

Research Article

Evaluating UPI's Role in Advancing Financial Inclusion and MSMEs' Development in India

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Abstract

In 2016, the Indian government took a very firm stance on the black money market, which was followed by demonetization. Afterward, the government realized that the economy would benefit more from digital transactions and plastic money, considering Singapore as a reference. People were struggling to meet their basic needs; consequently, the government understood the importance of stabilizing the money supply, leading to the emergence of digital transactions and UPI. Objective: to investigate the dynamics of UPI transactions post-2020 and how UPI has been very critical in making financial inclusion a possibility in the Indian scenario. The paper also evaluates the role of UPI in MSMEs growth and development. Methods: Information about UPI transactions, including their volume and value, the number of active users, and their geographic distribution, was gathered using the NPCI dataset, on which we ran a linear regression model. For MSMEs, we saw a span of the last 4 years through the government's annual report. Findings: Linear regression showed time predicts UPI transaction volume ($R^2 = 0.97$, $p < 0.001$) and value ($R^2 = 0.837$, $p < 0.001$), indicating that UPI adoption growth explains much of the rise in digital activity. The compound annual growth rate of UPI transaction value was about 19.75% from 2020 to 2024. The MSME transaction data from 2020-21 to 2023-24 shows a trend of an increase in the number and value of transactions, with the vast majority of them being carried out online during this time.

Keywords

Unified Payment Interface, MSME, Digital Transaction, Economic Growth, Financial Inclusion

1. Introduction

The global drive towards digital transformation has profoundly reshaped economic landscapes, placing paramount importance on the development of efficient, secure, and universally accessible payment systems. Within this dynamic environment, the Unified Payment Interface, a groundbreaking innovation by the National Payments Corporation of India, stands as a premier example of a real-time digital payment solution. Widely acknowledged for its role in revolutionizing inter-bank peer-to-peer (P2P) and

person-to-merchant (P2M) transactions, UPI has rapidly solidified its position as a critical catalyst for digital financial inclusion and a modernizing force within payment infrastructures, particularly evident in emerging economies.

India's digital payments system has undergone remarkable advancements, primarily driven by technological improvements and the visionary efforts of the Reserve Bank of India (RBI). A pivotal moment in this evolution occurred during the demonetization initiative in November 2016, when

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the Indian government implemented various measures to promote digital transactions. This shift notably transformed the number and value of payment systems, marking a significant turning point in the country's economic landscape [1]. Prime Minister Narendra Modi has been a strong advocate for enhancing cashless transactions as a critical component of the government's reform agenda post-demonetization, leading to substantial growth in digital payment methods [2].

The launch of the Unified Payments Interface (UPI) in 2016 represents a paradigm shift in payment technology, offering an interoperable platform that enables seamless transactions among various banking and financial institutions [3]. UPI's rapid adoption has transformed the way individuals and businesses conduct financial transactions, extending its impact beyond mere convenience to influencing macroeconomic factors such as financial inclusion and the effectiveness of monetary policy transmission [4].

Furthermore, Micro, Small, and Medium Enterprises (MSMEs) play a crucial role in India's economic and social development. Accounting for approximately 30% of the nation's GDP and providing employment to over 110 million people, the sector comprises around 6.33 crore MSMEs (Ministry of MSME, Annual Report 21-22). The ongoing wave of digitization has significantly benefited MSMEs, contributing positively to the broader Indian economy and highlighting the transformative power of digital advancements [5].

2. Literature Review

The convenience and affordability of digital financial services provide substantial benefits for those facing financial exclusion. In India, a large portion of the population, particularly individuals working in the informal sector, encounters such exclusion as noted by Jishajoseph & Varghese (2014) [6]. Additionally, research by Nandru et al. (2021) indicates that the digitization of financial services facilitates easier access for individuals to the formal financial sector, thereby enhancing their entry into this space.

According to Karmakar (2024), the emergence of UPI is inextricably linked to the larger conversation about financial inclusion, which aims to give underprivileged groups access to financial services and acts as a stimulant for economic growth by bringing more people into the official financial system [7]. With low transaction costs and a smartphone-centric interface, UPI extends financial inclusion and economic growth beyond urban centres to rural areas [8].

The introduction of UPI has significantly contributed to financial inclusion by integrating a larger segment of the population into the formal financial system. UPI has become an important driver of financial inclusion, a multifaceted concept that includes the availability and use of accessible and reasonably priced financial services, especially for marginalized and vulnerable groups, to enable their participation in the formal economy and promote equitable

growth [3]. Mehta (2025) also observed the drastically changed scene of financial inclusion in India after the spread of digital payments, especially via UPI [9].

Fahad and Shahid (2022) used the DOI theory components to explore participants' usage and recommendation intentions towards UPI via data collection using convenience sampling. One of the results of the study suggested that users saw comparative advantages of UPI over other payment systems, particularly cash payment systems, based on efficiency, convenience, and timely payment [10]. Dr Chatterjee and Roshna (2017) conducted an explorative study using government data and found that within few months after the launch of Pradhan Mantri Jan Dhan Yojana, on 28th August 2016, 19.72 crore bank accounts were opened with deposits worth Rs. 28699.65 crores, which created a fertile platform for the growth and proliferation of UPI among the masses [11]. The research by Duvendack et al. (2023) highlights how the Jan Dhan Yojana has significantly advanced digital financial inclusion in India by simplifying the process of opening bank accounts through biometric identification linked to mobile phone numbers [12]. Vidani (2024) notes that the user-friendly interface of the Unified Payments Interface (UPI) has played a crucial role in democratizing access to financial services, reaching even the most remote regions [13]. Furthermore, Santiso (2022) observes that this approach promotes transparency and reduces corruption, ensuring more effective distribution of social transfers [14]. Additionally, Buteau et al. (2021) emphasize the Indian government's commitment to Direct Benefit Transfers, which leverage digital platforms to directly deposit subsidies and benefits into beneficiaries' accounts, thus minimizing leakages and enhancing efficiency [15].

According to Kini and Basri (2022), the coronavirus pandemic has ushered in a new era of contactless mobile banking, significantly impacting the adoption of digital payment systems [16]. The increased reliance on digital platforms during the pandemic has further accelerated the use of the Unified Payments Interface (UPI). Windasari et al. (2022) highlight that both businesses and consumers are increasingly seeking contactless payment solutions to mitigate health risks [17]. A study by Shinki Pandey (2022) found that India's digital payment volume surged by an impressive 26.2 percent in 2020-21, following a remarkable 44.2 percent increase in the previous year [18]. Furthermore, Hanedar et al. (2023) observe that the integration of UPI with other digital initiatives, such as the Account Aggregator framework, has greatly improved access to financial services for millions of people and businesses [19]. Gochwal (2017) notes that UPI has simplified the payment process by eliminating the need for users to understand the complex payment information of all parties involved in a transaction [20]. In addition to having an effect on financial inclusion, UPI may have had an impact on how monetary policy is communicated in India, pointed out M et al. (2024) [21].

In India, digital payments have been revolutionized by the

Unified Payments Interface (UPI), which has drastically altered the nature of transactions. With over 9 billion transactions per month in 2023, there was an astounding 58% year-over-year increase [22]. As of 2023, Chopra and Gupta (2023) report that UPI has contributed to economic savings of approximately INR 5.5 lakh crore (\$67.07 billion) since its launch [23]. By bringing millions of previously unbanked and underbanked people into the formal financial system, UPI's easy-to-use accessibility has promoted economic participation and literacy recorded World Bank. The efficiency of monetary policy transmission is enhanced by increasing the reach and velocity of money through digital payment platforms like UPI. Despite these developments, UPI's multilingual support and user-friendly interfaces have made it easier to use. Digital literacy is still a barrier, though, especially in rural areas, which emphasizes the value of educational initiatives in raising awareness and encouraging adoption [21]. The growth of digital payments could face challenges due to digital illiteracy, inadequate internet connectivity in rural areas, and a lack of awareness among rural customers [24].

Research has shown that financial literacy enhances individuals' understanding of the various financial tools available to them, which allows them to make more informed and prudent financial decisions [25]. Furthermore, financial stability partially mediates the link between financial literacy and financial inclusion. Although financial inclusion is directly impacted by financial literacy, financial stability is necessary for its full impact to be realized. With a coefficient of 0.0996, financial stability has a significant indirect impact on financial inclusion through literacy [26]. Furthermore, the work of Paramasivan and Ganeshkumar (2013) and Vashisht and Wadhwa (2013) emphasizes that financial inclusion is a crucial element of economic development, ensuring that both individuals and businesses have access to, and can effectively utilize, a wide range of financial services [27, 28]. Moreover, Kumar and Shobana pointed that the rise in digital payment adoption offers central banks improved and up-to-date data on economic transactions, which facilitates the more efficient application of monetary policy and enhances economic management [29].

Research conducted by Rangrajan (2008) emphasizes that financial inclusion guarantees the underprivileged segments of society access to adequate credit and financial services at a reasonable cost [30]. According to the studies by Ambarkhane et al. (2016) and Sarma (2008), the financial inclusion index serves as a key tool to assess the level of financial inclusion [31, 32].

Muharsito and Muharam (2023) found that expanding financial inclusion plays a significant role in alleviating poverty by promoting savings, investments, and access to credit for low-income households and small businesses [33]. Singh and Pushkar (2019) argue that financial inclusion is critical to a country's economic progress, allowing individuals and small businesses to invest in their futures and contribute to overall prosperity [34].

Additionally, Reddy (2016) points out that while financial inclusion is essential for promoting inclusive growth, challenges such as inadequate financial literacy and ineffective credit delivery mechanisms continue to impede progress [35]. Boston Consultancy Group (2016) studied the future of digital payments by 2020. According to the study, the digital payment system in India displays significant growth potential due to global changes that are also occurring within the Indian context. The main reasons behind this potential growth include the technological revolution that has made digitization easier, the entry of various non-banking institutions offering payment services, and the increasing consumer awareness and adaptation to one-touch payment systems [36].

Bhatia, Kumar, and Agarwal (2016) researched the contemporary study of microfinance, which has become a primary medium for extending financial services to unbanked populations through initiatives like the Jan Dhan Yojana in India [37]. Financial inclusion has emerged as a major policy objective for the country's development. Further research by Rastogi et al. (2021) found that the Pradhan Mantri Jan Dhan Yojana (PMJDY) and the Unified Payments Interface (UPI) play crucial roles in promoting financial inclusion, contributing to overall economic growth [38].

In addition to financial inclusion, the macroeconomic impact of UPI potentially extends to the realm of monetary policy transmission. Traditional monetary policy transmission mechanisms, such as the interest rate and credit channels, may be influenced by the widespread adoption of digital payments. The efficacy of monetary policy relies on the seamless transmission of policy signals from the central bank to the broader economy, influencing borrowing costs, investment decisions, and aggregate demand. The adoption of UPI and other digital payment methods can potentially expedite and amplify these monetary policy impulses throughout the economy [39].

Digital payments can reduce transaction costs, improve price transparency, and facilitate the flow of information, enhancing economic actors' sensitivity to changes in monetary policy [40]. However, the increasing prevalence of digital payments could alter these dynamics, affecting the sensitivity of economic agents to policy interventions and the speed at which policy changes permeate through the financial system [41]. UPI's success is also attributed to its open-protocol architecture, which promotes interoperability among diverse stakeholders and encourages continuous innovation [42].

Research shows that the exponential surge in digital payment adoption, particularly accelerated by the COVID-19 pandemic, presents a unique opportunity to reassess and potentially recalibrate existing models of monetary policy transmission. This warrants further investigation into the nuanced effects on macroeconomic stability and financial system resilience [3, 19, 43]. Nayan Ambali and Mahesh Jaisingh (2021) explore UPI's effects on the Indian banking

system and financial inclusion, finding that UPI has boosted digital payment adoption, supporting financial inclusion in India [44].

Richa Chaturvedi and Sangeeta Sharma (2021) highlight that UPI enhances financial inclusion in rural India by facilitating transactions for people in remote areas, thus promoting digital financial services [45]. With the government's emphasis on a digital economy and the rising acceptance of UPI, India is set to emerge as a frontrunner in the digital payments arena. Looking ahead, UPI is anticipated to maintain its upward growth pattern with greater adoption, innovation, and expansion beyond borders [46].

Promoting financial inclusion should be fundamental to national and international policy initiatives to ensure that everyone is considered and to create opportunities for all [47]. UPI has fundamentally changed the landscape of digital payments in India, promoting financial inclusion, enhancing economic activities, and paving the way for a future without cash [48]. Narayanan et al. highlighted that the Reserve Bank of India (RBI) serves as the main regulatory body, establishing rules for transaction thresholds, data security, and handling disputes. Nevertheless, the open framework of UPI presents challenges, particularly concerning anti-money laundering (AML) measures and consumer protection [13].

Arvind Chaudhari and Deepak Chaudhari (2019) found in their research that customers generally hold a favorable view of UPI services and emphasized the connection between the respondents' education levels and their use of UPI services [49].

Garg and Panchal (2017) noted a strong preference for cash transactions, with merchants avoiding record-keeping to evade taxes and buyers finding cash more convenient. Despite recent increases in cashless transactions, a meaningful shift relies on awareness, technological advancements, and government intervention [50].

Founded by the Ministry of Electronics & IT (MeitY) and subsequently moved to the Department of Financial Services (DFS), the DIGIDHAN Mission has been a vital component of promoting digital payments in MSMEs. Digital payment transactions have increased dramatically since their inception, rising from 2,071 crore in FY2017-18 to 13,462 crore in FY2022-2023. This increase highlights the increasing acceptance and integration of digital payments throughout the nation, which is supported by a variety of payment methods such as IMPS, debit/credit cards, and BHIM-UPI, among others [51].

In a study on the adoption of digital financial services by rural populations, Gaurav Agrawal (2019) identifies the obstacles to financial inclusion as being low financial literacy, high service costs, and regional disparities [52].

Mahajan and Agarwal (2023) identified that the number of digital transactions in the MSME sector has grown significantly over the years, with a 41.33 percent increase from 2021-22 to 2022-23, indicating that digital is the way forward. Although there was a slight dip during the Covid

years, digital transactions have surged substantially since then [5].

3. Research Methods

3.1. Design of Research

In order to give a thorough analysis of UPI's contribution to the advancement of financial inclusion and the growth of rural inclusion MSMEs, this study uses a mixed-methods approach, combining quantitative and qualitative data.

Quantitative Research

1. Data Collection: Information about UPI transactions, including their volume and value, the number of active users, and their geographic distribution, was gathered using the NPCI dataset.
2. Data Analysis: To find trends and patterns in UPI usage, statistical methods, including linear regression analysis and time-series analysis, were used. Key measures of financial inclusion, including the rise in bank accounts, decline in cash transactions, and expansion of digital payments among MSMEs, were the focus of the examination.

3.2. Analysis of Data

Inferential Statistics: Using the sample data, inferential statistical techniques were applied to make inferences about the population. To ascertain the importance of the trends and connections that have been noticed, hypothesis testing was a part of this process.

4. Hypotheses

Based on the research questions and literature, the following hypotheses are formulated to evaluate the role of UPI in enhancing financial inclusion and MSME development in India:

H1: There is a statistically significant positive relationship between time and the average volume of UPI transactions per bank.

H0 (Null): Time has no effect on UPI transaction volume per bank.

H1 (Alternative): Time has a significant positive effect on UPI transaction volume per bank.

The null hypothesis is rejected since $p\text{-value} (0.000) < 0.05$.

H2: There is a statistically significant positive relationship between time and the average value of UPI transactions per bank.

H0: Time has no effect on UPI transaction value per bank.

H1: Time has a significant positive effect on UPI transaction value per bank.

The null hypothesis is rejected since $p\text{-value} (0.000) < 0.05$.

H3: UPI has contributed to increased digital transaction

volume and value in India over time (from 2020- 2024).

H0: There is no significant growth in digital transaction volume/value over time.

H1: There is a significant increasing trend in digital transaction volume/value, indicating deepening financial inclusion.

The null hypothesis is rejected since both p-values (0.000) < 0.05.

H4: UPI and MSME growth are positively correlated.

H0: There is no statistically significant correlation.

H1: There is a significant increasing trend in digital transaction volume/value, indicating deepening financial inclusion.

5. Findings

(i) NPCI data

Digital payment transactions have seen a steady yet significant increase due to the government's streamlined efforts and the involvement of stakeholders [5].

In this study, to analyze the impact of UPI in advancing financial inclusion, linear regressions were conducted between the time variable (measured in months, starting from January 2020 to June 2025) and both the average volume and value of UPI transactions per bank in India, obtained via the NPCI website.

Table 1. Regression Table of time and transaction volume obtained through Stata.

Source	SS	df	MS		Number of obs	66
Model	23234.5515	1	23234.5515		F(1,64)	2071.19
Residual	717.94854	64	11.2179459		Prob > F	0.0000
Total	23952.5	65	368.5		R-squared	0.97
					Adj R-Squared	0.9696
					Root MSE	3.3493
month	Coef.	Std. Err.	t	P > t	[95% Conf. Interval]	
perbank	3.176047	0.0697873	45.51	0.000	3.036631	3.315464
_cons	-23.89451	1.326807	-18.01	0.000	-26.54512	-21.24391

For transaction volume per bank, the regression produced an R-squared value of 0.97 and a p-value of 0.00. This indicates an exceptionally strong and statistically significant linear relationship, with 97% of the variance in transaction volume explained by the passage of time.

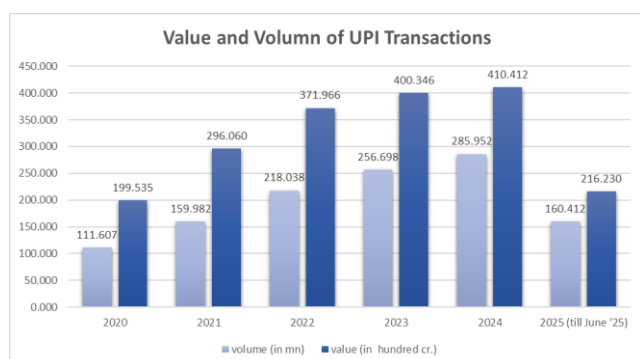
Table 2. Regression Table of time and transaction value obtained through Stata.

Source	SS	df	MS		Number of obs	66
Model	20051.8771	1	20051.8771		F(1,64)	329
Residual	3900.62288	64	60.9472325		Prob > F	0.0000
Total	23952.5	65	368.5		R-squared	0.8372
					Adj R-Squared	0.8346
					Root MSE	7.8069
month	Coef.	Std. Err.	t	P > t	[95% Conf. Interval]	
perbankvalue	0.0248299	0.0013689	18.14	0.000	0.0220952	0.0275646
_cons	-37.775	4.04529	-9.34	0.000	-45.85639	-29.6936

Source: NCPI

For transaction value per bank, the analysis yielded an R-squared value of 0.8372 and a p-value of 0.0000,

demonstrating that 84% of the variance in average transaction value is similarly accounted for by time and that this association is highly statistically significant.



Source: NCPI

Figure 1. Value and Volume of UPI transactions from year 2020 to 2025 (June)

$$\text{CAGR} = ((\text{Ending Value} / \text{Starting Value})^{(1/n)}) - 1$$

$$\text{CAGR} = 19.7568\%$$

To examine whether UPI has contributed to financial inclusion, a trend analysis was conducted on UPI transaction volume and value from 2020 to 2025. The results show a consistent and statistically significant upward trend in both metrics over the period.

Linear regression analysis revealed that time strongly predicts UPI transaction volume ($R^2 = 0.97$, $p < 0.001$) and value ($R^2 = 0.837$, $p < 0.001$), demonstrating that the passage of time—representing the expansion of UPI adoption—accounts for a major portion of the increase in digital financial activity. The compound annual growth rate of UPI transaction value stood at approximately 19.75% over 2020-2024.

These results indicate deeper penetration and adoption of digital payments, thereby supporting the hypothesis that UPI has played a central role in advancing financial inclusion in India.

(ii) MSME

Table 3. Digital Transaction for the Ministry of MSME and its attached Offices (from 2020-21 to 2023-24)

Years	Total		By Digital Means		Percentages	
	No. of transactions	Value in Rupees (In crore)	No. of transactions	Value in Rupees (In crore)	No. of Digital Transactions (in %)	Value of Digital Transactions (in %)
2020-21	3861529	18284.67	3376621	17946.58	90.19	92.02
2021-22	4135997	27292.98	3611362	26891.22	87.32	98.53
2022-23	5758260	20595.27	5104276	20115.15	88.64	97.67
2023-24	16620118	98,396.45	14486733	84046.984	87.16	85.42

Source: Annual Reports (from 2020-21 to 2023-24) of the Ministry of MSME

The MSME transaction data from 2020-21 to 2023-24 demonstrates a dramatic surge in both the volume and value of transactions, with a substantial majority being conducted digitally throughout the period. This trend reflects the critical role of UPI and digital payments in promoting financial inclusion within the MSME sector, facilitating access to formal finance, and supporting MSME growth. The evidence places digital platforms as essential tools in processing financial services and accelerating the expansion of micro, small, and medium enterprises in India.

The total number of MSME transactions increased substantially from approximately 3.86 million in 2020-21 to over 16.6 million in 2023-24, reflecting more than fourfold

growth. The total value of transactions also grew, rising from ₹ 18,284.67 crore in 2020-21 to ₹ 98,396.45 crore in 2023-24, indicating more than a fivefold increase.

Throughout this period, the overwhelming majority of transactions were conducted through digital means, with the share of digital transactions by number remaining consistently high—from 90.19% in 2020-21 to 87.16% in 2023-24—and by value ranging from 92.02% to 85.42%.

A slight dip in the percentage share of digital transaction value in the latest year can be observed; however, the absolute digital transaction values have continued to rise significantly, underscoring growing trust and reliance on digital payment solutions.

6. Implications

The consistently high R-square values and highly significant p-values for both volume and value clearly demonstrate that the number and value of UPI transactions handled by banks grew steadily and strongly over the study period. These simultaneous increases imply that the UPI system is becoming more popular for both small and large financial transactions. This is because more people trust and rely on it.

These trends are strong signs that financial inclusion is growing in India: more people and businesses are using UPI to access, use, and get value from modern banking and digital payment solutions. The system's growth, as seen in the rising number of transactions and values per bank, supports the enabling of broader participation in the formal financial system and fosters economic development.

Transitioning from this aggregate perspective to the MSME sector, analysis of annual report data for 2020-21 to 2023-24 underscores the widespread and intensifying integration of digital transactions—primarily enabled by UPI—among micro, small, and medium enterprises. More than 85% of MSME transactions, by both volume and value, have consistently been digital throughout the period, even as total activity has expanded. This pattern affirms that the digital infrastructure exemplified by UPI is not only accelerating MSMEs' access to financial services but is also empowering their operational flexibility, transparency, and growth potential.

7. Future Directions

For future directions, researchers can explore financial inclusion pre- and post-COVID, particularly in the rural or informal sector of the economy. Additionally, a sectoral analysis of how different schemes have impacted UPI or digital transactions in improving financial inclusion would be valuable. A sectoral analysis on the usage of UPI in different industries or verticals of India can also be conducted.

8. Conclusion

Since the introduction of digital transactions, particularly after demonetization, India has seen tremendous growth and movement towards a cashless economy. Among various methods of digital transactions, UPI is one of the biggest contributors. From the above study, a strong positive correlation is witnessed between UPI and financial inclusion in India. The CAGR of UPI transaction value recorded for the period 2020-2024 is around 19.75%. Furthermore, in the MSME sector, more than 85% of its transactions are via digital means, concluding it as a factor for advancement in this sector. The Indian government has taken various measures to further enhance the financial inclusion level

through digital transactions by various initiatives like the DigiDhan Mission or Pradhan Mantri JandDhan Yojana. The government should continue to support the cashless economy and work towards its improvement.

Abbreviations

AML	Anti-money Laundering
BHIM	Bharat Interface for Money
CAGR	Compound Annual Growth Rate
DOI	Digital Object Identifier
GDP	Gross Domestic Product
IMPS	Immediate Payment Service
MSME	Micro, Small, and Medium Enterprises
NPCI	National Payments Corporation of India
P2M	Person-to-Merchant
P2P	Peer-to-peer
PMJDY	Pradhan Mantri Jan Dhan Yojana
RBI	Reserve Bank of India
UPI	Unified Payment Interface

Author Contributions

Kanak Sharma is the sole author. The author read and approved the final manuscript.

Conflicts of Interest

The author declares no conflicts of interest.

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