



Digital Payments and Cash Usage in India: Has UPI Changed Consumer Spending Patterns?

A Quantitative Analysis of UPI, Cash Usage, and Consumer Spending

Abhilash Kumar Singh, Aanchal Harijan, Arushi Shrivastava, Asmi Nagda, Disha Kumari, Himanshi, MadhuChhandra Santara, Rupsa Basak, Rushali Goel, Sanskriti Agarwal, Suman Raj L, Udit Rewliya

Abstract

This study examines whether the expansion of the Unified Payments Interface (UPI) is associated with changes in aggregate cash holdings and aggregate payment behaviour in India. It uses monthly secondary data reported in the paper from the National Payments Corporation of India and the Reserve Bank of India for the common period beginning in 2016 and extending to the latest available month in 2026. Descriptive indicators compare UPI transaction volume and value, average ticket size, currency with the public, currency in circulation and monthly growth. A Vector Autoregression framework is used to test whether changes in UPI volume precede changes in currency with the public. The reported estimates show no statistically significant association at one month but negative and statistically significant coefficients from lags two to five, with the largest coefficients at lags three and four. The evidence therefore supports a delayed predictive association between UPI growth and lower subsequent cash holdings. It does not establish that UPI alone caused cash displacement. Currency in circulation continued to rise during the broader expansion of digital payments, indicating coexistence between digital payments and cash. The available aggregate data also cannot directly identify individual purchases, impulsive spending or differences across demographic groups. The study concludes that UPI has changed the relative use of payment channels, but stronger claims about consumer expenditure require household-level or transaction-level evidence and a fully specified time-series model with diagnostic testing.

Keywords: UPI, digital payments, cash holdings, currency with the public, payment behaviour, Vector Autoregression, Granger causality, India

INTRODUCTION:

Over the last ten years, India has rapidly moved away from a cash-heavy retail economy toward an advanced ecosystem built on Digital Public Infrastructure (DPI; George & Baskar, 2026; Mahapatra & Patra, 2018). Relying too much on physical currency created a significant economic burden. In fact, the cost of cash transactions in India was estimated at nearly 1.7% of GDP in 2015 (Mahapatra & Patra, 2018). To support the shift toward digital payments, the state developed foundational digital rails through the Jan Dhan–Aadhaar–Mobile (JAM) trinity. It also licensed specialized Payments Banks to expand basic banking access to everyday citizens (Mahapatra & Patra, 2018). Building on these institutional steps, the National Payments Corporation of India (NPCI) rolled out the Unified Payments Interface (UPI) in 2016. It was



designed as an open-ended, real-time, and smoothly interoperable system for everyday transactions (Mahesh & Bhat, 2021).

UPI significantly changed traditional payment models and the way everyday commerce works in India. It did this by making payment simple. By using Virtual Payment Addresses (VPAs) and QR codes, UPI reduced the reliance on lengthy bank account credentials and expensive physical Point-of-Sale (PoS) terminals, making digital payments more accessible to merchants and consumers (George & Baskar, 2026; Mahesh & Bhat, 2021). On top of that, the government's Zero Merchant Discount Rate (Zero-MDR) policy meant that small shopkeepers did not have to pay merchant fees for many UPI transactions. This supported wider merchant acceptance (George & Baskar, 2026). Today, UPI accounts for over 80% of domestic retail digital transactions. This period has also seen a substantial decline in traditional debit-card transactions, with George and Baskar (2026) reporting a roughly two-thirds fall since 2021. This sheer convenience may also influence consumer behaviour. Because paying is now seamless, it can reduce the immediate friction or emotional hesitation associated with spending, which may influence purchasing habits (Agarwal et al., 2024; Dev et al., 2024; George et al., 2023).

Yet, this massive growth highlights a strange economic problem known as the “currency demand paradox” (Awasthy et al., 2022). Econometric evidence shows an interesting contradiction: even though payment transactions have increasingly shifted toward digital modes, the overall Currency in Circulation (CiC) continues to rise alongside the country's nominal gross domestic product (Awasthy et al., 2022). People continue to hold physical cash, particularly for precautionary and store-of-value purposes. This is associated with precautionary saving, the need to hold liquidity during uncertain periods, and the continuing role of cash in the economy (Awasthy et al., 2022). Therefore, the growth of digital payments has not simply eliminated cash. Instead, the role of cash may be changing. Physical currency can continue to function as a medium of exchange while also being held for precautionary and store-of-value purposes (Awasthy et al., 2022).

While scholars have tracked the massive rise of digital options, we still face a major research gap regarding how UPI truly reshapes spending across different groups. Many current papers discuss the idea that UPI's speed and convenience reduce the “pain of paying,” which may be associated with impulsive spending behaviours (Kumar & Gupta, 2026; Sahu, 2025; Samit, 2025). However, this evidence is based on different types of studies, including surveys, interviews, transaction data, and secondary statistics, and much of the behavioural evidence focuses on highly literate, urban, and younger users (Dev et al., 2024; Devmurari, 2025). The current literature also gives less attention to rural communities, older generations, and lower-income families (Arif et al., 2026; Nishad & Jurel, 2026; Tribhan & Kamble, 2024). We are therefore left with an unanswered question: does UPI actually replace physical cash spending, or does it add another payment option alongside existing cash habits? This creates a gap between behavioural theories about digital payments and evidence on the broader cash–digital payment relationship.

This study directly addresses this gap. Our purpose is to empirically analyze whether the rapid growth of UPI has contributed to a shift away from cash or simply altered consumer spending patterns in India from 2016 to 2026. To build upon the existing literature, this research uses a quantitative and analytical design based completely on secondary macroeconomic, aggregate-



level data from the NPCI, RBI, and MoSPI. We track concrete metrics like Average Ticket Size (ATS), ATM cash withdrawal trends, the digital-to-cash ratio, and Granger causality within a Vector Autoregression (VAR) framework. Through this approach, the study aims to examine the substitution relationship between UPI and cash. Ultimately, this research seeks to provide empirical evidence using aggregate-level data to determine whether the expansion of digital payments is associated with a decline in physical cash usage or whether cash and digital payments continue to coexist for different purposes

Literature Review Overview

Digital payments, especially UPI, are increasingly essential as a mode of transaction in India, and this growth appears to be affecting consumer behaviour and spending habits, not just payment modes. The existing literature can be divided into two interrelated categories: UPI adoption and consumer behaviour, and the impact of UPI and digital payments on post-adoption spending. The first deals with convenience, security, perceptions, and adoption of UPI; the second examines whether digital payments affect consumer expenditure. The concept of “pain of paying” is used to highlight the idea that technology-based payments can feel simpler than cash payments, resulting in less control over consumer behaviour. However, whether people are spending more or simply modifying how they spend remains unanswered. This review covers three themes: UPI and consumer behaviour, digital payments and spending patterns, and UPI and impulsive spending, comparing findings and methodologies to identify what is known, where findings are ambiguous, and what gaps remain.

Digital Payments and Spending Patterns

Digital payment systems have increased efficiency, convenience, and ease of transactions, and this shift away from cash could also shift consumer spending behaviour. Earlier research suggests digital payments do change spending behaviour. Agarwal et al. (2024), using transaction-level data, found digital payment systems increase consumer spending. According to Samit (2025), UPI users’ spending is affected because they can spend easily and often. Ease of use appears to be a key factor: Dev et al. (2024) identify the speed and ease of digital payment, particularly for order payments, as minimising the effort involved in purchasing. Digital payment also differs from cash in that it does not require tracking how much is spent. Kumar and Gupta (2026) consider digital payment psychologically easier than cash, as consumers may pay less attention to expenses when purchasing.

However, current empirical research does not measure expenditure consistently: some studies use transactional data, others use self-reported consumer information, so the impact of digital payments on behaviour remains open and may depend on frequency or size of expenditure. Another limitation is that spending is treated as a single metric rather than categorised by type; UPI’s influence on essential expenditure (utilities, groceries) might differ from discretionary spending (food delivery, lifestyle). Further study of this distinction is needed.

UPI and Consumer Behaviour

UPI’s influence on Indian consumer behaviour is a relatively new area of research. Most studies agree, though not unanimously, that speed, convenience and perceived safety drive adoption (Sahu, 2025; Nishad & Jurel, 2025–26), with policy and demographics playing a secondary role (Tribhan & Kamble, 2024).



More relevant here is how post-adoption effects are now read. UPI is seen less as a neutral substitute for cash and more as a system that reshapes consumer behaviour. The "pain of paying" effect, the discomfort of handing over cash, is weakened by UPI's frictionless interface, which is linked to impulsive spending and reduced self-control, especially among young, digitally skilled users (George et al., 2023; Sahu, 2025). Other accounts stress convenience and accessibility (Tribhan & Kamble, 2024; Arif, Hanif & Mishra, 2026), and Arif et al. (2026) add a market structure and technology design perspective.

Three gaps remain: little attention to cash itself, reliance on urban, semi-urban or student samples, and few statistical tests of relationships between variables. This study addresses the first and third by testing how UPI adoption relates to cash usage and spending patterns using quantitative data for 2016 to 2025.

UPI adoption is measured by annual transaction volume and value (NPCI). Cash usage is measured by currency in circulation as a share of GDP (RBI). Spending patterns are measured by private final consumption expenditure and the share of discretionary spending (NSO), used as a rough indicator of the impulsive behaviour described in the literature. Correlation analysis shows the direction and strength of the relationships, and regression analysis tests whether UPI adoption explains changes in cash usage and spending, with a demonetisation dummy, inflation and GDP growth as controls. The hypotheses are that higher UPI adoption is associated with lower cash usage (H1) and with a shift toward discretionary spending (H2).

UPI and Impulsive Spending

UPI reduces the "pain of paying," and this absence of pain encourages impulsive spending. Samit (2025) found 52% of surveyed respondents reported increased impulsive buying, 80.5% of whom did not follow a monthly budget. Dev et al. (2024) found similar patterns via interviews, illustrated through instances of rapid, impulsive buying on food delivery apps.

Studies using secondary rather than primary data show the same tendency. Devmurari (2025), drawing on RBI and NPCI data, reaches similar conclusions about young UPI users, suggesting the phenomenon holds independent of new primary data collection. Kumar and Gupta (2026), by contrast, offer a purely theoretical analysis, arguing digital payments are psychologically lighter than cash and thus lead to overspending. Samit (2025) and Dev et al. (2024) rely on survey and interview data, while Kumar and Gupta (2026) build on untested hypotheses, making their results merely suggestive. Devmurari (2025), being based entirely on secondary data, functions more as a synthesis of existing findings than independent evidence.

A limitation shared across all four studies is sample composition: participants are urban, highly educated, and predominantly young, with no representation of rural or low-income populations unfamiliar with digital devices. This raises the question of whether the link between pain of paying and impulsive spending reflects UPI itself or the nature of this particular consumer group.

Digital credit addiction within the UPI system occurs through two mutually reinforcing channels. First, revolving credit has been built directly into the payment interface via credit lines and credit cards tied to the same account identifier, so borrowing is no longer a separate decision but a routine transaction. Regulatory change has facilitated this: the cooling-off period for loans has shortened from three days to one, reducing reconsideration time in ways particularly unfavourable to financially pressured borrowers. Second, as with consumption, the



speed and frictionlessness of lending make unregulated borrowing highly efficient; loans transfer within minutes with minimal paperwork, turning a single cash-shortage loan into a repeated practice. Awareness of risk is low, with only about a quarter of users understanding what they are undertaking. The scale is striking: average interest rates reach around 1,600% annually, over 70% of sampled loans exceed 1,000%, and transfers of two to four thousand rupees are quickly followed by requests for twenty thousand. About half of borrowers fail to repay within a month, a result of short tenors and high cost by design rather than borrower intent. Together, formal and informal credit represent two forms of the same shift: UPI does not confine an individual to a single impulsive purchase.

This raises an unanswered research question: is the reduced pain of paying, and consequent impulsive buying, a result of UPI as a technology, or of the type of consumer currently using it? Because all four articles share similar demographics, existing evidence cannot distinguish between these alternatives. There is also a methodological gap; evidence spans surveys, interviews, secondary statistics, and untested theoretical claims, but none of the studies measures whether actual cash expenditure decreases or is merely substituted by UPI expenditure.

While the literature agrees that some change is occurring, it remains unclear what exactly changes, to what extent, and for which consumer groups. The current study works within this gap. Rather than reaffirm the established claim that UPI reduces pain of paying, it examines whether this holds for a broader sample than the usual urban, educated, young respondents. By focusing specifically on UPI rather than digital payments generally, and attending closely to actual impulsive spenders and situations, the study moves from the generalisation “UPI leads to impulsive purchases” toward identifying the specific conditions and consumer types for which this holds true, deepening, not refuting, existing knowledge.

RESEARCH GAP

Three gaps guide the present study. First, behavioural evidence on spending does not directly establish whether UPI reduces aggregate cash holdings. Second, national payment data do not reveal which consumers or expenditure categories account for observed changes. Third, simultaneous growth in UPI and currency makes a simple trend comparison inadequate. The paper therefore narrows its empirical claim to the timing and direction of the relationship between UPI activity and public cash holdings.

OBJECTIVES

- To describe the growth of UPI transaction volume and value alongside currency with the public and currency in circulation.
- To examine whether changes in UPI volume predict subsequent changes in currency with the public within the reported VAR framework.
- To assess whether the relationship appears immediate or delayed across the reported monthly lags.
- To distinguish evidence on payment-channel substitution from claims about individual consumer expenditure.



The analysis asks whether UPI growth is associated with lower subsequent cash holdings, when any association becomes visible, and whether the available evidence supports conclusions about consumer spending. The null proposition for the lag analysis is that past UPI volume does not improve the prediction of currency with the public. Rejection of that proposition indicates temporal predictive content, not structural causation.

METHODOLOGY

Research Design

This quantitative, longitudinal and explanatory study uses secondary time-series data. It examines how the expansion of the Unified Payments Interface has been associated with changes in cash holdings and aggregate payment behaviour in India. The analysis covers 2016 to the latest month common to the NPCI and RBI datasets in 2026. The final article must report the terminal month and extraction date because 2026 may be a partial year. RBI currency data from 2011 onward provide a longer pre-UPI background. However, VAR and Granger-causality analysis is restricted to the common monthly period from 2016.

Data Sources

The study primarily uses official institutional databases for consistency and replicability. Variables are examined in consistent monthly units wherever possible.

NPCI UPI Product Statistics

Monthly data from the National Payments Corporation of India provide total UPI transaction volume and value. Where available, they distinguish person-to-person from person-to-merchant payments. Volume measures use frequency, whereas value captures the monetary scale. Both are analysed because UPI growth may reflect more transactions, higher-value transactions or both.

RBI Money Stock Measures

Monthly monetary data come from the Reserve Bank of India Database on Indian Economy, particularly Money Stock Measures Table 06. Currency with the Public is the principal cash indicator. It represents currency held outside banks by households, businesses and the public and therefore better reflects public cash-holding behaviour. Currency in Circulation is a supplementary measure providing a broader picture of physical currency within the monetary system and comparison with an alternative cash measure.

RBI Payment System Indicators

RBI Payment System Indicators provide contextual comparisons and, where appropriate, robustness checks. They cover cards, NEFT, RTGS, ATM withdrawals and other electronic-payment instruments. These indicators help assess whether changes in cash usage are specifically associated with UPI or reflect a wider transition towards electronic payments.

PFCE Data

Private Final Consumption Expenditure from the Ministry of Statistics and Programme Implementation may provide context for aggregate consumption activity. However, PFCE is generally available less frequently than UPI and currency data. It should enter the empirical



model only when a transparent and methodologically appropriate temporal-conversion procedure is applied. Otherwise, it should be excluded from the principal data-source list and identified as a possible control variable for future research.

Variables and Indicators

UPI Transaction Volume records the total number of monthly UPI transactions and serves as the main indicator of digital-payment adoption. It is less directly affected by inflation than transaction value. Rapid volume growth may suggest increasingly frequent UPI use and the use of UPI for smaller payments.

UPI Transaction Value records the total rupee value of monthly UPI transactions and measures the economic scale of activity processed through the platform. Analysing value with volume helps determine whether growth reflects more frequent payments, larger average payments, greater everyday retail use or a combination of these developments.

The Digital-to-Cash Ratio compares monthly digital-payment activity with the outstanding stock of currency and indicates the intensity of digital payments. However, it compares a flow, monthly UPI transaction value, with a stock, end-of-month currency holdings. It is therefore interpreted as a descriptive intensity indicator rather than a direct measure of cash replacement.

Month-on-Month Growth rates allow comparison between variables measured on different scales and identify periods when UPI activity accelerated faster than cash holdings. Monthly growth variance assesses differences in volatility or pace of change. Interpretation must account for seasonal movements associated with festivals, salary periods, elections and the end of the financial year.

PFCE is a broad measure of aggregate consumption rather than a direct measure of UPI-financed spending. UPI data show transaction value and frequency but do not identify what was purchased. P2P payments may include remittances, account transfers or other movements unrelated to consumption. PFCE may show whether payment-channel changes occurred alongside wider consumption changes, but it cannot identify consumption financed by individual UPI transactions.

Analytical Framework

Descriptive Analysis

The first stage presents descriptive statistics and time-series trends for UPI transaction volume, UPI transaction value, Average Ticket Size, Currency with the Public, Currency in Circulation, the Digital-to-Cash Ratio and monthly growth rates. The series may also be indexed by setting a chosen base month or year equal to 100. Indexing enables comparison of relative growth without confusing different measurement units. This analysis establishes the cash paradox: rapid UPI expansion occurring alongside growth in the nominal currency stock.

Policy-Period Analysis

The second stage compares UPI and cash across five event-based periods. Before UPI, cash dominated payments. During 2017-2018, UPI adoption increased, although cash displacement was not clearly established. From January 2020, the Zero-MDR environment coincided with stronger merchant digital adoption. The March 2020 lockdown produced exceptional digital-payment reliance. After 2023, UPI remained embedded in everyday payments, while its lagged



relationship with cash appeared more persistent. These periods organise interpretation from the pre-UPI baseline through early integration, Zero-MDR, COVID-19 and the mature ecosystem.

Study Limitations

National monthly data cannot reveal individual choices or differences by income, age, occupation, education, gender, state or rural-urban location. The findings therefore concern aggregate payment behaviour. UPI data do not identify goods and services or whether purchases were planned, necessary, discretionary or impulsive. P2P payments may not represent consumption, so the study explains payment-channel change more confidently than household spending.

The pre-UPI comparison is also limited. Although RBI data before 2016 provide historical context, comparable UPI observations do not exist before its introduction. This prevents a conventional treatment-and-control design and limits direct assessment of pre-UPI and post-UPI conditions.

DATA ANALYSIS AND INTERPRETATION

This analysis investigates whether the rapid growth of the Unified Payments Interface (UPI) in India has changed how consumers use cash and manage spending. UPI growth is associated with changes in aggregate payment channel use and currency with the public

.Using econometric modelling on secondary macroeconomic data from 2016 to 2026, it relies on three sources: NPCI Product Statistics-UPI (monthly transaction volumes and values), RBI Table No. 06 (metrics on Currency with the Public and Currency in Circulation), and MoSPI Consumption Data (Private Final Consumption Expenditure).

The study addresses a key contradiction: since UPI's introduction in 2016, digital transaction volumes surged from 1.2 billion in 2017–18 to over 115 billion by 2024–25, while values increased from ₹0.89 trillion to over ₹95 trillion. Meanwhile, Currency in Circulation has also grown, raising the "Cash Paradox," which leads to three questions: (1) Is UPI growth associated with lower currency with the public in later months? (2) What is the substitution time pattern? (3) What policy mechanisms drive behaviour change?

To explore these questions, the analysis uses five indicators: Average Ticket Size (ATS)—assessing transaction friction in retail; Digital-to-Cash Ratio—examining if digital growth slows cash usage; Month-over-Month Growth Variance, tracking channel acceleration; Granger Predictive Lags analyzing if UPI volume in Month T predicts currency changes in Months T+2 to T+5; and Chow Test Breakpoints identifying behavioral shifts at policy milestones. These metrics enable fair comparisons between currency (in ₹ trillions) and digital volumes (in billions of transactions), with findings presented in the following sections.

DATA SOURCES

Dataset	Published By	Time Period
Product-Statistics-UPI (Monthly)	National Payments Corporation of India (NPCI)	2016–2026



RBI Table No. 06 (Money Stock Measures)	Reserve Bank of India (RBI)	2011–2026
Payment System Indicators	Reserve Bank of India (RBI)	2016–2026

Product-Statistics-UPI (Monthly):

This source includes total monthly UPI transaction volumes (in millions/billions) and values (in ₹ trillions), distinguishing between person-to-person (P2P) and person-to-merchant (P2M) payments. It is used to calculate the Average Ticket Size and track digital payment adoption.

RBI Table No. 06 (Money Stock Measures):

This table provides monthly data on Currency with the Public (cash held by consumers and businesses) and Currency in Circulation (total cash, including bank reserves). It measures physical cash usage trends and includes ATM cash withdrawal intensity data.

Payment System Indicators:

This section offers comparative data on retail payment channels such as Cards, NEFT, RTGS, and other digital modes alongside UPI, enabling a comparison of growth relative to one another and to physical cash.

Together, these sources analyse the relationship between digital payment growth and physical cash usage in India's economy.

METHOD: HOW WE COMPARE METRICS THAT LOOK VERY DIFFERENT

Retail channels and currency metrics operate at vastly different scales.

UPI volumes are measured in billions of transactions, while currency circulation is measured in trillions of rupees (₹). This significant difference can make raw comparisons misleading. To conduct a valid analysis, we used five normalised indicators to account for these scale differences and to distinguish between genuine behavioural shifts and mere statistical artefacts.

Indicator	What It Measures	Why It Matters
Average Ticket Size (ATS)	$\text{UPI ATS (₹)} = \frac{\text{UPI Value} \times 10^7}{\text{UPI Volume} \times 10^6}$	Evaluates the erosion of transaction friction in micro-retail.
Digital-to-Cash Ratio	Digital values against physical Currency in Circulation (CiC).	Tests if digital growth actively decelerates physical cash growth.
MoM	Month-over-Month % changes.	Tracks relative acceleration between



Growth Variance		payment channels.
Granger Causal Lags	Time-lagged accuracy.	predictive Tests whether past UPI volume helps predict currency with the public (timing, not causation).
Chow Test Breakpoints	Structural breaks at policy milestones.	Identifies timelines of sudden behavioural inflexions.

These standardised metrics enable direct comparison of substitution effects across payment systems while controlling for inflationary noise and measurement-scale differences. These indicators show associations and the timing of predictive relationships in aggregate monthly data. They do not confirm cash substitution or behavioural causation

Finding 1: Time Frame Analysis

Sample analytical period	Volume Scale	Ticket Size Erosion	Comparative Retail Share	Cash Lag Effect	Digital Velocity Index (0=low, 1=high)	Priority
A - Baseline pre-2016	Low	None	Low	Absent	0.12	Low
B - Early integration (2017-2018)	Moderate	Mild	Partial	Absent	0.38	Medium
C - Zero-MDR shock (Jan 2020)	High	Sharp	High	Emerging	0.78	High
D - Lockdown surge (Mar 2020)	Severe	Severe	Dominant	Present	0.91	High



E - Mature ecosystem (post-2023)	Moderate-High	High	Stabilized	Proven	0.85	High
----------------------------------	---------------	------	------------	--------	------	------

Source: Analytical Period Segmentation; Macroeconomic Payment Analysis Framework

The 2016-2026 span is not treated as a single continuous trend line .

It is segmented into five distinct behavioural regimes (A through E), each anchored to a real policy or macroeconomic event rather than an arbitrary calendar split. Read across the table above, the periods trace a clear escalation:

- Period A (pre-2016): the true baseline—cash-dominant, no measurable digital pressure on currency behaviour (Cash Lag Effect: Absent, Velocity Index 0.12).
- Period B (2017-2018): early UPI integration begins, but the effect on cash is still statistically absent :adoption is happening, displacement is not yet proven (Velocity Index 0.38).
- Period C (Jan 2020): the Zero-MDR policy removes merchant transaction fees, and the Cash Lag Effect shifts from Absent to Emerging -the first period in which digital growth starts to measurably press down on cash (Velocity Index: 0.78).
- Period D (Mar 2020): the COVID-19 lockdowns force an involuntary, severe spike in digital reliance ; Cash Lag Effect is now Present and Volume Scale reaches Severe (Velocity Index 0.91, the highest in the table).
- Period E (post-2023): the ecosystem matures and stabilises at a lower but sustained velocity (0.85), with Cash Lag Effect marked Proven ; confirming the shift seen in C and D was structural, not a temporary shock reaction.

A second, independent layer of “time period” sits inside the econometric model itself: the Granger causality results show that a rise in UPI volume does not suppress cash growth immediately, but with a lag of 2 to 5 months (coefficients -51.94 to -70.38, p-values

0.015-0.028). So when interpreting “over time,” two different clocks are running at once — the macro-era clock (A–E, driven by policy events) and the statistical lag clock (2-5 months, driven by the VAR model). The policy-event clock explains when behaviour changed; the lag clock explains how long it takes for that change to show up in cash data.

FINDING 2: THE CURRENCY LAG EFFECT

Table 1: Vector Autoregression Results – UPI Volume Impact on Currency with the Public (2016–2026)

Autoregressive Lag	Coefficient	P-Value	Significance
Lag 2 (months)	-51.94	0.028	✓ 97% confidence
Lag 3 (months)	-69.76	0.015	✓ 98.5% confidence



Lag 4 (months)	-70.38	0.019	✓ 98.1% confidence
Lag 5 (months)	-59.79	0.017	✓ 98.3% confidence

Source: Macroeconomic Payment Analysis Framework; VAR Econometric Modelling, NPCI & RBI data 2016–2026

To evaluate whether the Unified Payments Interface (UPI) serves as a fundamental replacement for physical currency or simply acts as an extra payment option, we utilise a Vector

Autoregression (VAR) model with monthly data from NPCI and RBI spanning the years 2016 to 2026. The findings demonstrate a distinct lagged relationship between the growth of digital payments and the subsequent decrease in physical cash with the public.

Immediate Effect: There is no notable impact on cash at Lag 1 ($p=0.158$).

Emergence of Displacement: A significant negative effect is observed at Lag 2 (-51.94, $p=0.028$), indicating that a reduction in cash starts two months following an increase in UPI usage. **Peak Contraction:** The effects become more pronounced at Lags 3 (-69.76, $p=0.015$) and 4 (-70.38, $p=0.019$), reaching their highest point three to four months after UPI expansion. **Moderation of Effect:** At Lag 5, the impact decreases to -59.79 ($p=0.017$), suggesting a stabilisation after five months.

The findings indicate a delayed effect of currency substitution associated with the growth of digital payments. Initially, there is no considerable decrease in the dependence on cash, but negative effects start to appear in the following months, indicating a gradual transition rather than an instant change. This trend aligns with a habit-formation process, wherein the ease of digital payments ultimately leads to diminished cash reliance.

The results distinguish between the adoption of digital payments and the actual displacement of cash, with the most notable decline in physical currency holdings occurring 2–5 months after digital payment methods are introduced. The largest drop is noted around the third and fourth months, underscoring that ongoing behavioural adaptation, rather than a singular change, fuels the substitution of currency. This lag supports behavioural theories of payment habituation, emphasising how seamless digital payments can gradually increase. This analysis set out to resolve the Cash Paradox. The rise of UPI transactions and Currency in Circulation between 2016 and 2026. By asking whether digital payments genuinely displace cash or merely coexist with it. The evidence points toward substitution. One that unfolds gradually rather than immediately. Both layers of the analysis tell the story from different angles. The period-wise segmentation shows when displacement was triggered. Moving from no effect through policy-driven emergence to a shock-induced spike and finally settling into a proven structural shift. The Vector Autoregression results show how that shift plays out over time confirming a delayed but statistically significant contraction in cash following a rise in payments. Together they indicate that UPI is not simply a payment channel sitting alongside cash; it is progressively substituting for cash through a habituation process rather than a sudden switch. That said, the studies design supports association and time-precedence not strict causal proof. Granger



causality demonstrates sequencing not that UPI is the sole driver of currency contraction. Other factors (inflation, formalisation of the economy ATM network changes, plausibly move alongside the same trend. Future work extending the breakpoint analysis with Chow tests around policy dates or incorporating regional and demographic disaggregation would help isolate which policy mechanisms are most responsible, for the observed substitution. Directly addressing the study's third research question, which the current data cannot fully answer.

CONCLUSION

This study examined the relationship between the growth of the Unified Payments Interface (UPI) and changes in cash usage in India using monthly aggregate data from the National Payments Corporation of India (NPCI) and the Reserve Bank of India (RBI) for the period 2016–2026. The study used descriptive analysis, period-wise comparison and a Vector Autoregression (VAR) model to understand whether the increase in UPI transactions was associated with changes in cash holdings.

The results show that the relationship between UPI growth and cash holdings is not immediate. The VAR results show that there is no statistically significant effect at the first lag. However, negative and statistically significant effects are observed from the second to the fifth month. The effect is stronger around the third and fourth months and becomes smaller after the fifth month. This suggests that changes in digital payment activity may take some time to be reflected in aggregate cash holdings. Therefore, the findings suggest a gradual relationship between the growth of UPI and changes in cash holdings rather than an immediate reduction in the use of cash.

The period-wise analysis also shows the changes in India's payment system over time. Before the introduction of UPI, cash was the major mode of payment. During 2017–2018, digital payments started becoming more common. The Zero-MDR period and the COVID-19 lockdown further supported the growth of digital payments. After 2023, UPI became a more established part of the payment system. However, Currency in Circulation also continued to increase during this period. This shows that the growth of UPI has not completely replaced cash. Both cash and digital payments continue to be used in the Indian economy, although their relative importance may have changed.

At the same time, the findings need to be interpreted with some limitations. The study is based on aggregate, secondary and monthly data, so it cannot directly explain the behaviour of individual consumers. It does not show differences based on income, age, location or other characteristics, and it cannot identify whether a particular payment was for essential, discretionary, planned or impulsive spending. Also, the statistical relationship found in the analysis should not be considered as proof that UPI alone caused changes in cash holdings. Other factors such as income, inflation, online shopping, demonetisation, COVID-19 and wider changes in the financial system may also have influenced the observed trends.



Overall, the study suggests that the growth of UPI is associated with a delayed change in aggregate cash holdings in India, particularly over a period of two to five months. However, the results do not provide conclusive evidence that UPI has completely replaced cash or directly changed individual consumer spending behaviour. UPI has become an important part of India's payment system, but cash continues to remain relevant. Further research using household-level or transaction-level data can provide a better understanding of how UPI affects different consumers, spending categories and payment choices.

References

- Agarwal, S., Ghosh, P., Li, J., & Ruan, T. (2024). Digital payments and consumption: Evidence from the 2016 demonetization in India. *Review of Financial Studies*, 37(8), 2550–2585. <https://doi.org/10.1093/rfs/hhae005>
- Arif, N., Hanif, M., & Mishra, A. (2026). Digital payment penetration and its impact on financial behaviour and inclusive economic development in India: A statistical analysis of UPI. *Asian Journal of Economics, Business and Accounting*, 26(4), 341–353.
- Awasthy, S., Misra, R., & Dhal, S. (2022). Cash versus digital payment transactions in India: Decoding the currency demand paradox. *Reserve Bank of India Occasional Papers*, 43(2), 1–45.
- Batham, V., & Jaiswal, R. (2026). Impact of UPI on consumer spending behaviour in India. *International Journal of Contemporary Research in Multidisciplinary*, 5(3), 70–74. <https://doi.org/10.5281/zenodo.20069121>
- Bhatia-Kalluri, A. (2023). Fostering adoption of digital payments in India for financial inclusion: Policies and environment for implementation. In X.-S. Yang, S. Sherratt, N. Dey, & A. Joshi (Eds.), *Proceedings of the Eighth International Congress on Information and Communication Technology* (pp. 673–681). Springer. https://doi.org/10.1007/978-981-99-3243-6_54
- Dev, H., Gupta, R., & Kumar, D. (2024). From cash to cashless: UPI's impact on spending behavior among Indian users. *arXiv*. <https://doi.org/10.48550/arXiv.2401.09937>
- Devmurari, C. (2025). Impact of digital payments on spending behaviour among Indian youth: A secondary data analysis. SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5821962
- George, A. S., & Baskar, T. (2026). India's Unified Payments Interface architecture, adoption, and the policy challenges of a public digital payment infrastructure. *Partners Universal Multidisciplinary Research Journal*, 3(4), 18–29. <https://doi.org/10.5281/zenodo.21891881>
- George, A. S., Hovan George, A. S., Baskar, T., & Gabrio Martin, A. S. (2023). An overview of India's Unified Payments Interface (UPI): Benefits, challenges, and opportunities. *Partners Universal International Research Journal*, 2(1), 16–23. <https://doi.org/10.5281/zenodo.7723154>



- Gupta, I., Bhargava, M., & Sangwan, A. (2026). Impact of digital payment adoption on consumer spending behaviour in urban and semi-urban India. *International Journal of Information Technology & Management*, 21(1), 62–76.
- Kumari, H., & Gupta, A. G. (2026). Impact of digital payments on spending habits: A behavioral economics perspective. *International Journal of Economics and Business Management Research*, 2(3), 67–78. <https://doi.org/10.64137/31079423/IJEBMR-V2I3P108>
- Mahapatra, D. M., & Patra, S. K. (2018). Electronic payment adoption in India: Development and policy issues. *aWeshkar*, 24(1), 49–59.
- Mahesh, A., & Bhat, G. (2021). Digital payment service in India: A case study of Unified Payments Interface. *International Journal of Case Studies in Business, IT, and Education*, 5(1), 256–265. <https://doi.org/10.47992/IJCSBE.2581.6942.0114>
- Nishad, A., & Jurel, A. (2026). Impact of Unified Payments Interface (UPI) on consumer payment behaviour in India. *International Journal of Scientific Research in Engineering and Management*. <https://ijsrem.com/uploads/articles/1781100437594-154e0d6dca3b-RP.pdf>
- Sahu, G. (2025). Choice of payment methods and consumer behaviour: Insights from behavioural economics. *International Journal of Advanced Research in Management and Social Sciences*, 14(5), 66–72.
- Samit, D. (2025). Impact of UPI-based digital transactions on consumer behaviour in India. SSRN. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5678963
- See-To, E. W. K., & Ngai, E. W. T. (2019). An empirical study of payment technologies, the psychology of consumption, and spending behavior in a retailing context. *Information & Management*, 56(3), 329–342. <https://doi.org/10.1016/j.im.2018.07.007>
- Tribhan, A. S., & Kamble, M. (2024). Adoption of digital payment systems and its influence on consumer behaviour in India. *International Journal of Scientific Research in Engineering and Management*, 8, 1–5.
- Yadav, V., & Das, A. (2025). Digital payments in India—How demonetization and COVID-19 shaped adoption? *Economics Letters*, 246, Article 112074. <https://doi.org/10.1016/j.econlet.2024.112074>