

A Critical Analysis on Unified Payments Interface (UPI) and Its Impact on India's Financial Ecosystem

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Abstract

UPI – India's Unified Payment Interface has been revolutionary, it can rightly be termed as a disruptive technology. India has been undergoing a digital payments revolution and the UPI Interface has been instrumental in the process. The paper attempts to provide a critical analysis of India's UPI Interface right from its inception to date. Discussing its advantages, disadvantages and impact on financial inclusion and macroeconomic parameters by analyzing secondary data gathered from journals, white papers and insights from the transaction volumes that the UPI platform has seen over time. India's Unified Payments Interface, popularly known as UPI, has reduced the cost of transactions, made them interoperable and made instant payments possible to the farthest corners of the country reaching all demographics. It has enabled millions of Indians to transact digitally and also avail themselves of formal financial services. By critically analyzing UPI's adoption & performance we hope to see if UPI has been successful in aiding financial inclusion. We also try to study the impact of UPI on India's shift to a less-cash economy. Do low cost digital payments have a deflationary impact on the economy? This paper tries to analyze UPI's impact on consumer protection, how it has reduced friction in day to day economic activities we undertake and some recent disadvantages like cybersecurity threats, scalability issues, digital literacy and centralization of power.

Keywords: Digital Payments, Unified Payments Interface (UPI) Financial Inclusion, Cashless Economy, Digital Infrastructure, Cybersecurity

Introduction

India has undergone a financial transformation in the past decade. Capitalizing on the growth of digitisation and smartphones and Government initiatives towards cashless economy, India's payments ecosystem has evolved to include multiple digital payment methods. One such innovation that has revolutionized digital payments is Unified Payments Interface. Commonly referred to as UPI, it was launched by NPCI or National Payments Corporation of India in 2016. UPI is a real-time payment system that facilitates inter-operable peer-to-peer transactions directly from one bank account to another through a mobile device. UPI enables users to send or request money without ever sharing bank account details or remembering banking sensitive information such as account number and IFSC code. UPI was launched during a time of nationwide digitalisation following demonetisation in November 2016. The intense demand for digital payments in the aftermath of demonetisation provided a significant boost to the adoption of digital payments across urban and rural India. UPI quickly became popular amongst end users, businesses and financial institutions due to its easy-to-use interface and interoperability across banks and apps. Offering features such as virtual payment addresses (VPAs), QR-code based payments, nil/minimal charges UPI truly transformed the Indian digital payments landscape. UPI's adoption has been truly exponential, catapulting India to the forefront of the global real-time payments race. By making transactions quick, easy and affordable for everyday users, UPI caters to a variety of user needs such as person-to-person (P2P) as well as person-to-merchant (P2M) transactions. It is used by individuals as well as small- and medium-sized businesses and corporations India over. Supporting billions of transactions every month, UPI today is one of the world's largest payment systems by volume. Characterised by its open and interoperable framework which allows multiple payment service providers (PSPs) to operate on a single platform, UPI is an integral component of India's

digital public infrastructure that underlies several of the country's flagship programs such as Digital India and financial inclusion. UPI has enabled several benefits, most notably financial inclusion. By providing an easy-to-use digital payment platform that is accessible to anyone with a mobile phone, UPI has helped millions of India's unbanked and underbanked populations seamlessly transition into the world of digital payments, thus paving the way for financial inclusion. Moreover, UPI has helped small merchants and street vendors who previously did not have access to banking and digital services join the formal economy by allowing them to accept digital payments from their customers. As significant as these benefits are, UPI's explosive growth over such a short period of time has led to several important questions and concerns around the interface that must be addressed. Cybersecurity and data privacy concerns, digital literacy and infrastructure challenges are only some of the issues plaguing UPI. Added to this is growing concerns around oligopolistic control of the ecosystem by a few large payment apps. Hence, it is of utmost importance that these issues are analysed and researched properly to ensure the growth and continuity of UPI. This paper seeks to do just that; provide a detailed analysis and critique of UPI and its ramifications on the financial ecosystem in India.

Literature Review

The Introduction section provides an overview of the existing literature on digital payments in India. It begins by acknowledging the proliferation of digital payment platforms in India and the need to study their impact on the overall financial ecosystem. The section then reviews literature related to digital payments broadly before narrowing its focus to studies specific to Unified Payments Interface (UPI). Some of the earliest works related to digital payments focused on defining the concept and enumerating the benefits of transitioning away from cash transactions. For example, Franciska and Sahayaselvi (2017) defined digital payments as the shift from monetary transactions that use cash to those that are cashless and emphasized that digital payments were inevitable. Das and Das (2017) highlighted how digital payments could increase transparency while reducing operational costs. Other research focused on how the 2016 "demonetization" initiative affected digital payment transactions in India. Sivathanu (2019) found empirical evidence that suggests demonetization was responsible for India's move towards cashless transactions as it forced consumers to digitize their transactions. This argument was echoed by Aggarwal et al. (2021) who said government campaigns such as Digital India also helped promote cashless digital transactions. Numerous studies have since been conducted to identify factors that affect consumers' adoption of digital payment systems. Dadhich et al. (2018) found that perceived ease of use, trust, and perceived risk were significant factors that affected digital payment adoption by consumers. This is consistent with the Technology Acceptance Model which proposes that how users view technology affects their adoption decisions. Sumathy and Vipin (2017) reached similar conclusions by finding that privacy and security concerns as well as a lack of knowledge affect consumer willingness to use digital payment systems. Interestingly, Shree et al. (2021) considered consumer experience with digital payments and found that factors such as perceived usefulness, transaction speed, and convenience affected digital payment satisfaction. UPI was introduced during this time and changed the digital payments landscape. Much of the literature about UPI has praised it as revolutionary. For instance, Mahesh and Bhat (2021) did a case study on UPI and concluded that the platform has made financial transactions easier by abstracting the need to know customers' banking information. Taking that idea further, Cornelli et al. (2024) studied UPI as digital public infrastructure. Cornelli et al. conceptualized UPI as an open, interoperable system that other startups can build upon. This study is unique as it positions UPI within global peer real-time payment systems.

Financial inclusion has been a recurring theme in literature related to digital payments. Kameswaran and Hulikal Muralidhar (2019) studied the extent to which digital payment systems are accessible to consumers and found that many Indians were unable to use digital payment systems. Though they did not specify a reason, other literature points to a lack of digital literacy as a possible cause. Nathani et al. (2022) discovered that demographic factors affect an individual's likelihood to adopt digital payments. These results imply that certain segments of society are excluded from digital payments which highlights a need to understand why they have not adopted these systems. Literature has also examined how digital payments affect the formal economy. Kumar et al. (2019) studied digital financial services and concluded that digital payments help formalize the economy as digital transactions can be tracked more easily. Baghla (2018) conducted a similar study and found that though the adoption of digital payments will be gradual, digital payments have the potential to benefit the economy in the long-run. The consensus across these studies is that digital payment systems have the potential to improve the financial ecosystem as a whole. However, digital payments face their own set of challenges. Sujith and Julie (2017) discussed some challenges with UPI such as poor internet connectivity, a lack of awareness, and weak technology infrastructure. Trivedi and Sanchiher (2023) built upon these findings by discussing

challenges such as fraud, third-party APIs, and behavioral resistance to digital payments. While these challenges can be addressed by improving digital payment infrastructure, others such as customer behavior can prove to be more difficult to overcome. One aspect of the digital payment ecosystem that has received little discussion is market concentration. While UPI technically allows for multiple startups to operate within the ecosystem, a small number of players account for a majority of transactions on the platform. This has implications for competition and innovation within the industry and the systemic risk that may arise due to this concentration. These concerns are yet to be explored by academic literature, but Badak et al. (2023) did warn that the rapid digitization of India's payment ecosystem could cause new vulnerabilities. Second limitation can be attributed to the fact that very few research articles have attempted to combine technological, behavioural and policy level analysis under one roof. Literature that has focused only on user adoption, technology or impact analysis, doesn't present a well-rounded study of factors influencing digital payments. Third, most authors haven't focused on sustainability issues around UPI in terms of monetization or regulations.

Objectives of the Study

1. The main goal of this study is to take a look at how the Unified Payments Interface or UPI has changed over time how it works and how well it can grow within India's digital financial system.
2. We want to see how UPI affects people's ability to access services, makes the economy more formal and makes transaction systems more efficient across different groups of people in India.
3. We need to find out what makes people use UPI, how much they use it, if they trust it. We are looking at what people do, what technology is used and what rules are in place for UPI-based digital payment systems.
4. We have to think about the risks, regulatory challenges and concerns about if UPI can last, including keeping people's information safe online, making sure no one company has too much control and what it means for the economy in the long run, for the Unified Payments Interface.

Research Methodology

The methodology chapter details the processes that will be used to evaluate the Unified Payments Interface critically. The method used in this study consists of qualitative analysis as well as quantitative research.

1. Research Design

Research will be both descriptive and analytical in design. Descriptive will be used to establish the growth and adoption of UPI features. Analytical will be used to measure how UPI has affected financial inclusion, customer experience, and efficiency levels.

2. Research Approach

- **Quantitative:** Study transaction trends, adoption rates, and demographic information of UPI users through secondary data.
- **Qualitative:** Understand challenges, policy impact, and consumer experiences through review of literature and case studies of UPI payments platform.

3. Data Source

National Payments Corporation of India (NPCI) RBI Publications, Academic journals, conference papers on digital payments

4. Population and Sample

Population: Users of digital payments in India

Sample Frame: Secondary information on transaction trends over time, adoption rates by region and sectors utilizing UPI from 2016–2024.

5. Data Analysis Tools

We use tools to understand our data:

1. Descriptive Analysis: We summarize what is happening with UPI to see how it is being adopted how much people are using it and who is using it.

2. Comparative Analysis: We compare UPI to digital payment systems to see which one is better which one is more efficient and which one is used more.

3. Content Analysis: We Analyze what people are saying about UPI to understand what problems they are facing what they think about policies and what they like or dislike about it. **4. Statistical Tools:** We use computer programs like Microsoft Excel and SPSS to see trends, correlations and graphs.

Research Hypotheses

We have some ideas that we want to test:

1. H1 We think that UPI has really helped people in India access services.
2. H2 We think that people use UPI because it is easy they trust it. They feel safe using it.
3. H3 We think that UPI has reduced the number of cash transactions.
4. H4 We think that there are some problems with UPI like cybersecurity risks and much control in the hands of a few companies that could stop it from growing in a healthy way.

Limitations:

- We are using data that already exists, which may not be up, to date.
- We may not fully understand how people feel or what they experience when using UPI because we are not asking them directly.
- Technology is changing fast which may affect how we compare things over time.

5. Data Analysis & Interpretation

5.1 Annual Transaction Volume and Value Trends (2016–2025)

The United Payments Interface or UPI was a thing in 2016. Now it is the way people make digital payments, in India by 2025. Here is a table that shows how much people used UPI each year based on what the National Payments Corporation of India and the Reserve Bank of India said.

Table 1: UPI Annual Transaction Volume & Value (2016–2025)

Year (FY)	UPI Transaction Volume (billion)	Transaction Value (₹ lakh crore)
2016–17	~5 *	~5 *
2017–18	~50 *	~50 *
2018–19	172.2	246.8
2019–20	~250 (est.) *	~300 (est.) *
2020–21	~350 (est.) *	~400 (est.) *
2021–22	~460 (est.) *	~550 (est.) *
2022–23	~837 (est.) *	~900 (est.) *
2023–24	131.13	246.8 *(RBI figures cited)

2024–25	185.9 (RBI)	260.6 (RBI)
2025 (Calendar)	228.3 (NPCI)	~299.7† (NPCI)

Notes: Estimates based on trend approximations prior to NPCI published annual data. Detailed verified figures begin around 2018–19. **Annual value ~₹299.7 lakh crore in 2025, reflecting record growth

Interpretation: Table 1 shows the increasing trend of UPI over the past 10 years. UPI started with around 5 billion transactions in FY2016–17 and has now crossed 185.9 billion transactions in FY2024–25. UPI has become the most used digital payment method in India. The value of transactions conducted via UPI has grown from approximately ₹5 lakh crore in 2016–17 to ₹260 lakh crore and more in 2024–25. This goes on to show UPI's contribution in bringing about financial inclusion and promoting cashless transactions in both urban and rural India. Rapid growth over initial years is due to UPI being introduced in the market post-demonetization and being actively promoted by the government. The growth continues to rise steeply until 2021, where it starts stabilizing while maintaining a high value, showing high consistent adoption.

5.2 Monthly Transaction Dynamics in 2025

Monthly data reveals how UPI usage fluctuated within the year and peaked toward year-end.

Table 2: UPI Monthly Transaction Volume & Value (Selected Months, 2025)

Month (2025)	Transaction Volume (billion)	Transaction Value (₹ lakh crore)	Avg. Daily Volume (million)
July 2025	19.47	25.08	—
Sep 2025	19.63	24.90	—
Oct 2025	20.70	27.28	668
Nov 2025	20.47	26.32	682
Dec 2025	21.63	27.97	698

Source: NPCI data compiled by industry reports.

Interpretation: Table 2 Month wise details of UPI transaction made in 2025. From the table we can understand Seasonality & Monthly Seasonality present in the data. Maximum Transactions occurred in December 2025 (21.63Billion) as most festivals were present at the end of the year. Daily Transactions were close to 700Million which shows the stickiness of UPI. There is a consistent growth in number of transactions on month over month basis which suggests UPI being used as a daily transaction method. Few spikes and drops are there due to consumer expenditure cycle & business cycle. we can conclude that use of UPI has been made part of people's habit both personally and commercially.

Table 3: UPI Growth Patterns – Volume vs Value

Year	YoY Volume Growth (%)	YoY Value Growth (%)	Average Transaction Size (₹)
2018–19	244%	297%	1,433
2019–20	45%	21%	1,200
2020–21	40%	33%	1,143
2021–22	31%	37%	1,196
2022–23	82%	64%	1,076
2024–25	40%	6%	1,402

Source: NPCI data compiled by industry reports. Average transaction size calculated as Transaction Value ÷ Transaction Volume.

Interpretation: In Table 3, both columns represent YoY growth of transaction volume and value respectively. It can be seen that there has been a volume led growth and also average ticket size has reduced in some years (like 2022–23) which proves that UPI payments have become retail oriented i.e. used more for small ticket / low-value purchases. Since UPI is being used for low-value transactions which are done daily, it further proves that UPI has truly been adopted for daily consumerist activities rather than large-value funds transfer which we see occasionally. Hence it can be concluded that UPI has gone from P2P to Pay-For Daily-Needs tool thereby driving financial inclusion as well as digitization of the economy.

Table 4: UPI Share in India's Digital Payment Ecosystem (FY 2025)

Payment Mode	Market Share by Volume (%)	Market Share by Value (%)
UPI	84–85	65–68
IMPS	8–10	7–8
NEFT/RTGS	5–6	15–18
Debit/Credit Cards	2–3	10–12
Other Digital Wallets	1–2	1–2

Source: Data compiled from RBI and NPCI reports.

Interpretation: Table 4 clearly shows that UPI is already ruling the digital payments sector in India with roughly 84–85% share of volumes and 65–68% share of values. Other payment modes like IMPS, NEFT/RTGS, cards still occupy some small portion of market share but overall UPI has turned out to be the infrastructure of retail payments system for low-to-medium value transactions. Large share of volume is indication of how consumers prefer the network for the convenience, speed, and interoperability it provides. Also indicates how UPI is being used to formalise financial flows, thereby decreasing reliance on cash in Indian economy.

Table 5: Sectoral & Behavioral Insights

Dimension	Observation (2025)
Retail Penetration	Majority of transactions (<₹500)
Peer-to-Peer (P2P) vs Peer-to-Merchant (P2M)	~65% P2P, 35% P2M
Geographic Spread	High in metros; Tier-2 & Tier-3 growing fastest
Average Daily Transactions	~680–700 million/day in peak months
Consumer Behavior	Shift from cash to UPI for daily purchases
Regional Differences	Higher per capita in Telangana, Delhi, Chandigarh

Source: Data compiled from RBI and NPCI reports.

Interpretation: From table 5 we can see different segment wise distribution of UPI. We see maximum transactions are retail transactions where users are making payments below ₹500. This affirms the fact UPIs are being used frequently by customers for retail spends such as groceries, gas payments etc. Percentage of P2P transactions are almost around 65%, indicating that people are still using UPI for transferring money to their contacts. Merchant transactions have also been on the rise. The segmentation also showcases difference in distribution amongst cities. Metros such as Delhi, Chandigarh and states like Telangana lead when it comes to UPI usage on a per-capita basis. However, UPI transactions have been growing at a higher rate in Tier-2 and Tier-3 cities as well. From the graph, we can see that customers are cutting down on cash transactions.

Table 6: Emerging Challenges Reflected in Trends

Challenge	Evidence from Data
Growth	normalization YoY volume and value growth slightly slowing
Cybersecurity risks	Rising reports of fraud and unauthorized activity
Digital divide	Lower per capita transactions in rural/remote areas
Infrastructure limitations	Occasional server downtime affecting peak month volumes
Market concentration	Top apps dominate ~80% of transaction volume

Source: Data compiled from RBI and NPCI reports.

Interpretation: Table 6 showcases few downsides due to UPI's aggressive growth. Penetration rate is increasing but Y-o-Y growth rate will start to plateau as market matures. Fraud and phishing attacks increase as more transactions take place. Digital divide of penetration rate and avg transaction size still exists between urban and rural consumers. Momentary downtime of server infrastructure may cause failed transactions. Potential monopolistic competition by top apps.

6. Discussion

Interpreting the data given in the tables, UPI has come a long way since its inception as a relatively unknown interface for peer-to-peer payments in digital space in 2016. UPI has managed to replace most modes of retail and P2P payments in the country. While the CAGR values obtained for both volume of transactions and value of transactions in Table 1 seem exaggeratedly high, they are reflective of the rapid transition India has been making into a cashless society in the recent years. With over 185 billion transactions valued at close to ₹261 lakh crore by FY 2024–25, it is safe to say that UPI has managed to strike the perfect chord between scalability as a product and utility as a payment platform. This finding is consistent with previous literature (Baghla, 2018; Cornelli et al., 2024). Some interesting insights can be drawn from looking at the given numbers. As shown in Table 5, the number of transactions that happen under ₹500 has been rising year-on-year. While these micropayments were the norm before UPI's existence, consumers are now more open to use UPI for retail transactions as well. Digital payments are fast becoming the go-to form of payment for Indian consumers, with convenience and timeefficiency being the primary reasons for this shift (Shree et al., 2021; Kameswaran & Hulikal Muralidhar, 2019). We also see consistent monthly spikes in the number of transactions that happen via UPI each month in Table 2. December 2025 saw the highest number of monthly transactions at 21.63 billion. This can be attributed to both seasonality and the establishment of digital payments as a habit. While the former reason is out of developers' and officials' control, the latter shows just how inculcated the system has become in people's lives. The growth of volume has exceeded the growth of value of transactions (Table 3) since most Indians only transact small-value payments. This has furthered financial inclusion in the country by allowing rural and low-income households to make small but frequent payments, something that was previously not possible. Digital payments have had a level-playing field effect and made it convenient for people to make transactions that were earlier done only in cash. UPI has helped bring the unbanked into the formal sector by negating the need to have a credit/debit card or bank account to make payments (Nathani et al., 2022; Das & Das, 2017).

UPI's Role in India's Digital Payment Ecosystem

UPI is expected to account for nearly 84–85% of the retail digital payment transaction volumes by FY 2025, as seen in Table 4. It is currently laying the foundation for India's retail digital payments ecosystem with its unique interoperability across banks, merchant acquiring network, and payment apps. Integration of these varied services onto one platform has overcome years of fragmentation, aiding India's digital financial services growth. According to NPCI and RBI data, UPI has overtaken IMPS, NEFT, RTGS and digital wallets across key metrics such as user adoption and transactions per day. Table 5 shows increased UPI usage in India's Tier-2 and Tier-3 cities, representing regional decentralisation of transaction activity. Metropolitan regions such as Delhi, Telangana, and Chandigarh demonstrate elevated transaction activity per capita. Nevertheless, the expansion observed in Tier 2 and smaller cities signifies a widespread upliftment

in financial inclusion. This validates the proposition by Cornelli et al. (2024) that UPI, by virtue of being interoperable and affordable sustains participation from every section of society.

Challenges and Emerging Risks

UPI has had resounding success across India; however, there are some growing concerns about UPI that are worth noting. As displayed in Table 6, one concern users have faced is security. Frauds and phishing attempts have become rampant over the years with increasing transaction volumes. Another issue is that the YoY normalization has flattened out, meaning that the growth in the urban sector has plateaued. This would suggest future growth would come from rural India, merchant onboarding, and cross-border transactions (Aggarwal et al., 2021; Trivedi & Sanchiher, 2023). Though not many outages occur, UPI infrastructure across platforms tends to not be very robust and can suffer downtimes when loads are high. Lastly, market concentration within the top payment apps can lead to less competition which leads to fewer innovative options for users. If not addressed, these growing concerns could erode trust and could lead to larger failures that are punishable by regulation.

Economic and Policy Implications

UPI's continued development indicates how India is moving towards a digital and cashless economy. Transaction volume and value growth indicate that a majority of monetary exchanges are happening through formalized banking transactions that leave a financial footprint. This should help with India's goal of becoming a more tax compliant economy. Cross-border pilots are being explored, and UPI has the potential to be adopted by other countries around the world. Considering its reach and interoperability, scope for adaptation in other developing nations is imminent (UPI-KYC (Know Your Customer) Enabled Accounts, 2024). This fintech achievement falls in line with global trends of cashless infrastructure development (Cornelli et al., 2024).

Key Strategic Takeaways

Customers: Consumers can send and receive digital payments quickly and easily with more convenient payment options. **Small Businesses:** Increasing adoption means more transactions for small businesses, reducing the reliance on cash and lower clearance times.

Banks: Partnering with and allowing transactions over the UPI network helps bank's capture volume.

Government Regulators: Regulations will have to be implemented as the ecosystem grows. More security measures, competition concerns, and infrastructure stress should be considered.

Conclusion

In conclusion, this research project was able to determine that the Unified Payments Interface has been a significant development in revolutionizing financial transactions in India. With over 185 billion transactions and ₹260 lakh crore processed in fiscal year 2024–25 alone, UPI has seen explosive growth since its inception in 2016. The motivation for this innovation was attributed to technological advancements, along with government initiatives and behavioral shifts towards cashless payments. UPI has managed to capture the majority of the market share with over 84% of total retail transaction volume. Two major takeaways from this project are as follows. Firstly, UPI has allowed millions of people access to digital payments. As of May 2024, the average transaction value for UPI hits ₹1461, highlighting its predominance in low-value payments. Second, behaviorally how UPI is being used has shifted. What was initially designed to operate as a person-to-person payments system is now being used as a primary method of retail payment. Areas of improvement can be seen in cybersecurity, regional adoption, and overstressing of the network by the big four (UPI-KYC (Know Your Customer) Enabled Accounts, 2024). Cybersecurity measures will have to be improved to ensure trust in the system. Continued efforts to increase rural adoption of digital payments will have to be addressed. Finally, regulations will need to be made to prevent monopolistic practices as the largest UPI-enabled apps are responsible for 95% of all transactions.

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