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Digital Payment Patterns in India: A Cross-Sectional Study of Credit Cards, Debit Cards, and Unified Payments Interface (UPI) Trends

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Abstract

Digital payment systems have emerged as a critical enabler of financial inclusion in India. In recent years, credit cards have grown significantly, while debit cards have lost traction for routine transactions. Unified Payments Interface (UPI) has played a pivotal role as a preferred payment method for low-value and high-value transactions, underscoring its versatility and convenience. These evolving patterns have wider implications for business and economic performance. Time series analysis offers valuable insights into how digital payment behaviors not only mirror but also influence broader economic activity.

Objective: The objective of this study is to examine shifting payment preferences in India over 20 months, beginning from January 2023 to August 2024, focusing on the growth trajectory of credit and debit cards as well as the competitive landscape of prominent UPI Apps to offer a comprehensive view of both short-term trends and longer-term shifts in digital payment behavior.

Theoretical Framework: This study examines the evolution of digital payment systems in India through the lens of Diffusion of Innovation (DOI) Theory and Network Externalities (NE) Theory. Rogers' DOI theory suggests that innovations diffuse differently depending on the adopter group and setting, while NE theory emphasizes that banks offering bundled services encourage users to adopt and benefit.

Method: The research was conducted through a cross-sectional quantitative design using publicly available secondary data from the Reserve Bank of India and the National Payment Corporation of India. A time-series sampling approach was used to observe Automated Teller Machine/Point of Sale/Cash Statistics every month throughout the study period. Descriptive statistics and visual trend analysis were employed to assess growth patterns across the three key categories. The average ticket size of leading UPI Apps was analyzed to understand their competitive positioning in the digital payments landscape. The Kruskal-Wallis test was used to draw inferences about significant variations in digital payment adoption across transaction categories.

Results and Discussion: There are no significant differences in the growth rates of transaction value across the six categories of digital payments during the chosen period, suggesting that uniform growth alone does not explain user preferences. UPI-based payments and related Apps have also seen a significant drop in average ticket size during the study horizon, highlighting smartphone ownership as a key enabler of digital payments, even among low-income groups.

Research Implications: Familiarity with credit-based transactions may foster greater financial awareness and promote more responsible money management practices among consumers. This study expands the theory of digital payment adoption by showing that it is not confined to high-income or well-educated households, mere smartphone ownership and awareness of the platform (e.g., UPI App) are substantial to drive financial inclusion. Financial institutions, policymakers, and businesses can use these findings to adapt to changing consumer preferences.

Originality/Value: By evaluating the performance of traditional card transactions alongside leading UPI-based applications, this paper provides valuable insights into the competitive dynamics shaping the digital payments ecosystem. FinTech companies can strategize their product offerings to cater to the changing needs of the market.

Categories: Banking and financial services, Digital business, Sustainable entrepreneurship
Keywords: digital payment, financial inclusion, upi payments, credit cards, debit cards, transactions

Introduction

The digital revolution has significantly expanded global access to financial services, reshaping how individuals conduct transactions, obtain credit, and manage their savings-according to the World Bank

Group President David Malpass. Digital payments, enabled by technologies such as online banking, mobile apps, and secure encryption, have replaced traditional cash transactions across various financial activities like online shopping, peer-to-peer transfers, interbank transfers, and bill payments (Forbes, 2024). Globally, digital payment solutions have seen a significant surge in adoption due to the ubiquity of smartphones and expanded Internet access (Kaur et al., 2020). The effective implementation and widespread adoption of digital payments rest on four foundational pillars: reliable power supply in both urban and rural areas, robust communication technology, efficient payment switches, and a secure identification system. Together, these elements facilitate greater access to financial services and have the potential to enhance consumer welfare (Khiaonarong and Goh, 2020). Digital payment adoption is influenced by economic facilitators like a tech-savvy younger population, technological progress, banking access, underserved credit regions, economic formalization, and growing per capita income (Digitalisation and Financial Innovation, 2024).

India's payments industry underwent a revolutionary shift primarily due to the JAM trinity: Jan Dhan, Aadhaar, and Mobile. The first component, the Financial Inclusion campaign by the Government of India initiated in 2014, brought a massive number of people into the formal banking system. This led to the opening of millions of bank accounts. Its success was bolstered by the Aadhaar scheme, which streamlined identity verification, and the simultaneous surge in smartphone adoption and mobile connectivity, all linked via e-Know Your Customer regulations (Ramesh et al., 2020). The mobile-app based real-time payment system-UPI has emerged as India's leading payment platform, handling more than 15 billion transactions monthly (November 2024). Key factors driving this growth include its open and flexible technology, which simplifies app creation and enables transactions across various providers. User convenience, free transactions, and mobile/QR code-based payments have also boosted adoption. Supported by private sector collaboration and effective regulation that tackles challenges, UPI has significantly advanced financial inclusion while safeguarding consumers and financial stability (Cornelli et al., 2024). The resulting ecosystem is difficult to comprehend in a holistic manner. Current payment technologies are considered secure and user-friendly, enjoying widespread acceptance. As these trends continue to evolve, we can expect their full potential to be realized, further shaping the future of digital transactions. It is important to examine technology-related behaviors influencing payment preferences in the retail sector as product offerings expand. A deeper understanding of adoption factors can help service providers and researchers create more targeted and effective recommendations (Dahlberg et al., 2008).

The country has emerged as a global leader in real-time transactions, led by the widespread adoption of the UPI. According to the global business data platform Statista, India recorded more real-time payment transactions than the combined total of 43 other leading nations, underscoring its dominance in this space (Statista, 2023). The advancements in UPI have set a precedent for different nations, demonstrating how innovative payment solutions can significantly transform the financial landscape. The number of UPI transactions increased by 129% from 920 million in FY18 to 13,000 million in FY24 (Reserve Bank of India Bulletin, 2023). The shift in India’s digital payment preferences is also evident in card-based transactions. For the first time in April 2023, credit card transactions surpassed debit cards' volume, indicating a crucial moment in India's payment dynamics. By March 2024, credit card transactions reached 35.6 crore compared to 22.8 crore for debit cards, with total transaction values soaring to ₱18.3 lakh crore for credit cards against ₱5.9 lakh crore for debit cards (Digitalisation and Payment Revolution in India, 2024). This marks a reversal from earlier trends and points to changing consumer behaviors.

Credit card growth is fueled by benefits like reward programs, Equated Monthly Installment (EMI) options, buy now, pay later, and online offers (IBEF, 2024), while debit card usage has declined due to limited incentives and the growing convenience of UPI. Moreover, the sharp fall in debit card transactions-33% in volume and 18% in value during FY 2023-24-signals a clear transition .This decline is likely due to shifting preferences toward UPI’s ease and zero Merchant Discount Rate for merchants, alongside limited debit card rewards (Digitalisation and Payment Revolution in India, 2024). While traditional attitudes toward debit card usage have been deeply rooted in Indian consumer behavior, there is clear evidence that many are now embracing credit cards. This change is not only reshaping individual spending habits but also influencing the broader financial landscape in India. As more consumers recognize the benefits and conveniences offered by credit cards, it will be essential for financial institutions to adapt and cater to these evolving preferences (Sriram et al., 2023).

Is this beginning of a new era of payments? According to McKinsey's 2023 Global Payments Report, payments have evolved through distinct phases: first paper payments, then plastic with credit and debit cards, and subsequently digital platforms enabling seamless transactions without physical cards in the Account Era. In each phase, old payment methods declined as newer technologies took over, reshaping how payments are processed. Currently, with the Decoupled Era on the brink, payment systems are becoming increasingly independent of traditional accounts. Innovations like generative Artificial intelligence and Platform as a Service promise increased convenience, security, and personalization (Bionducci et al., 2023).

In summary, India’s digital payment ecosystem presents a compelling case study of how technological innovation, policy support, regulation, and changing consumer behavior converge to reshape financial

systems. This shift in payment preferences raises important questions: Are credit cards truly gaining popularity? Are debit cards gradually being phased out? Will UPI eventually replace both?

This paper investigates the evolving landscape of payment preferences in India by analyzing 20 months of public transaction data. Specifically, it aims to understand: The shifting growth patterns of credit cards compared to debit cards and the competitive dynamics and transaction growth among leading e-wallets. To achieve this, the study employs the Diffusion of Innovation (DOI) Theory and Network Externalities (NE) Theory to interpret consumer behavior and market dynamics observed in the data.

Research gap: Time series analysis offers valuable insights into business trends, enabling organizations to differentiate themselves through data-driven decision-making. Existing studies have focused on aggregate trends, but a granular analysis of month-on-month growth rates for specific types of transactions may reveal valuable information. While overall transaction figures provide a broad overview, it is equally important to examine common trends and cross-sectional data. Through time series analysis, it is also possible to understand competitive positioning of Third-party application providers in UPI ecosystem in the market. This will help in developing targeted marketing strategies and product development initiatives for these Apps.

Choice of period: January 2023 marks the beginning of significant product innovations and collaborations, following the Reserve Bank of India (RBI) announcement to integrate RuPay credit cards with UPI. This move aims to address the disparity in POS machines in rural areas, revolutionize the e-commerce industry, and enhance digital payment adoption in India. The period starting from January 2023 to August 2024 is used for study.

In the following sections, we discuss the organization of the Indian payment market. We first cover the theoretical framework of DOI and developments in the digital payment market in India. Next, we provide insights into growth rate analysis of payment methods over the chosen period. Finally, we discuss the implications of changing trends in card-based payment systems and UPI-based systems for financial inclusion in India.

The theoretical foundation

Diffusion of Innovation (DOI) Theory

This theory explains how new ideas, technologies, or innovations spread and are adopted by individuals in society. The adoption of an innovation is not accidental-it is a conscious decision influenced by four key factors: awareness of its consequences, communication channels (such as media and peer networks), time, and the social system in which individuals operate (Rogers, 2003). He outlines five adopter groups along a continuum of innovativeness: innovators, who first introduce the innovation; early adopters, who are quick to embrace it; the early majority, who adopt after some time; the late majority, who are more cautious and adopt later; and laggards, who are the last to adopt, often resisting change. Research has shown that users' intention to adopt UPI is influenced by social and functional factors such as the speed of real-time payments, ease of trial, and recommendations from peers (Kaur et al., 2020). These elements reflect how communication and perceived utility play an important role in spreading digital payment habits. In digital payments, an increase in the number of users on one side of the platform (customers) enhances the platform's value for the other side (merchants). This, in turn, attracts more users, creating a self-reinforcing cycle. This cross-side network effect is crucial in driving the early growth of mobile payment platforms. As digital transactions become a part of daily life, DOI theory also helps explain the behavioral shift. People now expect their financial services to match the pace and convenience of their online lifestyles, where communication, work, shopping, and entertainment all happen digitally.

Network Externalities Theory

This theory, widely applied to network-based innovations, suggests that as more people adopt a product or service, its value increases. The utility of a system depends on the number of users adopting it. A direct network effect occurs when more consumers find it beneficial to carry payment cards as more merchants accept card transactions. The growth of card-based payments has driven the adoption of indigenous RuPay cards (Liebowitz and Margolis, 1994). In the case of digital payment services, however, indirect network effects are seen more relevant driven by the perception of availability of a range of complementary services (Ewe et al., 2015). The adoption decisions are driven by the availability of bundled services that are a part of card-based transactions such as cashback rewards, EMI facilities, personalized spend insights provided by banks through these platforms. Following demonetization and COVID-19, along with financial inclusion initiatives like Jan Dhan Yojana (PMJDY), digital payments became more accessible to a broader population. Many small businesses and street vendors started accepting app-based payments. Additionally, as more people use payment cards, advancements in fraud protection technologies enhance security and build consumer confidence, further encouraging adoption.

India's evolving payment system

A payment system enables the transfer of funds between accounts or through cash transactions between payers and beneficiaries. According to RBI, a digital transaction refers to a payment transaction that is conducted in a seamless manner without the use of cash by at least one counterparty, either the payer or the recipient. Especially in emerging markets, digital transactions have the potential to bring financial inclusion by offering financial services to the unbanked masses, improving their quality of life.

The Indian payment system is broadly categorized into two types.

Funds Transfer Payments: Transactions that involve transferring money between bank accounts.
Merchant Payment Systems: Payments made for goods and services.

Key Payment Instruments in India: Debit Cards, Credit Cards, and Prepaid Payment Instruments account for a significant share of merchant payment methods in India.

Debit Cards or ATM Cards are used to make cash withdrawals and/or directly transfer funds from a consumer's bank account, by directly reducing the cardholder's deposits. They are especially popular among middle-class consumers as they simplify everyday transactions. Credit Cards allow users to make purchases on borrowed funds from the issuing bank or financial institution. Customers can defer payments, making them useful for short-term cash flow management. Few reasons for their increasing adoption are reward points, cash back, and discounts on purchases and complementary lounge access in airports. Research on credit card usage preferences indicates the role of economic factors, flexibility, promotions, reputation, and convenience, as well as demographic factors such as age and income (Banerji, 2020). India's credit card market is poised for growth, driven by increased card penetration, low household debt, and the rise of online shopping. The key motivators for credit card usage are convenience, prestige, and attractive features like rewards and cashback. Segment-specific factors and increasing financial literacy contribute to more responsible usage and targeted expansion of card payments (Sriram et al., 2022). Moreover, while the DOI Theory acknowledges the role of the social system in adoption, its effective application in India requires careful adaptation to the country's unique cultural and economic context (Fahad and Mohammad, 2022). The benefits of digital payments include one-click payments, no cash to carry, easy tracking, discounts and cashback programs, and most importantly security. Each method serves a specific purpose, and consumers choose their preferred payment option based on the value they associate with it in different contexts namely, time savings, reduced effort, and financial benefits (Alkhowaiter, 2020). Hence it is proposed that:

Hypothesis 1: There is statistically significant difference in the median transaction volume growth rates across the six transaction categories for credit and debit cards during the study period.

Hypothesis 2: There is statistically significant difference in the median transaction value growth rates across the six transaction categories for credit and debit cards during the study period.

The rise of UPI and digital transactions

One of India's most widely used funds transfer systems is the UPI, which offers seamless, real-time transactions. Its ease of use and instant payment confirmation have made it a preferred choice for daily financial transactions.

In 2015, the Government of India launched the "Digital India" program to create a "Faceless, Paperless, Cashless" economy. Digital payments play a crucial role in driving economic growth by increasing consumer spending, promoting financial inclusion, and enhancing economic integration. UPI's accessibility has been particularly impactful in reaching marginalized communities, fostering financial awareness and participation (Mukaria, 2020), (Ferra, 2023), and (Rastogi et al., 2021)

Launched by NPCI in 2016, UPI revolutionized real-time interbank payments, allowing users to make instant transactions via mobile apps. Its widespread adoption is powered by the high penetration of mobile phones; zero-cost transactions; convenience and real-time processing; and multiple payment options include payment using QR codes, phone numbers, and IFSC codes (Gochhwal, 2017), (Seth, 2024). These features have driven UPI's popularity in peer-to-peer (P2P) and peer-to-merchant (P2M) transactions, marking a significant shift toward a cashless economy (Gochhwal, 2017). The Bharat Interface for Money (BHIM) app, backed by the government, provides a secure and straightforward UPI experience. Meanwhile, third-party apps like Google Pay, PhonePe, and Paytm offer UPI services with additional features, enhancing user engagement and loyalty.

Table *1* compares the distinct characteristics of the government-operated UPI app and private third-party UPI apps across various aspects, including ownership, primary purpose, security protocols, user demographics, and availability of wallet functions. Each type of app targets slightly different audiences and provides unique benefits, contributing to the overall growth and diversification of digital payments in India.

Aspect	Government UPI App (BHIM)	Third-Party UPI Apps (Google Pay, PhonePe, Paytm, and others)
Ownership and Governance	Developed and operated by the National Payments Corporation of India (NPCI) under the Government of India.	Owned and managed by private companies like Google, Paytm, Amazon, etc., with integration via NPCI's UPI infrastructure.
Primary Purpose	Focused on providing a basic, secure, and accessible UPI platform for all Indian citizens, with minimal features beyond payments.	Aims to expand services by offering additional features, rewards, and integrations (e.g., e-commerce, bill payments, rewards) to engage users and drive loyalty.
Security and Privacy	Enforces strict government guidelines for data security and privacy; minimal data are collected.	Generally, follow NPCI and RBI guidelines, but some third-party apps may collect additional user data for analysis and targeted marketing.
User Demographic	Primarily designed for all Indian citizens; particularly appeals to users seeking a simple, official app without extra features.	Appeals to tech-savvy, urban users who are interested in additional services, rewards, and a more personalized app experience.
Availability of Wallet Feature	No wallet feature: transactions occur directly from bank accounts via UPI.	Many third-party apps (e.g., Paytm, Amazon Pay) offer an in-app wallet in addition to UPI, allowing users to store funds separately and pay even without direct bank involvement, along with unique limits and features.
Loan and Credit Facilities	BHIM does not offer loan or credit facilities, focusing solely on enabling secure and straightforward payments.	Many third-party apps (e.g., Paytm, PhonePe, and CRED) offer micro-loans, credit options, and "buy now, pay later" services, giving users access to short-term credit options directly through the app.

TABLE 1: Comparison of distinct characteristics of the government-operated UPI app and private third-party UPI apps

Source: National Payments Corporation of India (NPCI) website. UPI, Unified Payments Interface; RBI, Reserve Bank of India; BHIM, Bharat Interface for Money

Tiwari assessed various electronic payment systems based on reliability, ease of use, responsiveness, security, usefulness, and cost. Using the TOPSIS method, which evaluates alternatives based on their closeness to an ideal solution, the study ranked these systems as follows: Mobile Money - Best-performing system, ATM - Ranked second, Credit and Debit Cards - Secured the third position and Internet Banking - Ranked lowest (Tiwari, 2023). A 2021 survey by NPCI, in partnership with India's Consumer Economy, covered 25 states and 5,000 respondents to assess digital payment adoption (NPCI, 2021). The study found that one in four households from the poorest 40% uses digital payments. Smartphone ownership is nearly universal among the richest 20% (90%), while 57% of the poorest households also own smartphones. Respondents demonstrated a high level of awareness of UPI, payment apps, and digital banking connections through Aadhaar linkages and SMS notifications (NPCI, 2023). As shopping and social interactions become more digital, the demand for faster, real-time payments has risen sharply. In response, non-bank providers and FinTech companies are introducing innovative products such as UPI and mobile wallets, Quick Response (QR code-based) payments, instant credit, and Insurance Technology platforms, intensifying competition and extending payment services beyond the traditional banking sector (Boar and Szemere, 2020). Hence it is proposed that:

Hypothesis 3: There is statistically significant difference in the average transaction values (average ticket sizes) among the selected third-party UPI applications (PhonePe, Google Pay, Paytm, CRED, Amazon Pay, and BHIM) during the study period.

Research Method

The research employs a quantitative methodology to analyze the growth trends of digital payments in the Cards category, focusing on three primary categories of transactions: Online spending, POS transactions, and ATM cash withdrawals. This approach allows for a systematic examination of the month-on-month growth rates in both transaction volume and value across card-based payment methods. Additionally, the study will assess the transaction volumes of leading UPI-based applications to understand their competitive positioning in the digital payments landscape. Monthly data for volume and value of Card/UPI transactions presented in monthly handles were drawn from the following sources and consolidated for the study.

UPI ecosystem statistics and UPI Product statistics pertaining to the chosen period from NPCI website: This typically includes details related to digital payments, transaction volumes, and usage trends across various payment systems (NPCI, 2023).

RBI Data: RBI offers extensive datasets on banking statistics, financial markets, monetary policy, payment systems, and financial inclusion metrics. The RBI publishes Bank-wise ATM, Acceptance Infrastructure, and Card Statistics monthly. The total number of transactions (volume in actuals) and the total value of transactions (in Rs.000) in the last row of the monthly statistics table were used (RBI Bankwise Card Statistics, 2024).

Period considered for analysis: Key policy interventions by the RBI and the Ministry of Finance-such as zero-MDR UPI framework, the UPI Credit Card linkage, and expanded interoperability across wallets and banks-had been implemented by late 2022. Their impact began to materialize in transaction data by early 2023. Hence, the time frame chosen for the study is from January 2023 to mid-2024 to examine the competitive dynamics and adoption trajectories across digital payment channels. This time span offers a comprehensive view of both short-term trends and longer-term shifts.

Data analysis: The analysis involved calculating month-over-month growth rates for each category of card usage. These rates were computed by subtracting the first month's figure from the second month's figure and then dividing the result by the previous month's figure. The calculated growth rates were visually represented using 2D charts in MS Excel for clarity. Although tables were used for computation, only graphical representations were presented to highlight growth trends more effectively. The Kruskal-Walli's test was used to test whether significant differences exist between the three categories.

Limitations: The data covered all categories of banks and were not separated by bank group or by geography. Only 20 months data were used.

Objectives of study: To conduct a cross-sectional study of transaction volumes and values across credit cards, debit cards, and UPI apps, with a focus on usage categories-online commerce, POS, and ATM cash withdrawals-during the period January 2023 to August 2024, to uncover distinct consumer payment patterns using RBI and NPCI data.

Results

Growth rates analysis in payment methods

The study is divided into four sections, designated as A, B, C, and D, focusing on distinct comparisons:

A. Comparison of Annual Growth Rates of Credit Card, Debit Cards, and UPI

Table *2* and Table *3* present transaction figures for three chosen digital payment methods-Credit cards, Debit cards, and UPI-for the years 2018-19 to 2023-24. The Compound Annual Growth Rate (CAGR) over these 5 years shows that transaction volume grew by 15.1% for Credit cards, declined by 12.33% for Debit cards, and surged by 89.32% for UPI. In terms of the transaction value, the CAGR shows that Credit cards posted a growth of 24.86%, Debit cards posted a slight decline of 0.1%, and UPI recorded robust improvement of 86.9%. These findings highlight the significant growth in UPI transactions, both in volume and value (89.32 and 86.9%), while Credit cards demonstrate robust growth in both metrics and Debit cards demonstrate a decline in volume and minimal change in value.

	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	CAGR
4.1 Credit Cards	17,626	21,773	17,641	22,399	29,145	35,610	15.1%
4.2 Debit Cards	44,143	50,611	40,200	39,384	34,179	22,860	-12.33%
2.7 UPI	53,915	1,25,186	2,23,307	4,59,561	8,37,144	13,11,295	89.32%

TABLE 2: Transactions through Credit/Debit cards and UPI—volume (lakh)

Source: Reserve Bank of India (RBI)-Payment System Indicators-Annual Turnover.

Notes: 4.1, 4.2, and 2.7 are notations used for Credit cards, Debit cards, and UPI in RBI statistical tables. UPI, Unified Payments Interface; CAGR, Compound Annual Growth Rate

	2018-19	2019-20	2020-21	2021-22	2022-23	2023-24	CAGR in %
4.1 Credit Cards	6.03	7.31	6.3	9.7	14.3	18.3	24.86
4.2 Debit Cards	5.93	7.04	6.63	7.3	7.2	5.9	-0.1
2.7 UPI	8.77	21.32	41.04	84.2	139.1	200	86.9

TABLE 3: Transactions through Credit/Debit cards and UPI—value (Rs Crore)

Source: Reserve Bank of India (RBI)-Payment System Indicators-Annual Turnover.

Notes: 4.1, 4.2, and 2.7 are notations used for Credit cards, Debit cards, and UPI in RBI statistical tables. UPI, Unified Payments Interface; CAGR, Compound Annual Growth Rate

Building on the analysis of transaction figures and growth rates for digital payment methods, the next section will focus on calculating month-on-month growth rates for online spending, POS transactions, and ATM cash withdrawals. This will allow us to further investigate the growth of credit cards in relation to debit cards, providing a more detailed understanding of their performance in the current market.

B. Comparison of Growth Rates of Credit Card and Debit Cards in Three Categories of Transactions

RBI releases monthly data on Bank-wise ATM, Acceptance Infrastructure, and Card Statistics. For this study, the final row of the table, which summarizes the total transaction volume (in actuals) and total transaction value (in ₹'000), was used. Subsequently, the month-on-month growth rates for each of the six categories were computed to analyze trends over time.

For visual representation, the monthly growth rates in volume of transactions from January 2023 to July 2024 across various categories are shown in Figure *1*. The most notable growth rate for credit card-based transactions occurred in the month of September 2023, with 21.64% for online spending and 12% for payments at POS terminals; it is reflected in October in the figure. Online shopping is widely growing as the first choice for consumers. It can be a major factor in credit card use as credit is an easy payment option. A declining trend has been observed in the usage of debit cards at POS, with month-on-month growth rates recorded at (-)11.36% in August-September 23.

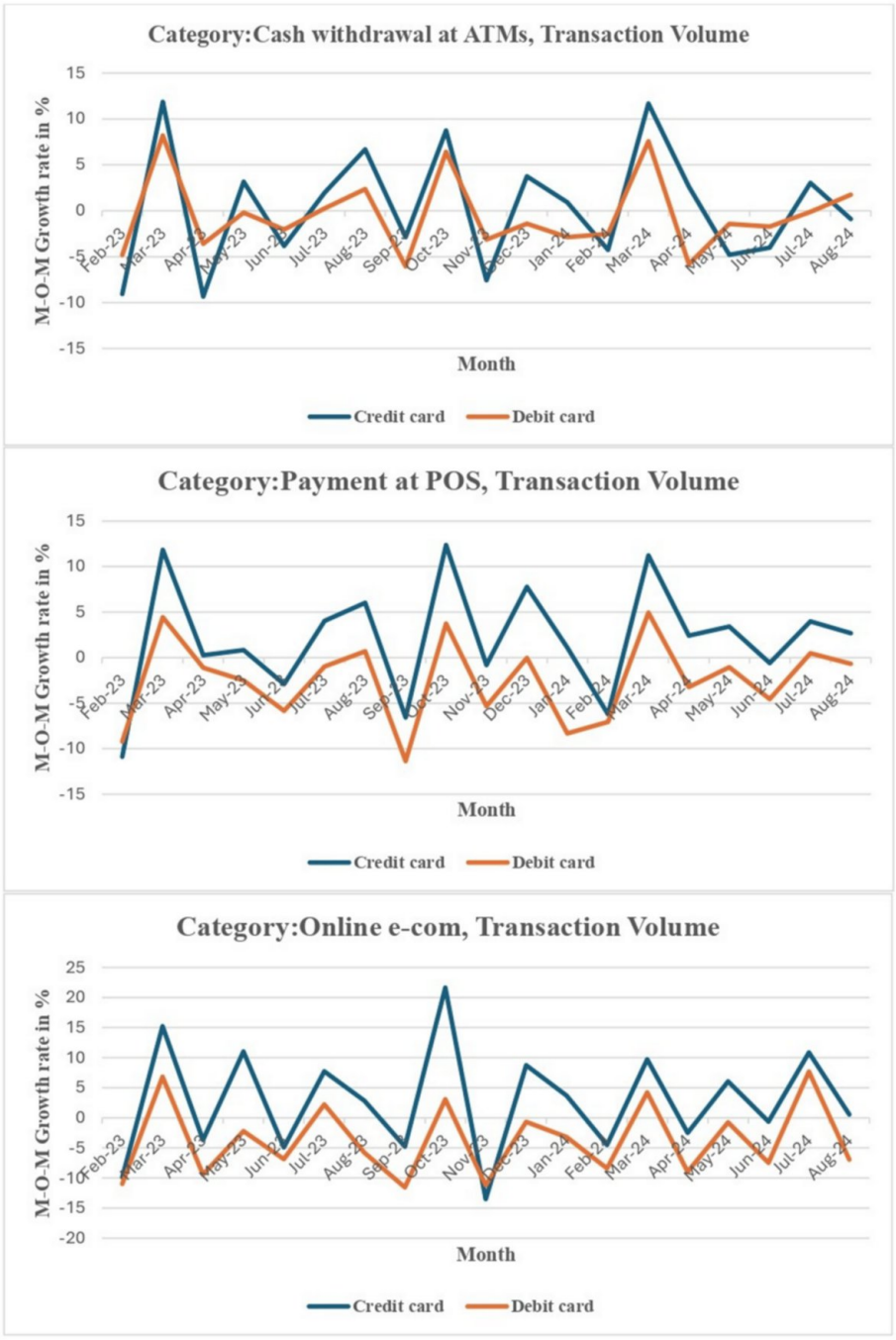

FIGURE 1: Growth rate of transactions in volume for Debit cards and Credit cards across three categories—online e-com, POS, and cash withdrawal at ATMs (January 23-August 24)

Author's creation from Reserve Bank of India (RBI) data, transactions in volume for three categories for chosen period. Data source: RBI-Monthly-Bank-wise ATM/POS/Card Statistics. ATM, Automated Teller Machine; POS, Point of Sale

Figure *2* illustrates the monthly increase in the value of transactions (in Rs'000) from January 2023 to July 2024 across various categories. Unlike transaction volume, which reflects the number of transactions, the value represents the total monetary amount processed. The most notable growth rate for credit card-based transactions occurred in the month of September 2023, with 30% for online spending and 16.86% for payments at POS terminals; it is reflected in October 2023 in the figure. Growth rates in terms of value are almost similar.

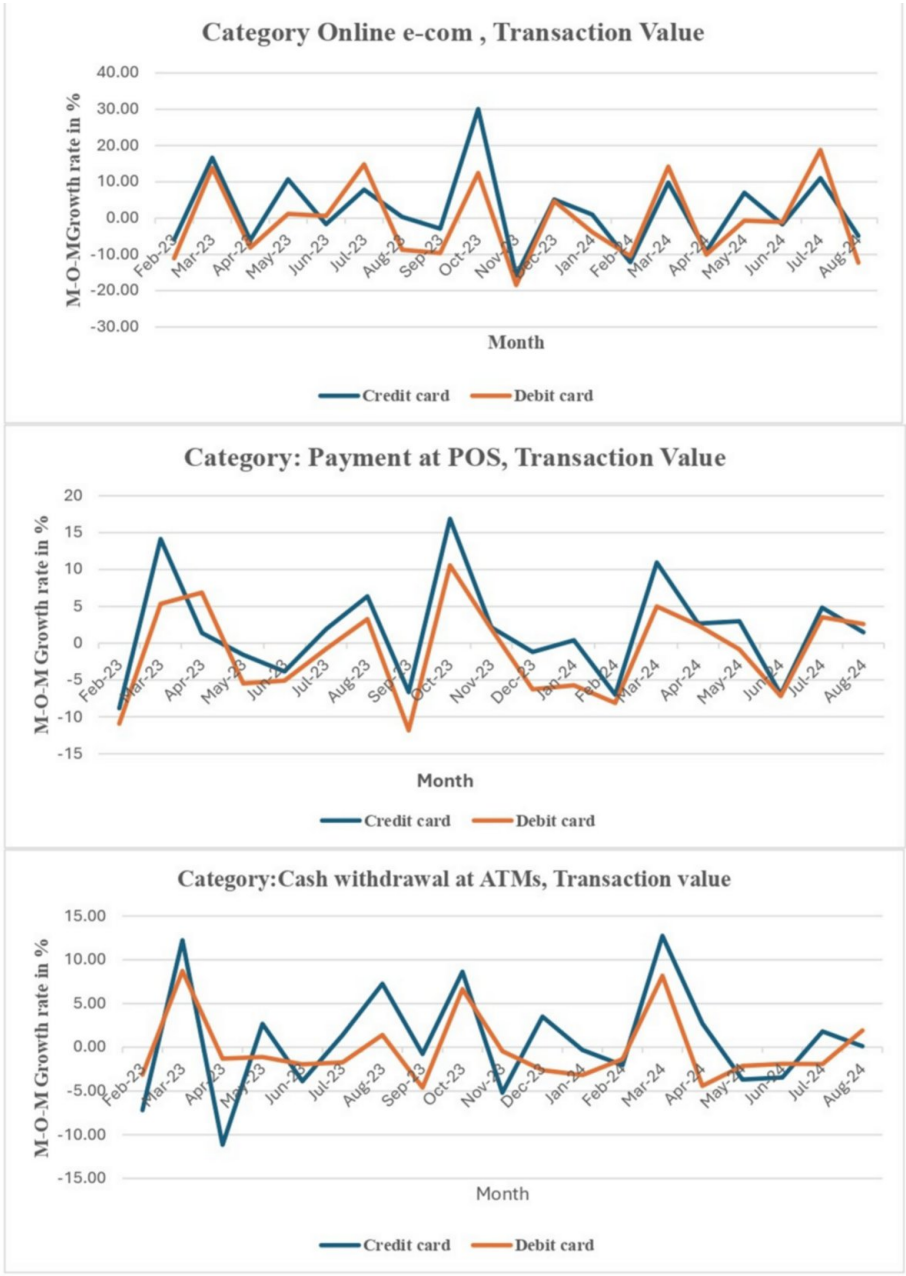

FIGURE 2: Growth rate of transactions in value for Debit cards and Credit cards across three categories—online e-com, POS, and cash withdrawal at ATMs (January 23 to August 24)

Author's creation from Reserve Bank of India (RBI) data, transactions in value for three categories for chosen period. Data source: RBI- Monthly-Bank-wise ATM/POS/Card Statistics. ATM, Automated Teller Machine; POS, Point of Sale

C. Comparing Growth Rates Across Six Categories of Card-Based Payment Transactions

Null hypothesis 1: The medians of the growth rates in terms of volume across the six categories of transactions for both the card-based payments are equal.

Null hypothesis 2: The medians of the growth rates in terms of value across the six categories of transactions for both the card-based payments are equal.

Table *4* presents the mean ranks for six categories of transactions, based on volume and value, using the Kruskal-Wallis test.

	Category	Mean Rank	Kruskal-Wallis Test Results
Growth rate_volume	Credit card for online (e-commerce)	65.97	Chi-square = 11.315, df = 5, Asymp. Sig.= .045
	Credit card at POS	67.61	
	Credit card for cash withdrawal	58.5	
	Debit card for online (e-commerce)	39.89	
	Debit card at POS	44.97	
	Debit card for cash withdrawal	53.61	
Growth rate_value	Credit card for online (e-commerce)	59.22	Chi-square = 2.104, df = 5, Asymp. Sig.= .835
	Credit card at POS	59.78	
	Credit card for cash withdrawal	57.31	
	Debit card for online (e-commerce)	50.89	
	Debit card at POS	49.08	
	Debit card for cash withdrawal	50.72	

TABLE 4: Mean ranks for six categories of transactions: volume

Authors calculation from RBI data, and monthly growth rate in transactions in terms of volume and value for three chosen categories for chosen period. POS, Point of Sale

From the table, it can be inferred that the calculated value of the Kruskal-Wallis test ($\chi^2 = 11.315$; $p < 0.05$; df = 5) is statistically significant at the 5% significance level ($\alpha = 0.05$) for transaction volume. This indicates that there are significant differences in the growth rates of transaction volume across the six categories; hence, null hypothesis 1 is rejected. In contrast, the results for transaction value are not statistically significant, suggesting that there are no meaningful differences in growth rates for value among the categories. This distinction highlights that while category-specific factors may influence volume, value does not show the same level of variability.

Next, we will examine each of the three categories within both card types, to compare the category-wise difference in growth performance for the study period using the Mann-Whitney U test. The detailed picture is given in Table *5*.

Growth rate	Category	Mean rank–credit card/debit card		Mann-Whitney U	Test statistic
Growth_rate_volume	Online (e-com)	22.44	14.56	91.00 @Z = -2.246	0.025
	POS	23.39	14.84	92.00@Z = -2.401	0.016
	Cash withdrawal	19.28	17.22	148@Z = -0.443	0.658
Growth_rate_value	Online (e-com)	19.44	17.56	145@Z = -0.538	0.606
	POS	20.5	17.58	144@Z = -0.820	0.425
	Cash withdrawal	19.61	17.39	142@Z = -.633	0.542

TABLE 5: Comparison of mean ranks of card-wise growth rates in three categories of transactions

Authors calculation from RBI data; transactions in volume and value for three chosen categories for chosen period. POS, point of sale

A category-wise comparison was performed using the Mann-Whitney U test for both debit and credit cards. The analysis revealed the following:

Online Transactions: There is a significant difference in the month-on-month growth rate of the volume of transactions for online transactions at the 2.5% significance level.

POS Transactions: There is also a significant difference in the month-on-month growth rate of the volume of transactions for POS transactions at the 1% significance level.

Cash Withdrawals: However, no significant difference was found in the month-on-month growth rate for cash withdrawals when using debit cards versus credit cards.

This indicates that growth rates differ significantly for online and POS transactions, but not for cash withdrawals across debit and credit cards.

There is no statistical evidence of a significant difference in the growth rate of the value of transactions across the six categories of digital payments.

D. Comparison of Growth Rates of App-Based Transactions

The UPI system in India has been highly successful, with several major apps offering a variety of services to meet users' financial needs. From established players like Google Pay and PhonePe to newer, specialized apps like CRED, each UPI app brings unique features tailored to different segments of users. Table *6* provides a comprehensive overview of popular UPI apps such as Google Pay, PhonePe, Paytm, CRED, Amazon Pay, and Government-backed BHIM, analyzing their capabilities, user base, rewards, and unique offerings. While all these apps support basic UPI transactions, additional features like digital wallets, credit facilities, bill payment options, and rewards programs vary (Moneymint, 2025).

Feature	Google Pay	PhonePe	Paytm	CRED	Amazon Pay	BHIM
Direct UPI Payments	Yes	Yes	Yes	Limited	Yes	Yes
Digital Wallet	No	Yes	Yes	No	Yes	No
Credit Facilities	Limited	Yes	Yes	Yes	Yes	No
Bill Payments	Yes	Yes	Yes	Yes	Yes	Yes
Rewards	Yes	Yes	Yes	Yes	Yes	No
User Base and Market Presence	Large base across India	Extensive user base	Popular across merchants, users, and e-commerce	Urban, high-credit-score users with credit card focus	Amazon-user centric	Government-backed, known for simplicity
Promotions and Rewards	Seasonal events and game-based rewards	Regular cashback on recharges, bills	Extensive cashback on various services	High-value discounts for members on lifestyle brands	Rewards and frequent discounts for Prime members	No promotional campaigns; serves as government app

TABLE 6: Comprehensive overview of popular UPI apps in India considered for study

Source: https://moneymint.com/ Best UPI Payment Apps in India (2025) retrieved on 4/12/24. UPI, Unified Payments Interface; BHIM, Bharat Interface for Money

NPCI publishes monthly statistics for UPI app transactions. Since these apps are often used for even the smallest payments, it is ideal to evaluate the average spending, which is calculated by dividing the total amount of online transactions by the total number of online transactions over the same period. Following UPI apps are considered for study: PhonePe, Google Pay, Paytm, CRED, Amazon Pay, and BHIM. The average spend data are segmented into two periods: from January 2023 to December 2023 and from January 2024 to December 2024. Figure *3* compares average spending for the six payment Apps for the 24 months.

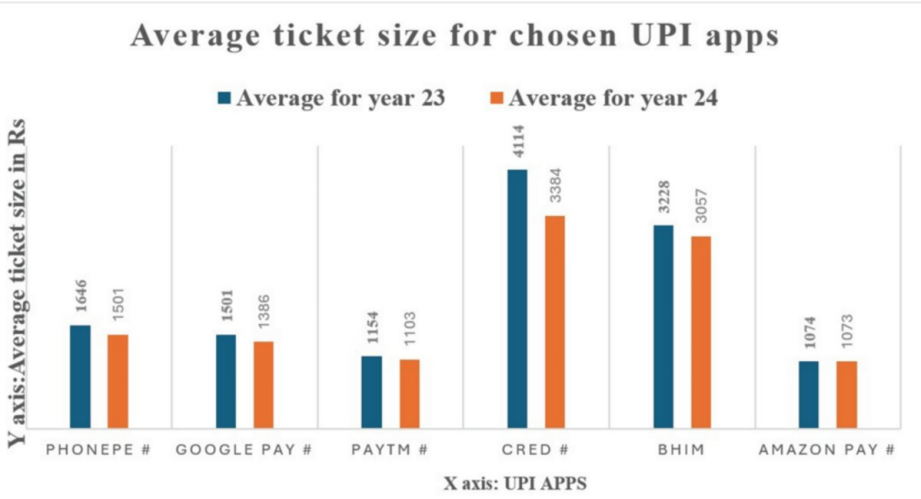

FIGURE 3: Average spend rate or average ticket sizes (in Rs) for the six UPI Apps chosen for study

Author's calculation from UPI Ecosystem Statistics-NPCI. UPI, Unified Payments Interface; NPCI, National Payment Corporation of India

Notably, PhonePe demonstrates a significantly higher average transaction value compared to Google Pay, while Paytm records a noticeably lower rate. Interestingly, the CRED app reports higher transaction values, likely due to its personalized spending insights and reward mechanisms that promote responsible credit usage. BHIM, developed by NPCI, offers a unique feature allowing users to make payments using their identification ID Aadhaar number. Additionally, its UPI ID format (mobile number@upi) is designed for easy recall.

A notable decline in average transaction values also known as average ticket sizes has been observed across all six selected UPI applications over the 1-year period. The decline is most pronounced for CRED from Rs 4114 to Rs 3384 (17%), followed by PhonePe from Rs 1646 to Rs 1501 (8.8%), Google Pay (7.65%), BHIM (5.29%), and Paytm (4.6%), while Amazon Pay exhibited no change. This trend underscores growing confidence in smartphone-based payment methods.

Null Hypothesis: The average spends across the different third-party UPI apps (PhonePe, Google Pay, Paytm, CRED, Amazon Pay, and BHIM) is equal for the period from January 2023 to December 2024.

The average spending for the 24 months from January 2023 to December 2024 was calculated and analyzed for significant differences, as presented in Table 7.

	UPI app	Mean rank	Kruskal-Wallis test results
1.	Phonepe#	85.23	Chi-square = 118 ,df = 5, Asymp. Sig. = .000
2.	Google Pay#	68.06	
3.	Paytm#	33.33	
4.	CRED#	130.58	
5.	Amazon Pay#	19.33	
6.	BHIM	98.62	

TABLE 7: Mean ranking for average spend rate and Kruskal-Wallis test results for the top six UPI apps

Author's calculation from UPI Ecosystem Statistics for the chosen six UPI Apps. UPI, Unified Payments Interface; BHIM, Bharat Interface for Money

Mean Ranks: CRED (130.58) and BHIM (98.62) have the highest mean ranks, suggesting that users of these

apps have significantly higher average spending compared to the other apps. PhonePe (85.23) and Google Pay (68.06) fall in the middle range. Paytm (33.33) and Amazon Pay (19.33) have the lowest mean ranks, indicating lower average spending compared to the others.

Hypothesis test results: The Kruskal-Wallis test was conducted to examine differences in average spending across six third-party UPI apps (PhonePe, Google Pay, Paytm, CRED, Amazon Pay, and BHIM) for the chosen period. Since the p-value is less than 0.05 ($p < 0.05$), the null hypothesis is rejected. A statistically significant difference in the average spending across the six UPI apps is proved.

Discussion

Are Indian consumers genuinely shifting toward credit cards?

Referring to the NE theory in India's digital payments landscape, indirect network effects play a pivotal role, as retail customers are increasingly influenced by the rich array of complementary services offered by banks for card based and UPI App platforms. Rather than focusing solely on how many people use these services, users are drawn to their functionality, convenience, and added value-such as card integration, rewards, and enhanced security features. DOI theory not only helps identify why people adopt digital payment methods but also illustrates the broader social and technological dynamics that drive their widespread acceptance in India's rapidly digitizing economy.

CAGR analysis over 5 years reveals notable trends: The growth rate of credit card usage has increased by 15% in terms of the number of transactions. In terms of the amount spent, credit cards have shown a robust increase of 24%. These figures suggest a growing preference for credit cards among Indian consumers, both in terms of usage frequency and spending volume because high-value purchases are increasingly made via EMIs and structured credit options (Indian Express, 2025). Debit card usage has declined significantly, with a -12% drop in transaction volume. The amount spent through debit cards has also slightly declined by -0.1%. This indicates a shift away from debit card usage, both in terms of the number of transactions and total spending. UPI transactions have witnessed the highest growth, with a remarkable CAGR of 86%. This highlights the rapid adoption of UPI as a preferred mode of payment due to the convenience feature of scan-to-pay payments, reducing the reliance on debit cards for purchases.

There are significant differences in the growth rates of transaction quantum across the six categories of digital payments-Credit card and Debit card usage for e-commerce, payment at terminals, and withdrawal at ATM. This implies that some categories are growing much faster or slower than others in terms of the number of transactions being processed. In contrast, the growth rates for the total value of transactions (monetary amounts) are not significantly different among the categories. This suggests that while the number of transactions may differ across categories, the total amounts spent (or transferred) are growing at similar rates across the six categories.

The findings of this research align with those of Angamuthu (Angamuthu, 2020) in several key aspects. Both studies identify significant differences in the growth rates of transaction volume across various digital payment categories, emphasizing that certain categories exhibit higher growth than others. However, while this research finds no significant differences in the growth rates of total transaction value, Angamuthu's study, which focuses on the period from 2012 to 2019, indicates significant variations in both volume and value growth, supported by statistical analysis.

A statistically significant difference in average spending across six UPI applications has been identified. Among UPI platforms frequently used for smaller, routine transactions, PhonePe exhibits a marginally higher average ticket size compared to Google Pay. In contrast, CRED appears to facilitate higher-value transactions, indicating a potential differentiation in user demographics and spending behavior across these platforms. The government-backed BHIM app demonstrates a higher average spending, whereas other UPI applications exhibit lower average transaction values. This variation highlights diverse user behavior and spending patterns across different digital payment platforms, suggesting potential differences in user demographics, transaction purposes, and platform preferences. The choice of app may be influenced by demographics such as age, profession, and socioeconomic status and how users interact with these apps. Younger demographics are more likely to use CRED because of its higher rewards and user-friendly interface, while older demographics prefer established platforms like PhonePe or Google Pay (Invalli and Bhat, 2025).

A notable decline in average spend rate, or average ticket size, is observed across all UPI-based apps, particularly within the 8-9% range for PhonePe and Google Pay over the 1-year period. This trend aligns with a Business Standard report, which highlights the growing integration of UPI for smaller, everyday purchases and the rise in person-to-merchant (P2M) transactions (Business Standard, 2024).

The evidence suggests otherwise; instead, Debit cards are being increasingly supplanted by the UPI, which has transformed the digital payments landscape. UPI enables both individuals and businesses to conduct transactions seamlessly and securely. This shift has instigated a significant behavioral change among the

Indian population, as even small and microtransactions-such as purchasing a cup of tea for ₹20 or a bag of fresh vegetables for ₹200-are now frequently executed through digital payment methods. UPI's rapid growth and technological advancements have revolutionized the digital payments landscape in India, making it an exemplary model for other nations looking to enhance their payment systems.

Theoretical contributions: The pictorial model shown in Figure *4* highlights how DOI adoption stages and NE dynamics explain payment trends: Growth in Credit Card transactions is fueled by differentiated offerings and merchant/issuer funded rewards. Debit Cards are declining for small value non-cash transactions taken over by UPI payments for compatibility and convenience.

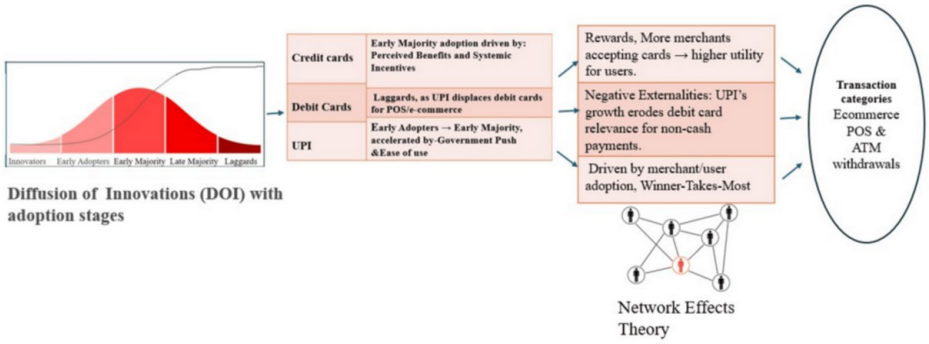

FIGURE 4: Model illustrating the relationship between the DOI theory and Network Effects theory and growth in transaction categories

POS, Point of Sale; ATM, Automated Teller Machine; UPI, Unified Payments Interface

Conclusions

In conclusion, the digital payments ecosystem in India is at a pivotal point, and understanding consumer transaction patterns across platforms will be key to shaping inclusive and efficient payment strategies. This study yields several practical implications for various stakeholders within the digital and physical commerce ecosystems, particularly in the context of Indian markets. Across both online and physical retail transactions, consumers consistently exhibit higher average spending when using Credit cards compared to Debit cards, highlighting a clear preference for Credit cards in higher-value purchases. Also, the rewards and loyalty programs associated with the usage of Credit cards motivate consumers to prefer Credit cards for larger transactions. It is generally considered that these Credit card aspects are intended to reduce the cost of purchases and provide savings benefits to the consumer when making a transaction. These features are perceived to reduce the effective cost of purchases, encouraging their use for high-value transactions. Many retailers promote Credit card usage by highlighting the benefits of monthly instalments. This analysis primarily examines national-level figures for card-based and select app-based transaction volumes and values. The study, which analyzed digital payment subcategories at an aggregate level over shorter timeframes, like monthly intervals, provides a clearer picture of their usage trends. While seasonal patterns indicating transaction demand are observed, this study focuses exclusively on banking platforms. UPI is already integrated with several other payment systems, such as Credit cards and Debit cards. In the future, UPI is likely to become even more integrated with other payment systems, making it easier for people to use UPI to pay for goods and services across a wider range of merchants. Innovation in the debit card space must happen to position the ecosystem for a significant transformation.

Limitations of study: The time series sampling method, though useful for trend analysis, restricts causal interpretation; and while DOI and NE theories offer valuable lenses, their application may oversimplify the diverse socio-economic and cultural factors influencing digital payment adoption in India.

Recommendations for further research: To achieve a more profound understanding of consumer behavior, a comparative study of transaction volume and value across different geographical areas is warranted. This can be further enriched by exploring the link between socio-economic indicators (such as income, education, and employment rates) and various aspects of card transaction behavior, including volume, value, and channel preference (online vs. offline), thereby revealing the impact of these factors on card usage. The analysis of peaks and troughs in transaction data can uncover seasonal trends, providing valuable insights for strategic marketing campaigns. Furthermore, publicly accessible time series data offer a benchmark against which a specific bank can evaluate its transaction volume and value performance relative to the industry or its competitors. The research also points out the current strategies employed by banks to promote debit card adoption through diverse card types, regular offers, technological integration, and marketing initiatives. With rising customer expectations and issuers

seeking scalable, cost-effective solutions, the landscape is primed for change. Factors such as internet connectivity, inflation, customer preferences, marketing efforts of banks and geographic diversity are beyond the scope of this analysis and have not been included.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Surekha Invalli

Acquisition, analysis, or interpretation of data: Surekha Invalli

Drafting of the manuscript: Surekha Invalli

Critical review of the manuscript for important intellectual content: Surekha Invalli

Supervision: Surekha Invalli

Disclosures

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