

The ANOVA results indicate a highly significant application effect ($p < 0.001$), confirming that transaction volumes differ substantially across applications. Month-wise variation was also statistically significant ($p < 0.001$), though its effect size was considerably smaller.

6.2 Regression Results

The regression model achieved an R^2 of approximately 0.71, indicating that application and time variables explain a large proportion of variation in transaction volumes. Application dummy variables were highly significant, while most month coefficients were not.

6.3 t-Test Results

An independent samples t-test comparing Google Pay and PhonePe showed no statistically significant difference in mean log transaction volumes, reinforcing the presence of a duopoly.

6.4 Chi-Square Results

The chi-square test confirmed that transaction volumes are not independent of application, further highlighting structural dominance within the UPI ecosystem.

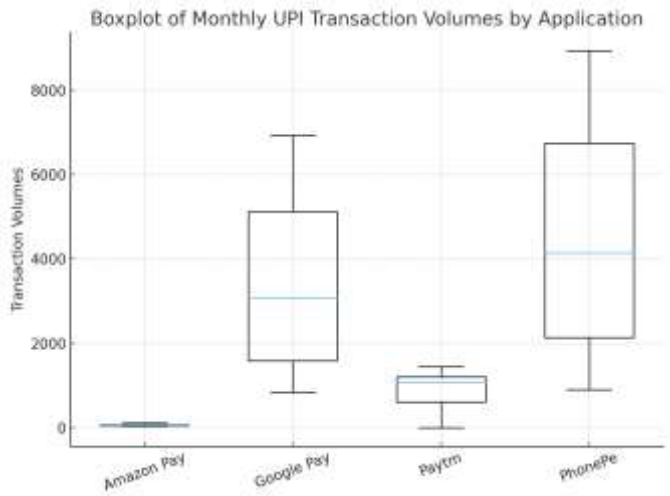

Figure 1. Boxplot of Monthly UPI Transaction Volumes by Application (2020-2025)

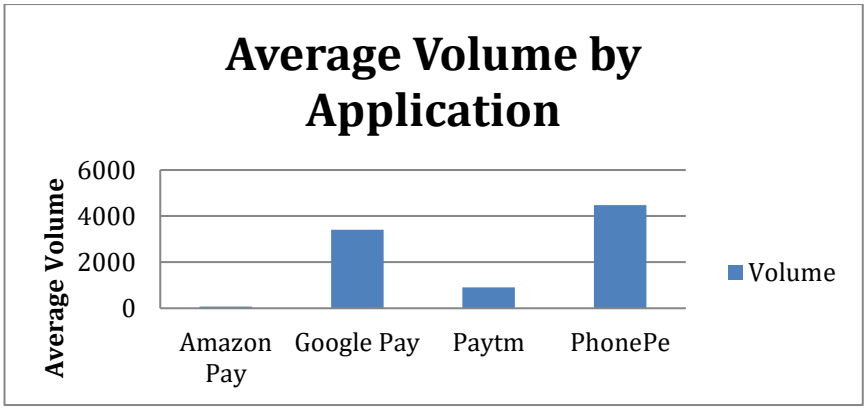

Figure 2. Average Monthly UPI Transaction Volumes by Application (2020-2025)

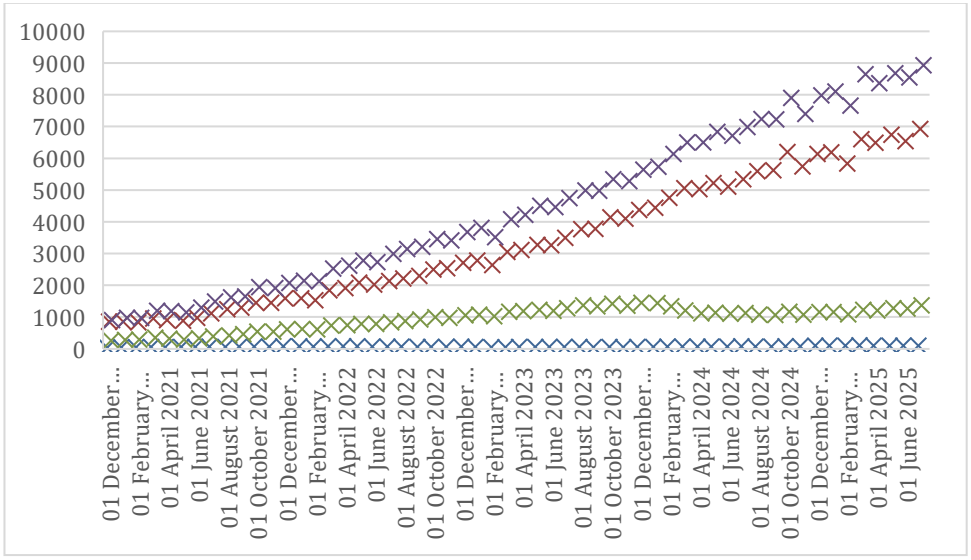

Figure 3: Annual UPI Transaction Volumes by Application (2020–2025)

7. Conclusion

The study demonstrates that UPI transaction volumes vary significantly across applications and months, with application choice exerting a much stronger influence than temporal variation. Google Pay and PhonePe dominate the market, while Paytm and Amazon Pay remain marginal. These findings have important implications for policymakers and industry stakeholders concerned with competition and systemic risk in digital payments.

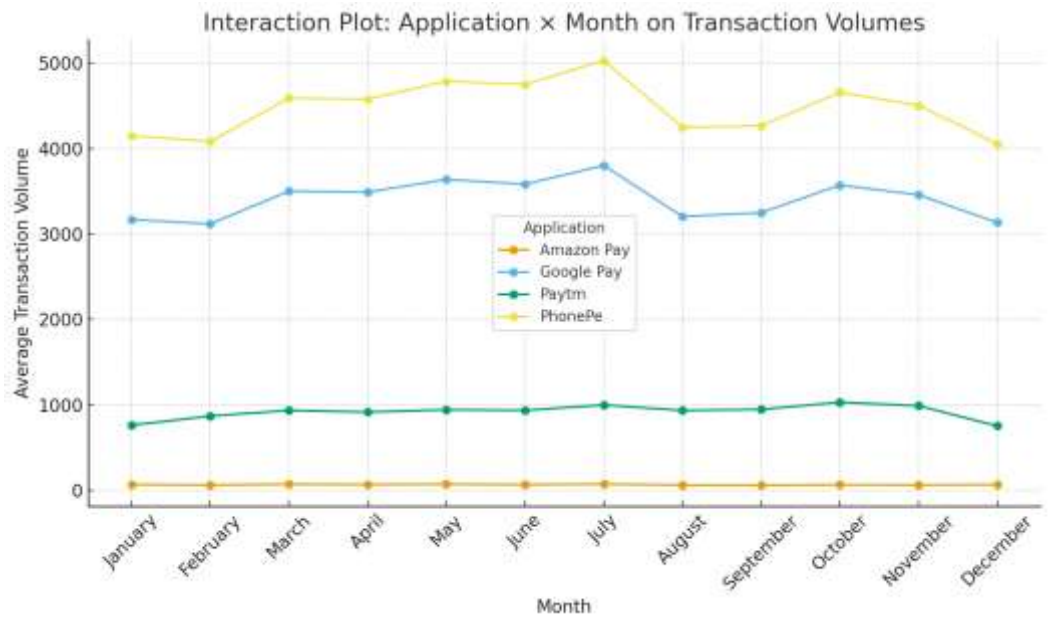

Figure 4: Interaction plot – application vs month

8. Limitations and Future Scope

The study relies on aggregated monthly data and does not account for demographic, regional, or promotional factors. Future research could incorporate micro-level transaction data, transaction values, or survey-based behavioral variables.

References:

Gupta, Ritu, and Shikha Arora. "Consumer Adoption of UPI in Urban India: The Role of Ease of Use, Security, and Trust." International Journal of Management Research, vol. 9, no. 2, 2021, pp. 45–58.

Rathore, Himanshu Singh. "Adoption of Digital Wallets and UPI in India: Impact on Financial Inclusion." International Journal of Advanced Research in Computer Science and Management Studies, vol. 4, no. 12, 2016, pp. 43–50.

Chaudhary, Neha, and Prateek Yadav. "Influence of Cashback and Promotional Offers on UPI App Usage: An Empirical Study." Journal of Business and Economic Development, vol. 7, no. 3, 2022, pp. 22–29.

Kumar, Ankit, and Rakesh Bhattacharya. "Market Concentration in the Indian UPI Ecosystem: Evidence of Duopoly." Asian Journal of Economics and Finance, vol. 2, no. 1, 2020, pp. 87–99.

Reserve Bank of India. Report on Trends and Progress of Banking in India 2023. RBI, 2023.

Mallik, P. K., et al., 2024. A Study on Consumer's Intention to Adopt Technology for UPI-based Payment Apps. *IJEMR*, [Volume(Issue)], pages.

Jacob, R. C., 2024. Understanding Factors Affecting UPI Adoption among Low-Income Indian Consumers. *Indian Journal of Entrepreneurship*, 14(1), pages. Indian Journal of Entrepreneurship

Dev, H., Gupta, R., Dharmavaram, S., Kumar, D., 2024. From Cash to Cashless: UPI's Impact on Spending Behavior Among Indian Users and Prototyping Financially Responsible Interfaces. *arXiv* preprint. arXiv

Vedala, N. S., 2025. Assessing Unified Payments Interface (UPI) adoption and utilization in India. *Palgrave Communications*, 12(1). IDEAS/RePEc+1

Razi-ur-Rahim, M., et al., 2024. Adoption of UPI among Indian users: Using extended meta-UTAUT model. *Journal of Payments & FinTech Research*, [volume(issue)], pages. ScienceDirect

"Comparative Study of PhonePe and Google Pay", IJSREM, 2025. IJSREM

"Comparative Study of Customer Satisfaction on Google Pay and PhonePe Mobile Apps", Ulavapalli, P., 2025. *Anveshak*, [volume(issue)], pages. iimpanveshak.in+1

"IJIRT, Case Study of Google Pay, PhonePe, Paytm", 2025. *IJIRT*, [volume(issue)], pages. ijirt.org

Wikipedia, *National Payments Corporation of India*, Wikimedia Foundation. Available at: https://en.wikipedia.org/wiki/National_Payments_Corporation_of_India *(Accessed 2nd Sep 2025)*

UPI Ecosystem Statistics." *NPCI – National Payments Corporation of India*, https://www.npci.org.in/what-we-do/upi/upi-ecosystem-statistics *(Accessed 4th Sep 2025)*