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Understanding India's Currency Demand Absurdity: Cash vs. Digital Payment Methods

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Abstract

The complex dynamics of monetary transactions in India are explored in this research, with a focus on the confusing cohabitation of traditional cash and the rapidly expanding world of digital payment systems. In light of governmental policies, technological developments, and evolving consumer habits, the study attempts to identify the elements influencing the ongoing need for hard cash. The study aims to provide significant insights into the changing financial transactions environment in India by examining the intricacies of this paradox and illuminating the interactions between traditional and digital payment systems. This study aims to give a full explanation of India's Currency Demand Paradox, focusing on the competing yet coexisting realms of cash and digital payment systems. The study tries to explore the complex causes underlying the persisting desire for real cash against the background of transformational government policies and breakthroughs in financial technology. This inquiry tries to unravel the complicated jigsaw that defines India's payment ecosystem through a comprehensive assessment of consumer behaviours, socioeconomic considerations, and the expanding financial infrastructure. The findings are expected to provide useful insights into the continuing story of financial history as well as enlighten stakeholders about the subtle processes affecting currency choices in the Indian market.

Keywords: Money Demand, Currency in Circulation, Payment Systems, Payment Paradox, ARDL Model, Monetary Policy.

1. Introduction

A striking dichotomy in the financial transactions environment of India is the coexistence of conventional currency with the swift rise of digital payment systems. This phenomenon, which we will refer to as the "Currency Demand Paradox," captures the fascinating cohabitation of contemporary digital financial solutions with physical cash. This study tries to clarify the complexities of this contradiction against the backdrop of revolutionary government efforts, technology advancements, and evolving consumer preferences. Through an exploration of the factors that support the ongoing need for hard cash in an increasingly digital economy, we want to offer a comprehensive comprehension of the mechanisms influencing India's payment environment. This introduction provides background information for a thorough examination of the interactions between traditional and digital payment systems, providing insights that add to the larger conversation on the development and behavior of finance in India.

Over the past 20 years, there has been a revolutionary change in India's payments environment. Conditions brought on by the pandemic encouraged the use of digital payments even more. The Reserve Bank of India (RBI) and the government's successful policy drive is seen in the rapid growth of digital retail payments, spearheaded by the UPI, between 2016–17 and 2022–2023 (CAGR of 51% and 27% in volume and value terms, respectively). The amount of currency in circulation (CiC) is still increasing despite the boom in digital payments; the CiC-to-GDP ratio peaked in 2020–21 at 14.4%. Because cash and digital payments are seen as interchangeable, it appears illogical that both are growing at the same time. This creates a "currency demand" conundrum that calls for a thorough examination of the factors that influence the various payment methods.

There are several ways in which deciphering this puzzle might be helpful for policy objectives. As the only entities authorized to issue money, central banks must first estimate demand for money in order to calculate the right amount of banknote supply, taking into account advancements in payment technology. Second, changes in the demand pattern for currency can have an impact on the operations of liquidity management and the execution of monetary policy, since currency is a major driver of system-wide liquidity. Third, the extent to which cash and digital payment modes are substituted can inform suitable retail payment tactics and make it possible to evaluate the success of digital payment programs.

Against this context, this study aims to debunk the paradox by delving into the causes of the exceptionally high cash demand observed during the COVID-19 epidemic, as well as investigating the numerous motivations for cash usage in India. We give various stylized facts to support our analytical viewpoints. We estimate currency demand as a function of its proximal factors, such as income, interest rate, digital payments, and precautionary variables, such as uncertainty and credit-to-deposit ratio, using an autoregressive distributed lag model.

According to our data, there appears to be a decrease in the transactional usage of cash, and the need for CiC is mostly driven by "precautionary" and "store-of-value" reasons. This is demonstrated, for example, by the rising percentage of large-denomination banknotes relative to the relatively slow rise of small-value notes and coins, the decline in cash velocity, the reduction in cash withdrawals, and the trend toward digital methods for conducting small-value retail transactions.

Furthermore, we propose that the recent CiC-to-GDP ratio may not be a suitable indicator to assess the effectiveness of ongoing digital initiatives because of the potential overestimation caused by a sharp decline in the GDP denominator along with an increase in the CiC numerator during the pandemic due to uncertainty. The increased demand for cash may have resulted from a number of factors, including declining interest rates on accounts (or the opportunity cost of keeping currency), a more informal workforce, and higher-than-usual direct benefit transfer (DBT)-based cash payouts during the epidemic. Additionally, when the economy was recovering from the pandemic shock, the excess cash saved for preventive measures reflected in part the need to deal with the uncertain outlook for income and employment as well as the absence of chances to spend during the epidemic.

The enhanced money demand function provides empirical insights that indicate the statistically significant influence of precautionary and income factors on cash demand. The usage of money and digital payments are adversely correlated, although the combined impact of cautious and positive income impacts outweighs the statistically significant and negative replacement effect between cash and digital

modes. This highlights the importance of cautious variables in influencing cash demand, even as it also shows that both cash and digital payments may expand in a rising country like India due to increasing transactional activity. All things considered, nevertheless, the continued pace of fast development in digital payments may be able to mitigate the positive income effect on currency demand. Eight parts comprise the remaining portion of the paper. A synopsis of the relevant literature is provided in Section II. The developments in digital payments and CiC are examined in Section III. Section IV provides a cross-national assessment. In Section V, the payments puzzle is solved by carefully analyzing the factors that contributed to the pandemic's higher-than-normal CiC-to-GDP ratio and by separating the transactional element from the overall CiC. The data and the autoregressive distributed lag (ARDL) approach are covered in Section VI. Section VII lists the empirical results, while Section VIII contains closing thoughts.

1.2.Historical Overview of Currency Usage in India

India's economic history is characterized by a diverse range of currency evolutions that mirror shifts in the country's politics, culture, and economy. Deciphering the historical background is essential to understanding the current currency demand dilemma.

1.2.1. Ancient and Medieval Periods: Barter System to Metallic Currency

a.Barter System

b.Metallic Coins

1.2.2. Mughal and Colonial Era: Diverse Coinage Systems

a. Mughal Coins

b. East India Company

1.2.3. Post-Independence: The Introduction of the Rupee

a. Currency Reforms

b. Introduction of the Indian Rupee

1.2.4. Liberalization and Globalization: Impact on Currency Dynamics

a. 1991 Economic Reforms

b. Globalization

1.2.5. Recent Trends: Digital Transformation

a. Digital Payments in the 21st Century

b. Technological Advancements

1.3.India's Currency Paradox

1.3.1. Recognizing the Currency Demand Paradox in India

In terms of currency demand, India is now facing a peculiar conundrum. On the one hand, the country's use of digital payments is rising, indicating a growing tendency towards digital payment systems (Verma & Chaudhuri, 2008). However, there is still a sizable market for cash, particularly for small-value transactions. The demonetization initiatives of the Indian government are one of the elements behind the currency demand conundrum in that country. The demonetization of high-denomination currency notes by the Indian government in 2016 was an attempt to combat black money and encourage digital commerce. Although there was initially a spike in digital payments as a result of this, the need for cash has not decreased dramatically.

1.3.2. Economic Realities

The economic realities of India should also be taken into account. Although digital payments are being pushed, a significant portion of the population, particularly in rural areas, still conducts most of their daily business with cash. This is partly because there is limited access to digital payment solutions and banking infrastructure, and cash is still preferred in certain cultural and traditional practices.

1.3.3. Prospective Remedies

India's currency demand conundrum will need to be addressed from several angles. It will entail improving banking service accessibility, encouraging the use of digital payment systems, raising financial literacy, and attending to the particular requirements of various demographic groups. The government, financial institutions, and technology providers must work together to address this complicated issue in order to facilitate the country's transition to a more stable monetary environment.

1.3.4. The Role of Financial Inclusion

A key component of solving India's currency demand issue is financial inclusion. More individuals will have access to digital payment choices and become less dependent on cash as a result of banking services being extended to underserved and rural areas. Investments in cutting-edge mobile banking solutions suited to the requirements of rural areas as well as physical banking infrastructure will be necessary to achieve this.

1.3.5. Education and Behavioural Modification

Addressing the paradox will require not only infrastructural improvements but also behavioral changes and financial literacy. Many people, particularly in rural areas, may not be familiar with or be wary of digital payment methods; educating people about the advantages and security of these transactions is crucial to getting them to stop using cash.

1.3.6. Industry Collaboration

To promote the use of digital payments, cooperation between financial institutions, IT firms, and the government will be essential. This might entail creating safe and easy-to-use digital platforms, encouraging retailers to use digital payments, and launching focused awareness initiatives.

1.3.7. Regulatory Framework

To guarantee the security and dependability of digital payment systems, a supporting regulatory framework will be required in conjunction with these initiatives. To increase confidence in digital transactions, this entails resolving issues including cybersecurity, fraud prevention, and data privacy. To properly solve the currency demand conundrum as India navigates this currency shift, a comprehensive plan that takes into account infrastructure, education, collaboration, and regulation is necessary. In conclusion, despite the fact that India has achieved great strides toward financial inclusion through digital technology, issues still need to be resolved (Malladi et al., 2021). In conclusion, there are still issues that need to be resolved even if digital financial systems have the ability to promote financial inclusion in India.

2. Evolution of Digital Payment Methods in India

India's digital payment systems have undergone a radical transition due to government efforts, evolving consumer behaviour, and technology breakthroughs. Below is a summary of the major phases of this evolution:

2.1.1. Introduction of Online Banking (Late 1990s - Early 2000s):

I. The advent of the internet paved the way for online banking services.
II. Banks started offering internet banking facilities, allowing users to check account balances and transfer funds online.

2.1.2. Mobile Banking (Mid-2000s):

III. With the proliferation of mobile phones, banks introduced mobile banking services.
IV. Users could perform basic transactions using SMS or dedicated banking apps.

2.1.3. Prepaid Instruments and Mobile Wallets (2010s):

I. The rise of mobile wallets like Paytm, Mobi Kwik, and others offered a convenient way for users to store money digitally.
II. These wallets allowed for easy mobile recharges, bill payments, and even offline transactions at various outlets.

2.1.4. Introduction of Unified Payments Interface (UPI - 2016):

I. The National Payments Corporation of India (NPCI) launched UPI to facilitate instant fund transfers between banks through mobile devices.
II. UPI enabled seamless peer-to-peer transactions and payments to merchants without the need for card details or net banking.

2.1.5. Demonetization (2016):

I. The Indian government's demonetization moves in 2016 aimed to reduce the circulation of high-denomination currency notes and promote digital transactions.
II. This event acted as a catalyst, accelerating the adoption of digital payment methods across the country.

2.1.6. Expansion of Contactless Payments (2018 Onwards):

I. Contactless payment methods, including Near Field Communication (NFC) and QR code-based transactions, gained popularity.
II. Mobile wallets and banking apps integrated contactless features, offering a faster and more secure payment experience.

2.1.7. Introduction of Bharat Interface for Money (BHIM):

I. BHIM, a UPI-based payment app, was launched by the Indian government to further promote digital transactions.

II. It aimed to simplify the process of making digital payments for users across various banks.

2.1.8. Rise of Digital Lending and Finance (2020s):

I. Fintech companies expanded their services to include digital lending, wealth management, and insurance.

II. The integration of financial services into digital platforms contributed to a more comprehensive digital ecosystem.

2.1.9. Blockchain and Cryptocurrency Exploration:

I. While the regulatory landscape is evolving, there's a growing interest in blockchain technology and cryptocurrencies as potential future elements of India's digital payment landscape.

2.1.10. Government Initiatives (Ongoing):

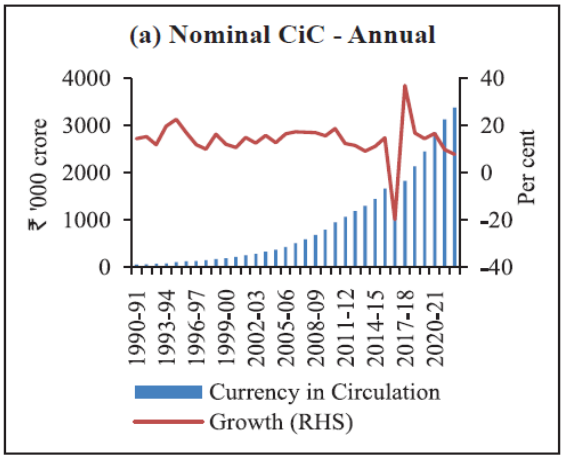
I. The Indian government continues to introduce initiatives to promote digital payments, financial inclusion, and the development of a robust digital infrastructure.

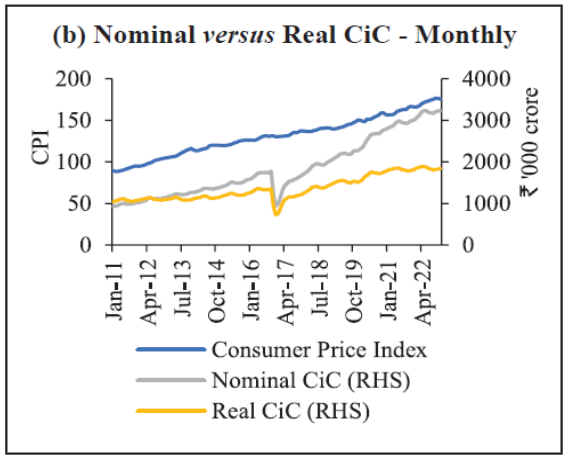
3. Trends in Digital Payments and Banknote Circulation

3.1.Money In terms of Utilization

Due to its anonymity and lack of traceability, currency in circulation (CiC), which is defined as the total of notes, rupee coins, and tiny coins, is commonly used as a stand-in for cash-based economic and financial activities. Chart 1 (a) displays intriguing trends in CiC data from India. A notable discontinuity in this sequence was seen between 2016 and 2017, which was brought about by the removal of the ₹500 and ₹1000 denominations of specified bank notes (SBN). Remonetisation that followed produced significant year-over-year growth in CiC (37 percent in 2017–18), which then moderated to 17 percent the following year.

Chart 1: Trends in Currency in Circulation (CiC)



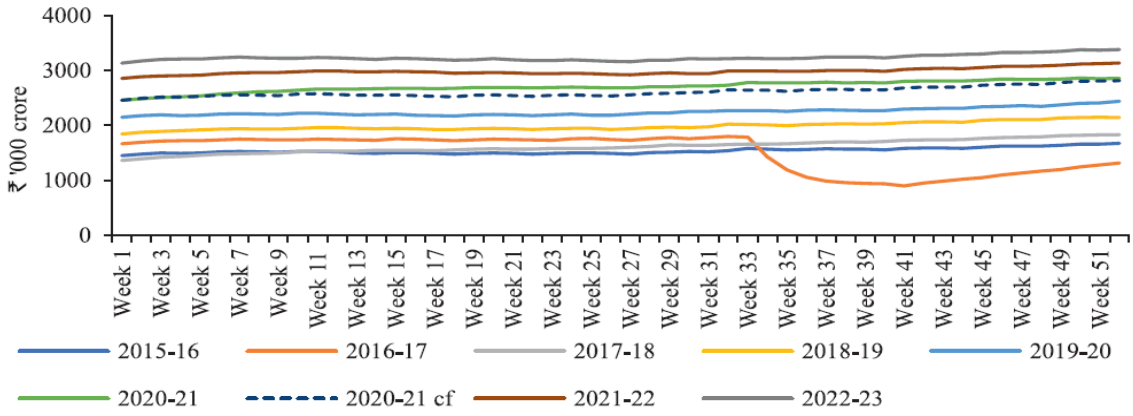


Cash demand was significantly impacted by the countrywide lockdown during COVID-19, and in the weeks that followed the mobility guidelines' relaxation in July 2020, it grew faster than it had previously (Chart 2). During the preceding ten years (2010–11 to 2019–20), the average annual growth rate for CiC was 12.7%.

In contrast, CiC rose by 16.6% in 2020–21. The next year saw a rise in CiC, but at a rate of 9.8%, the smallest in over forty years.

The statewide lockdown during COVID-19 had a major effect on cash demand, which increased more than it had been trending in the weeks until the mobility limitations were loosened in July 2020 (Chart 2).

Chart 2: Weekly Movement in CiC

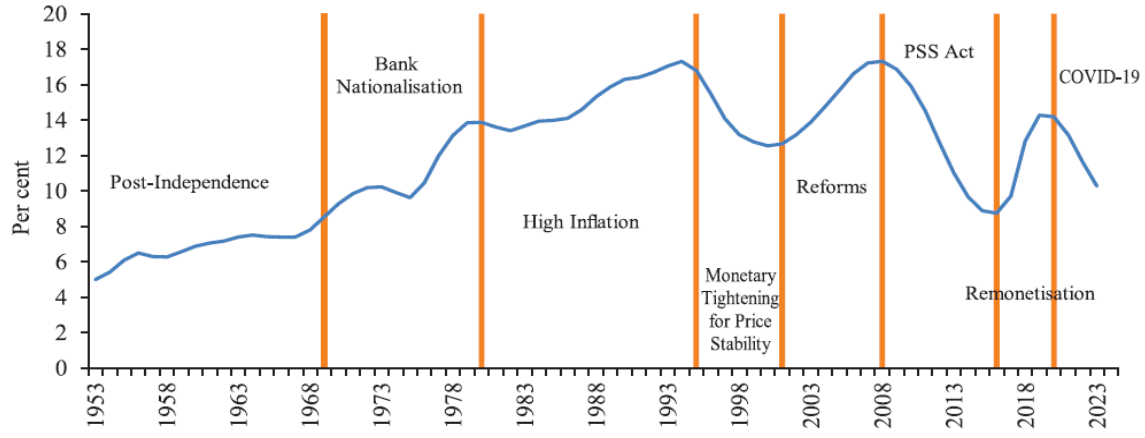


Note: The trend path has been computed taking average weekly growth rates of CiC recorded in 2018-19 and 2019-20. The counterfactual is indicated by the dotted line.
Sources: RBI and Authors' calculations.

During the preceding ten years (2010–11 to 2019–20), the average annual growth rate for CiC was 12.7%. In 2020–21, however, CiC rose by 16.6%. The subsequent year saw a rise in CiC, but at the slowest rate in over forty years (9.8%). CiC as a percentage of GDP therefore decreased, falling from a peak of 14.4% in 2020–21 to 13.2% in 2021–22. Generally, from the year 2000, the decadal average growth rates in CiC have been declining. A rise in price levels has caused the actual CiC, or CiC deflated by the consumer price index (CPI), to increase over time as well, albeit more slowly (Chart 1 (b)).

Based on a month-by-month examination, it can be observed that nominal CiC has grown at a rate of 10% or less annually from August 2021, with an average of 8.4% until June 9, 2023. This might allude in part to the effects of an increased base effect and the reverse of the

Chart 3: Long-run Trend Growth Path of CiC - 1950-2023



Sources: RBI and Authors' calculations.

monetary expansion seen during the epidemic. We use the Hodrick Prescott (HP) filter to acquire the trend growth rate in order to determine if these falling tendencies are ingrained in the long-term trend path. We specifically choose the Ravn Uhlig frequency method since it is the best approach for separating cyclicality in yearly frequency data and data series with shorter cycles (Ravn and Uhlig, 2002). Important moments in Indian history are reflected in the shifts seen in the trend growth path (Chart 3).

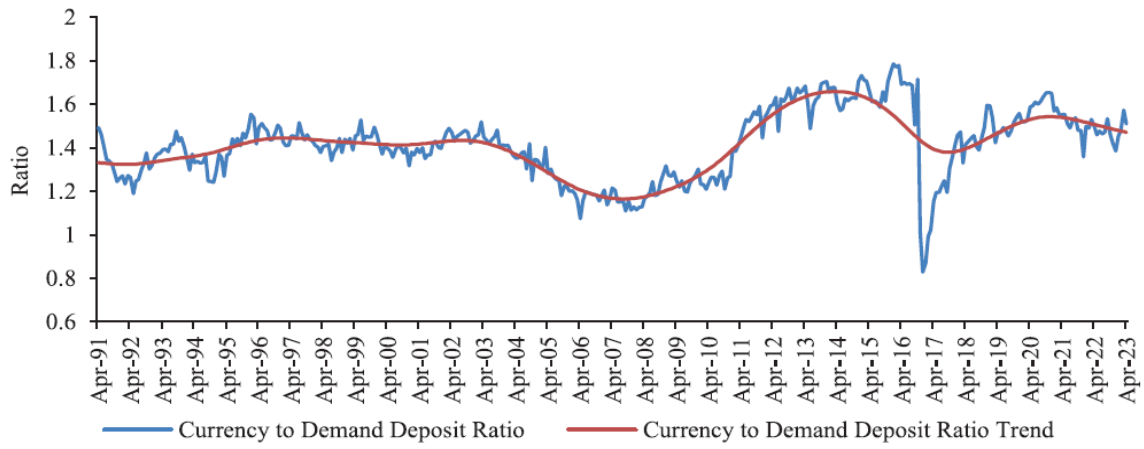
The percentage of CiC increased significantly from 8.4% to 14% between 1969 and 1980. This can be linked to the period's observable policy changes, such as the nationalization of banksand the growth of bank branches. Due to inflationary pressures, the escalation of the balance of payments crisis, and the ensuing structural changes, there was another surge between 1986 and 1995. With the exception of the 1991–1993 transition years, this era was marked by comparatively high inflation and rapid nominal GDP growth. After then, there was a drop in CiC growth as attention turned to maintaining price stability through a large monetary contraction (1996 to 2001). The economic recovery seen in India between 2001 and 2009 was a consequence of the country's first and second generation of reforms, which also caused another spike in CiC.

The Payment and Settlement Systems (PSS) Act of 2008, which opened the door for the emergence of alternative payment methods, resulted in an almost 50% reduction in the percentage of the credit cycle in growth, from 16.9% in 2007–08 to 9.5% in 2015–16. The move towards digital methods was further accelerated by other significant government efforts connected to the Jan Dhan-Aadhaar-Mobile (JAM) trinity and by actions under the Digital India project. All of these changes may have caused a level shift in the use of money, since the next peak in 2020 (15.3%) was less than the 2008 peak (16.9%) prior to the PSS Act. Two variables may have combined to cause the next increase in CiC between 2016 and 2021: the economy's remonetisation and the uncertainty brought on by COVID-19.

The long-term growth impetus of CiC appears to be decreasing after 2021. All things considered, the highs and lows are steadily declining over time.

Digital payments are based on demand deposits. Ceteris paribus, preference for money over digital forms is indicated by a larger currency-to-demand deposits ratio, whilst a smaller ratio would suggest the opposite. Because of branch growth combined with increasing interest rates on deposits, the monthly currency-to-demand deposits ratio reached its lowest point between 2005 and 2010 (Chart 4).

Chart 4: Currency-to-Demand Deposits Ratio – Monthly Trend *versus* Actuals



Sources: RBI and Authors' calculations.

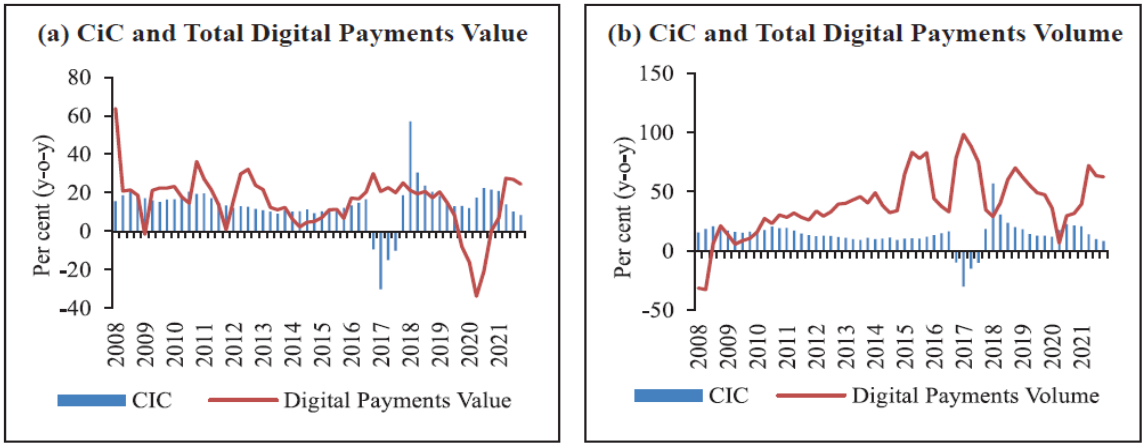
The ratio had been trending upwards between 2010 and 2014; however, in 2014, it began to fall because of the Pradhan Mantri Jan-Dhan Yojana (PMJDY) account openings. Throughout the pandemic, the ratio showed a declining tendency, with the exception of a little uptick after the reunion in 2017.

3.2.Trends in Digital Payments

Driven by regulatory actions and evolving payment patterns, the digital payment landscape has experienced a remarkable growth in the last several years. According to ACI Worldwide and worldwide Data (2023), India's percentage of worldwide real-time digital payments increased by 6 percentage points from 40% to 46% in 2022, the highest level. People used contactless payment methods, which are secure and convenient, as a result of the epidemic, which decreased personal interaction. As a result, in 2021–2022, digital payments increased in volume and value terms by 64% and 23%, respectively. The equivalent growth rates in 2022–2023 were 58% and 19%, respectively. Quick response (QR) codes and point of sale (PoS) terminal density rose as a result of the underlying payment infrastructure growing in tandem with the growing demand for digital transactions.

Remarkably, the usage of digital devices spurred by the epidemic keeps increasing. Growing digital awareness, expanding smartphone and debit card availability, and targeted welfare payments during the epidemic have all contributed to this change (Saroy et al., 2022). It appears that digital payments are replacing cash-on-delivery (CiC) in the past (Chart 5).

Chart 5

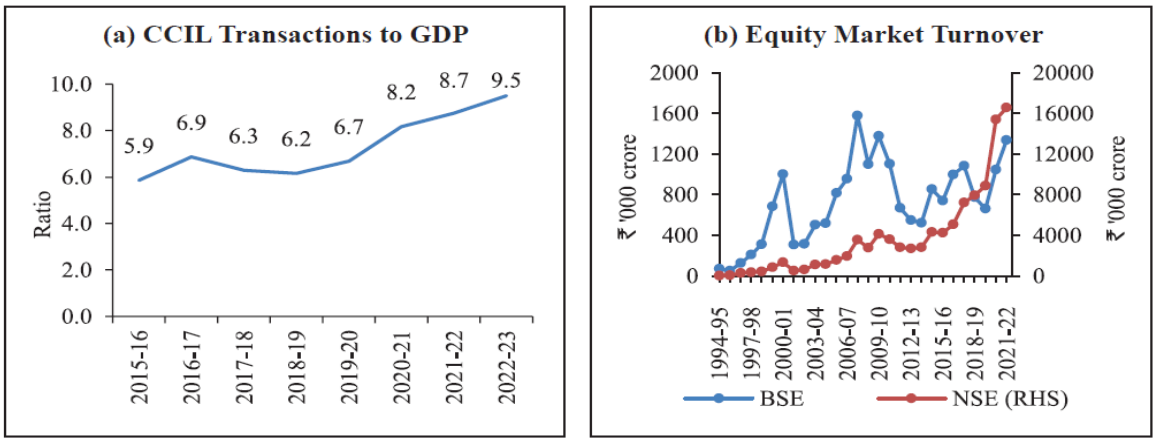


Source: RBI.

The increasing trend towards digital modalities is further supported by the secular drop in traditional paper-based clearance in recent years (Annex 1: Chart 1)[2]. From 2018 to 2019, there has been an increase in settlements through the Clearing Corporation of India Limited (CCIL)-run systems, including government securities clearing, currency clearing, and rupee derivatives. Notably, there was a notable spike in these types of transactions during the global epidemic (Chart 6(a)). Since the pandemic's start, retail investors have also been more interested in the stock markets through internet brokerages, which has led to significant market movement (Chart 6(b)). Since UPI and credit card payments are the most popular ways to fund trading accounts, the increased activity in the equities market may have also contributed to a rise in UPI and credit card transactions.

[2] The Payments Vision Document 2025 projects the share of paper-based clearing to fall to 0.25 per cent of the total retail digital transactions in volume terms by 2025 from 0.9 per cent in 2021-22 (RBI, 2022).

Chart 6



Source: RBI.

4. Comparing the Utilization of Online Payments and Currency Across National Boundaries

Not just India is witnessing a surge in the use of digital payments in addition to cash. Following World War II, industrialized nations saw a prolonged pattern of declining currency usage, which was followed by a stagnation until a steady increase throughout the 1990s (Ashworth and Goodhart, 2020). As to the Red Book Statistics of the Bank for International Settlements (BIS), there has been a concurrent rise in card payments and cash transactions for the majority of nations since 2007. As a matter of fact, the "paradox of banknotes" refers to the well-known rise in CiC even as the transactional usage of currency declines (Bailey, 2009).

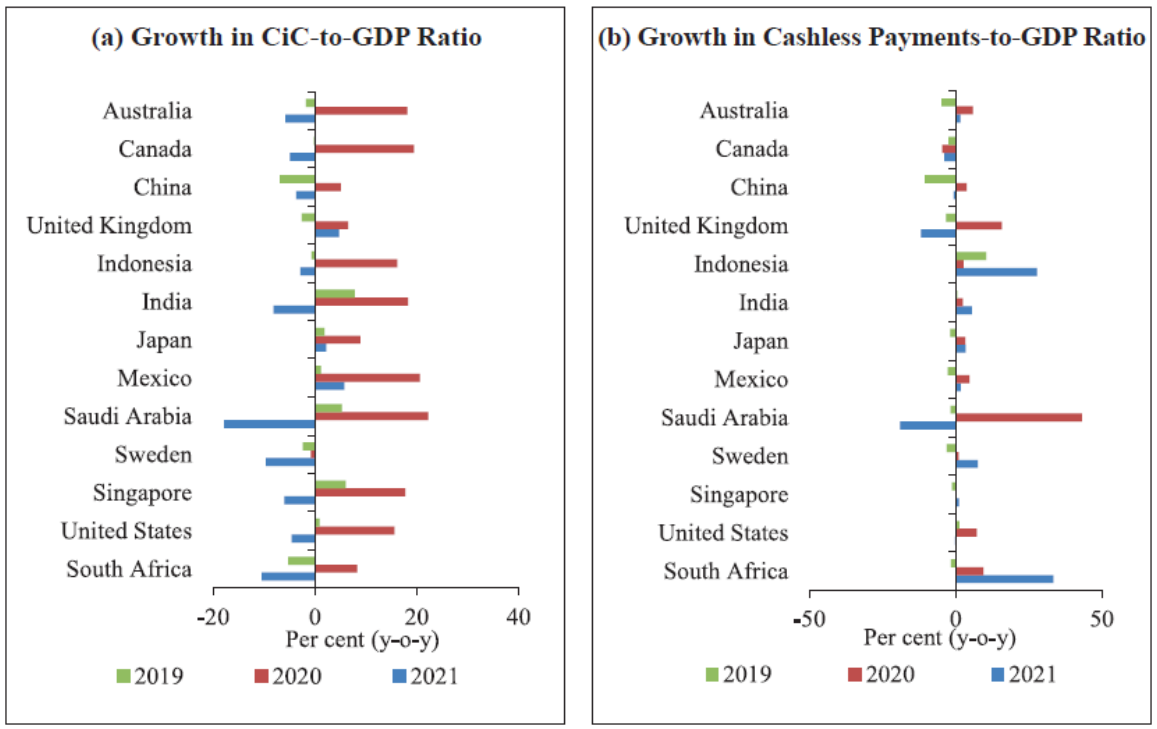
The research (Caswell et al., 2020 for a study of the Euro area; Chen et al., 2020 for Canada; and Bech et al., 2018 for a study of a group of nations) links the ongoing desire to use cash with cautious considerations more so than basic transactional demands. The only nation defying this pattern and seeing a secular fall in CiC as digital payments approach near-ubiquity is Sweden, the pioneer of digital payments.

Even if cashless payments took off after the pandemic, many nations' CiC-to-GDP ratios were still high in 2020 (Chart 7(a)). Large-denomination notes, which are usually employed as a precaution, saw a stronger increase in circulation in 2020 for the majority of nations compared to other notes and coins (BIS, 2021). Compared to 11 emerging market countries (EMEs) that had growth of 12% in 2020, eight advanced nations saw an average 15% increase in CiC in 2020.[3]Crucially, in 2020, the CiC-to-GDP ratio rose by around 12% for these developed nations, while the comparable growth for the EMEs included in the analysis was far larger, at 17% (BIS, 2021). It's interesting to note that in 2020, less cash withdrawals were made in the majority of countries as a result of mobility constraints that limited consumption. For the majority of nations, during the first wave of the epidemic, the magnitude of withdrawals increased as the quantity of withdrawals decreased more quickly than their value moderated.

[3]The advanced economies include Australia, Canada, Switzerland, United Kingdom, Japan, Sweden, United States, along with Euro Area, while the EMEs include Argentina, Brazil, China, Hong Kong SAR, Indonesia, India, Korea, Mexico, Saudi Arabia, Singapore and South Africa.

Concurrently, there was a notable decrease in the average value of cashless payments, suggesting a preference for digital methods for addressing small-value transaction requirements (BIS, 2021). Cross-country disparities in yearly withdrawals per capita varied from 50 in Saudi Arabia and Indonesia to the lowest of five in India. A notable shift towards digital payments and a strong rise in CiC point to a weak transactional use of cash.

Chart 7: Cross-Country Trends in CiC and Cashless Payments



Source: BIS Red Book Statistics, 2023.

For the majority of nations, the increase of the CiC-to-GDP ratio decreased in 2021 as a result of the large base and the normalization of cash demand as the pandemic subsided. However, several EMEs, particularly India, have continued to see rapid growth in cashless payments at the same time (Chart 7(b)).

5. Interpreting the Currency Demand Dilemma

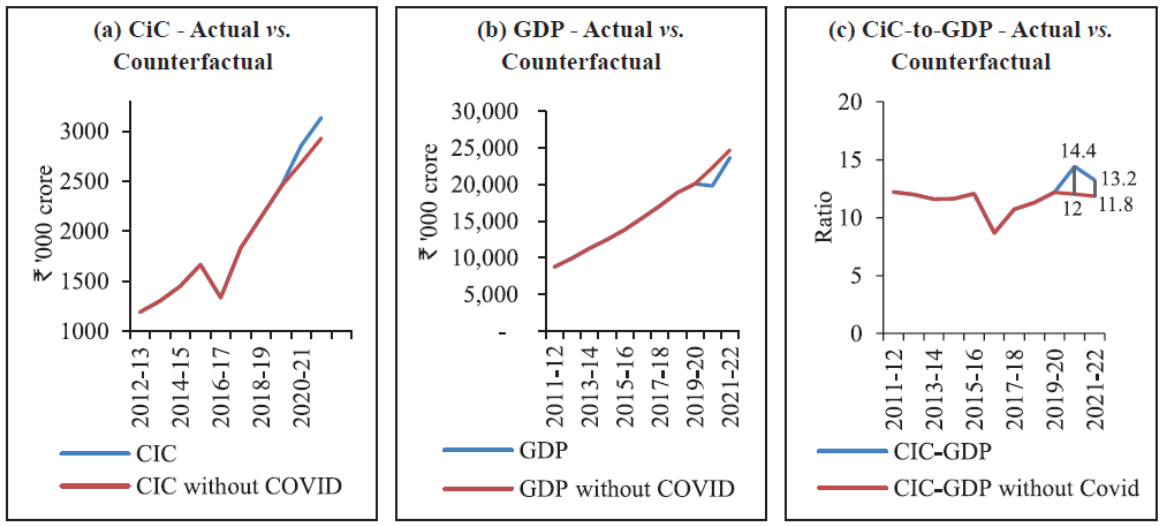
5.1. Overemphasized CiC-to-GDP ratio

A cursory review of the statistics could suggest that there was a noticeable increase in currency demand as a result of the outbreak. But a closer look at the statistics shows that given the public's propensity to hoard more cash during uncertain times, this may be the result of increased demand for non-transactional uses. Due to the reduction in the base (nominal GDP) and the exceptional increase in currency demand caused by uncertainty, the CiC-to-GDP statistic might not be a suitable way to assess how effective the current digital push works. As an example, the data suggests that the CiC-to-GDP ratio was overestimated. We create straightforward counterfactuals of the 2020–21 and 2021–22 statistics, estimating the values that these variables would have taken if the exogenous shock of the pandemic had not happened, in order to assess the impact of the pandemic on CiC and GDP. A rough calculation reveals that if CiC had increased at a compound annual growth rate (CAGR) of 9.5% (estimated from 2011–12 to 2019–20), there would have been a positive difference between the real and "without COVID" CiC values in 2020–21 (first wave) and 2021–22 (second wave), respectively (Chart 8 (a)).

Similar estimates for nominal GDP (at the CAGR of 1%1) reveal an anticipated fall due to disturbances in the economy; for GDP in 2020–21 and 2021–22, respectively, a negative output gap of ₹25 lakh crore and ₹10 lakh crore emerges (Chart 8 (b)). In comparison to the actual ratios of 14.4% and 13.2%,

respectively, the ratio would have been 12.8% in 2020–21 and 11.8% in 2021–22 based on these "without COVID" numbers (Chart 8 (c)).

Chart 8: Counterfactual Assessment



Source: RBI.

5.2. The breakdown of Cash Demand Causes

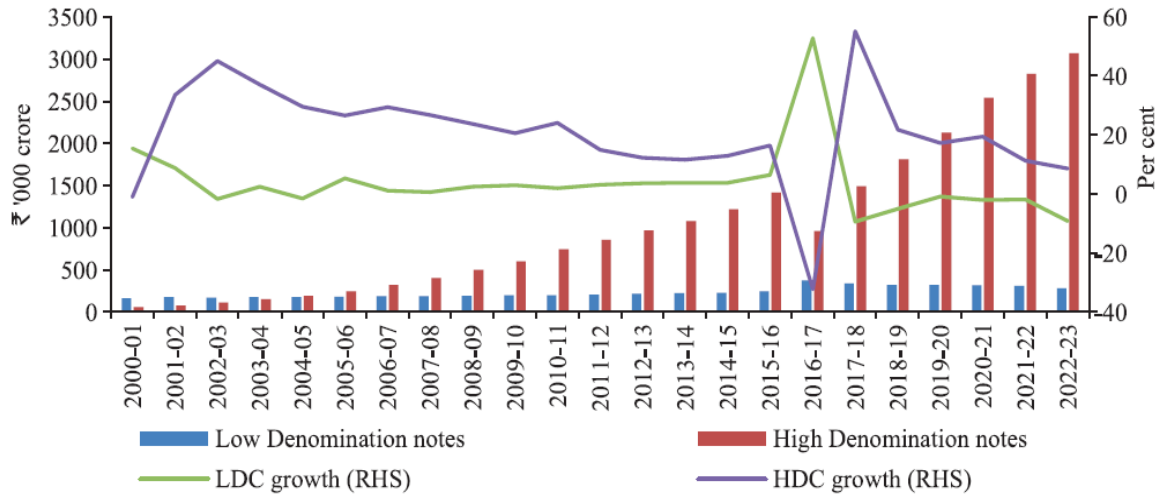
Cash serves numerous uses. However, disentangling these responsibilities raises several methodological challenges. A ₹500 bank note in a wallet may serve as both a payment method and a temporary store of wealth. Furthermore, not all large-denomination bills are kept only for hoarding purposes; some people may be holding cash for legitimate reasons. The majority of research employ micro-surveys or payment diaries to assess transactional cash demand. The next piece of the payment jigsaw is to separate the transactional and precautionary aspects of cash usage. Based on current literature, we examine trends in various denomination notes and ATM withdrawals to better understand retail cash use (Guttman et al., 2021).

5.2.1. Currency-denomination trends

Large denomination notes are frequently used for precautionary reasons since they are simpler to keep (Zamora-Perez, 2021) and provide payment secrecy (Drehmann et al., 2002). Given that change (or balance) is only provided for cash transactions, fluctuations in the supply of low denomination notes and coins may represent cash usage for retail purchases (Amromin and Chakravorti, 2009). The desire for bigger denomination banknotes, such as ₹200, ₹500, ₹1000[4], and ₹2000[5], has led to significant rise in India's total CiC in recent years. The withdrawal of SBN (₹500 and ₹1000 banknotes) from circulation in 2016-17 resulted in a substantial decline in their growth rates, while lower-denomination peers surged. An study of weekly data fluctuations reveals that remonetisation took 1.25 years to complete. As a result, while the value of low-denomination notes has stayed basically stable, the circulation of large-value notes has surged, particularly during the pandemic, by 19.4% in 2020-21 and 11.3% in 2021-22 (Chart 9). The total weekly change in CiC from April 2018 to March 2022 can be used to estimate

transactional cash consumption. Scaling the total sum gained to the CiC outstanding as of the end of March 2022, we discover that the transactional motivation might account for 42% of the change in CiC.

Chart 9: Evolution of CiC by Denomination



Source: RBI.

Furthermore, the percentage of high denomination notes (by number) in total notes in circulation increased from 21% on average in 2010-16 to 33.1 percent in 2020-21, 36.5 percent in 2021-22, and 44% in 2022-23 (Chart 10 (a). In terms of value, big denomination notes accounted for 90%, up 8 percentage points over the 2010-16 average (Chart 10 (b)).

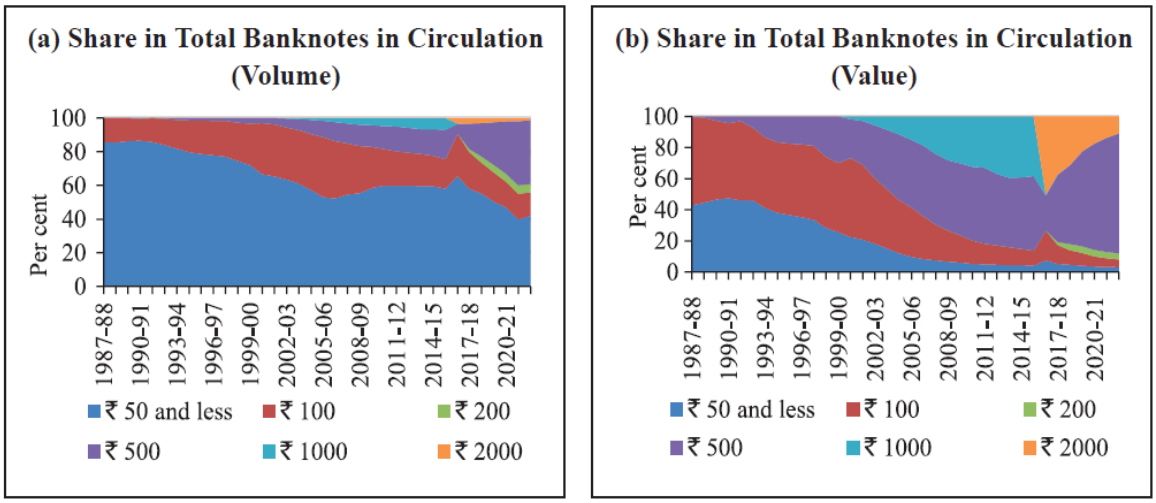
[4] Prior to the discontinuation of this denomination with effect from November 8, 2016.

[5] On May 19, 2023, the Reserve Bank of India announced the withdrawal of ₹2000 banknotes from circulation. The total value of ₹2000 banknotes in circulation, which was ₹3.56 lakh crore at the close of business on May 19, 2023, declined to ₹0.10 lakh crore at the close of business on October 31, 2023.

The increase in circulation of ₹500 banknotes can be attributed to a combination of factors, including larger-than-normal cash buffers as a safety measure for pandemic-induced uncertainties, withdrawal of ₹1000 notes from circulation, as well as moderation in circulation of the highest denomination of ₹2000 banknotes (RBI, 2021) and a tendency of banks to dispense higher denomination notes through ATMs given the operating cost advantage.

Small denomination notes have been decreasing in share over time. Part of the reason for this is that UPI payments have replaced small-value cash payments; in 2022–2023, UPI payments accounted for 73% of all retail purchases, up from 63% in the previous year. In 2022–2023 person-to-merchant (P2M) transactions made through UPI had an average per transaction value of over ₹750, whilst pre-paid mobile wallets had an average per transaction value of less than ₹500.

Chart 10: Trends in Share of Bank Notes in Circulation



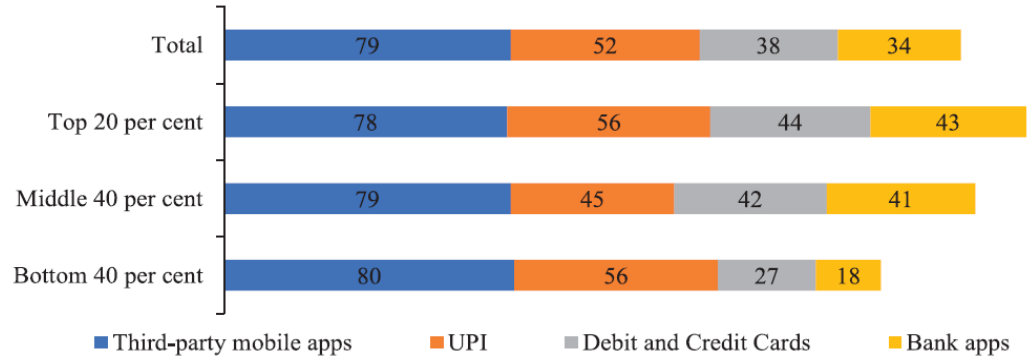
Source: RBI.

A growing body of research indicates that the epidemic has sped up the digitalization of payments; during the lockdown phase, 33% of Indian households adopted digital payment methods for the first time, including third-party smartphone applications, UPI, and cards (NPCI, 2020). Crucially, during COVID-19, the usage of digital payments increased across all income levels (Chart 11).

5.2.2. The patterns of cash withdrawals

CiC can be used as a stand-in for cash demand, even if the transactional part makes up a very tiny percentage of overall CiC (Stix, 2004). Data on ATM withdrawals may be analyzed to determine how often cash is used for payments. Because ATMs are flow devices, the amount of money taken out of them is modified to reflect velocity shifts brought about by the replacement of cash with digital payment methods (Khiaonarong& Humphrey, 2023)[6]. There are several ways to obtain cash in India, including bank offices, ATMs, Micro ATMs (via business correspondents), and Points of Sale. Cash access points, or ATMs, have been a major feature since they were introduced in 1969. The amount and frequency of cash withdrawals from ATMs in India are restricted, therefore these withdrawals may be used as a gauge for "genuine" precautionary balances (as opposed to hoarding) as well as the transactional aspect of cash demand. Stated differently, an increase in ATM withdrawals would suggest a greater requirement for cash for routine financial operations.

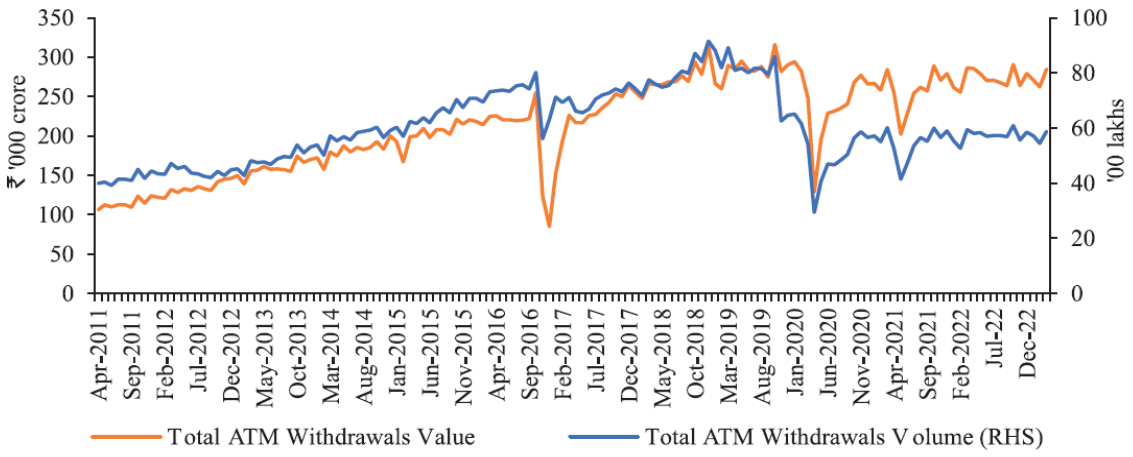
Chart 11: Digital Payment Adoption during COVID-19 by Income Groups



Note: The bars depict the mode-wise adoption of digital payments during the lockdown by first-time users across different income groups - Top 20 per cent, Middle 40 per cent, and Bottom 40 per cent. The respective shares do not add to 100 as respondents were allowed multiple responses.
Source: NPCI (2020).

There was a noticeable decline in ATM withdrawals when the lockout in 2020 started. The quantity and amount of withdrawals were about equal (Chart 12). But when the gap between the quantity and value of withdrawals grew, this pattern was reversed both during and after the pandemic's initial wave. As the pandemic expanded, there was a 52% decrease in cash withdrawals during the April–June 2020 quarter compared to the same quarter in 2019, and a 36% decrease in value.

Chart 12: ATM Withdrawals through Cards



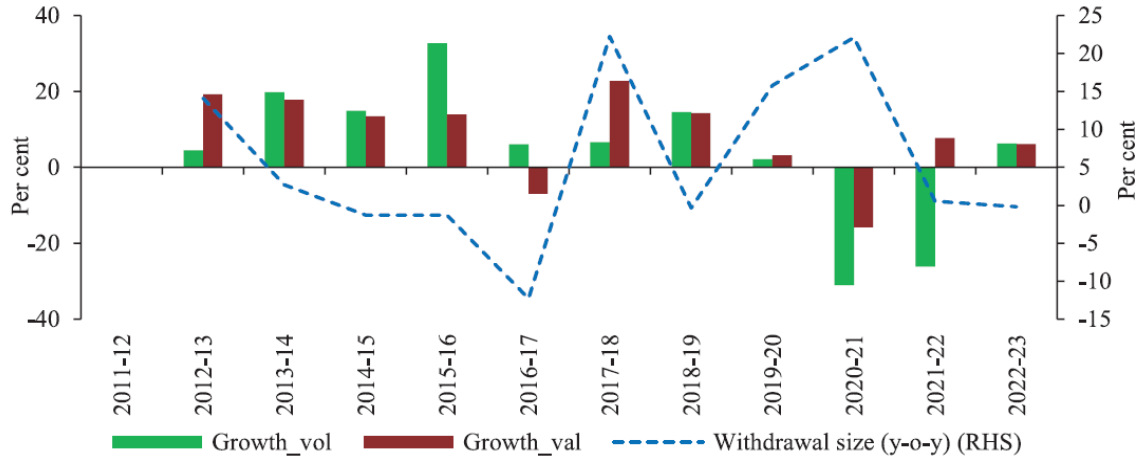
Source: RBI.

[6]CiC is a stock variable and ATM withdrawals are flows. The change in CiC equals thedifference between note withdrawals and returns into the system. Cash withdrawals from ATMscomprise the flow component of the CiC indicating the change in the transactional componentof CiC over time.

It's possible that the pandemic's uncertainty caused households to hoard cash in order to avoid making frequent trips to the bank or ATMs. If past experiences are any indication, periods of extreme

uncertainty usually prompt a rush for cash as a crisis management tactic (Rösl and Seitz, 2021). In 2020–21, cash withdrawals decreased by almost 32% overall, although in value terms, the fall was only about 16% (Chart 13). The increase in the average withdrawal amount suggested that people were making larger-than-normal withdrawals by using fewer ATM trips due to uncertainty. Despite the spike brought on by COVID, the trend rise in cash withdrawals has essentially stopped in the last several months, showing almost no growth (Annex 1: Chart 2).

Chart 13: Growth in ATM Withdrawals



Source: RBI.

Reduced transactional cash demand is seen by the shrinking gap between CiC and ATM withdrawals (both scaled to GDP) between 2018 and 2019. Furthermore, notwithstanding a little increase during the remonetisation in 2016–17, the cash velocity as shown by the GDP ratio to the outstanding CiC has shown a continuous declining trend. This pattern suggested that a greater percentage of cash was being held rather than spent or invested, and it also showed a decline in the frequency of utilizing money for transactions.

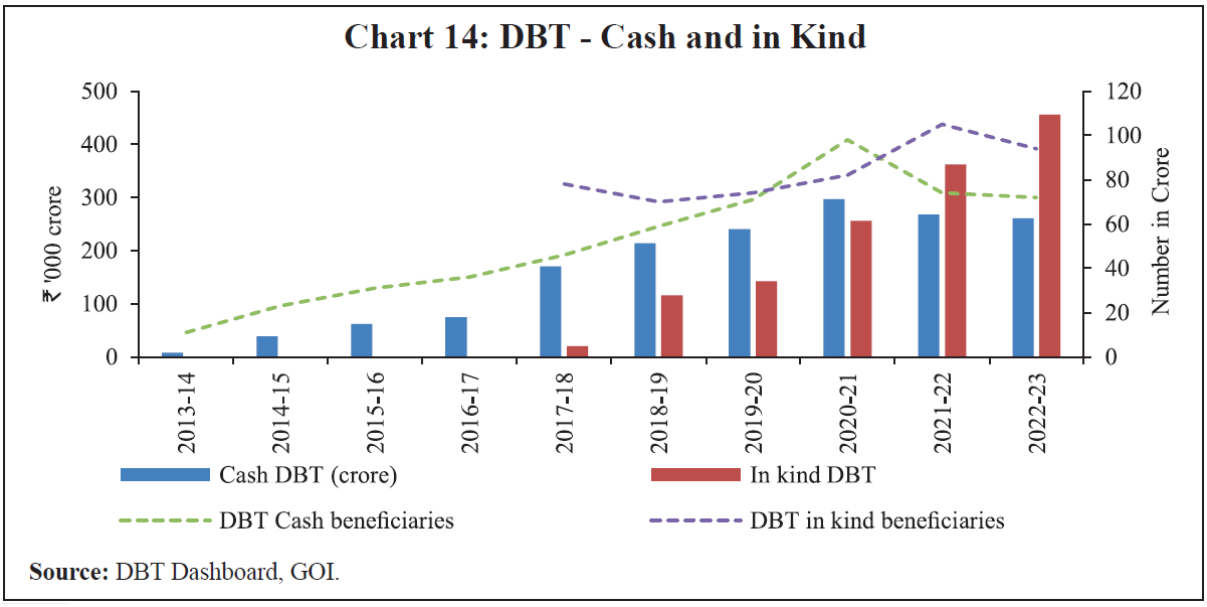
Since the first wave's high in April 2020, there has also been a declining trend in the cash-to-card ratio, or the ratio of the average monthly value of ATM withdrawals to the average monthly ticket size of card payments. The decline in this ratio implies that the pandemic circumstances drove a diminishing desire for cash to fulfill transactional reasons, with cards being used more for making digital payments. This is because cards may also be used to withdraw cash. Additionally, according to FIS (2023), the percentage of cash used at PoS terminals dropped from 71% in 2019 to 27% in 2022.

5.3. Additional CiC Drivers

5.3.1 Direct Benefit Transfers

Benefit transfers using digital channels have been shown to increase efficiency (Aker et al., 2013). The government's use of Aadhaar-linked bank accounts to disburse subsidies has been crucial in promoting financial inclusion and digital adoption throughout the nation. Social protection programs—particularly

cash transfers—took center stage during the epidemic (Gentilini et al., 2020). With the number of intended recipients growing by 27 crores, the government increased total cash-based direct benefit transfers (DBTs) by 24% in 2020–21 from 12% in 2019–20 (Chart 14).



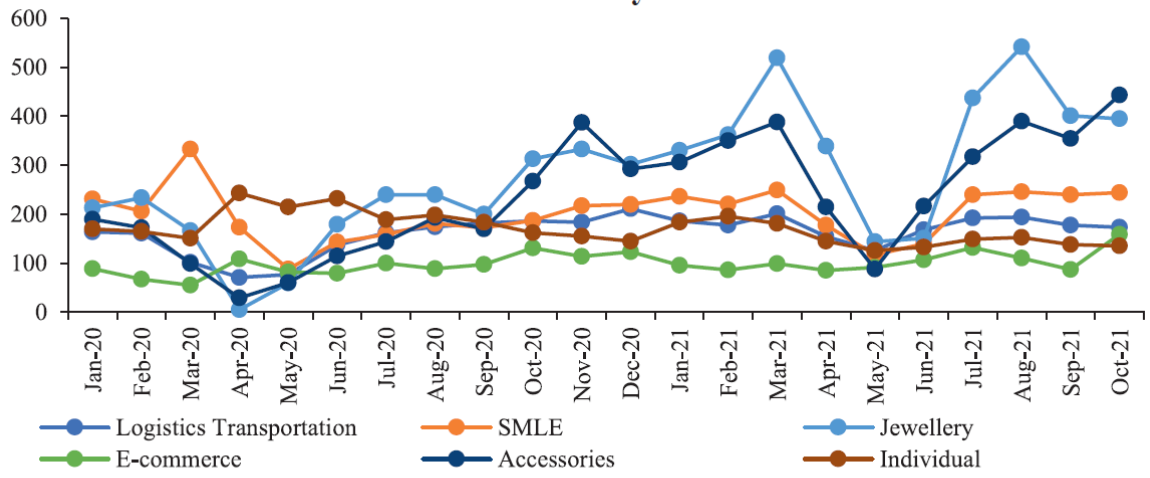
The ₹56,849 crore increase in cash transfers represented 14% of the overall variance in CiC in 2020–21. About 10% of the change in CiC during 2021–2022 was explained by the increase in cash transfers compared to the pre–COVID era. Following the epidemic, a number of State Governments, including those in Rajasthan, Tamil Nadu, Bihar, and Madhya Pradesh, in addition to already-existing DBT schemes like Telangana'sRythuBandhu and Odisha's KALIA, introduced a variety of one-time cash-transfer schemes. These targeted transfers improved the ways that cash and digital modes complement one other. Benefits were electronically transferred to beneficiary accounts via the National Automated Clearing House, or NACH (the digital leg). The cash leg involved beneficiaries withdrawing their benefits in cash from banks or micro-automated teller machines (micro-ATMs) that enabled cash withdrawals in underprivileged areas. As a result, both legs grew at the same time. In several cases, they went the further mile by way of different middlemen, such as BCs, who withdrew and gave the recipients cash.

5.3.2 Dynamics of the Informal Sector and Labor Market

Since the informal sector is largely linked to cash settlements, it plays a critical role in influencing the demand for cash (Amromin and Chakravorti, 2009). According to an index created by CMS Infosystems, a cash management organization, there were significant fluctuations in cash-intensive industries between 2020 and 2021. It's interesting to note that there was a noticeable increase in the relative intensity of cash, or the average amount of cash taken from industry for further processing and vaulting. Particularly affected were industries like jewellery, accessories, transportation, and different small, medium, and large businesses (SMLE). The movement of lump sum cash payments grew, especially once the limits were loosened in July 2020 (Chart 15).

Price increases may have contributed to some of this increase. Nonetheless, an increase in retail inflation accounted for around 40% of the overall rise in CiC[7], suggesting the existence of additional reasons supporting the continued use of cash.

Chart 15: Retail Cash Collections by Sectors - CMS Cash Index

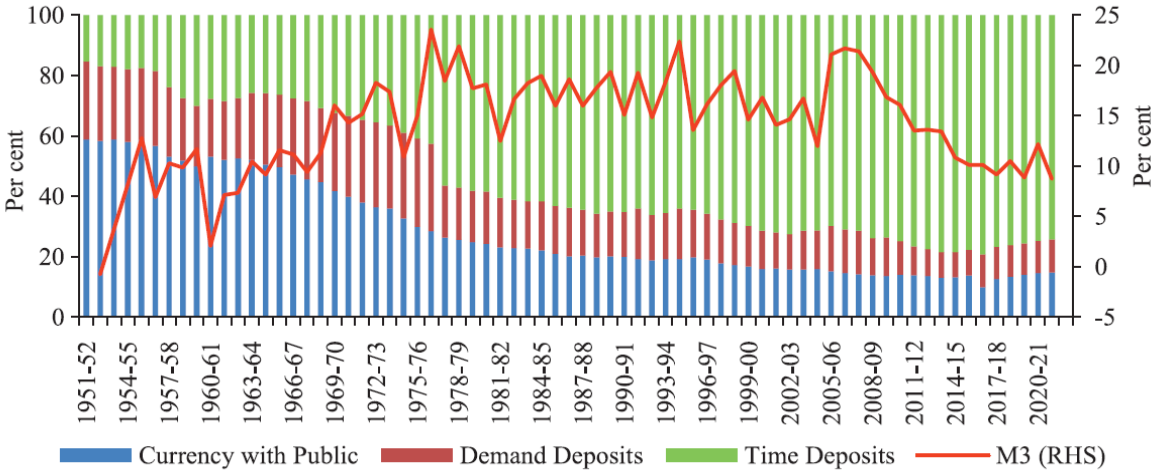


Note: All values are indexed to January 2020.
Source: CMS Infosystems.

5.3.3 PortfolioAdjustmentofHouseholds

The requirement to hold more cash on hand is becoming more and more necessary, mostly due to declining interest rates and reduced global prices since the early 1990s, which helps to explain the currency demand conundrum. Because of the policy stimulus to spur economy and the introduction of the Flexible Inflation Targeting (FIT) framework, which strengthened inflation anchoring, deposit rates in India fell from 2016. The average deposit rates decreased to 5.8% between 2016–17 and 2022–23 from 7.5% in the seven years prior (2009–10 to 2015–16); nonetheless, it should be noted that deposit rates increased in 2022–23 and 2023–24 thus far.

Chart 16: Evolution of M_3 Components



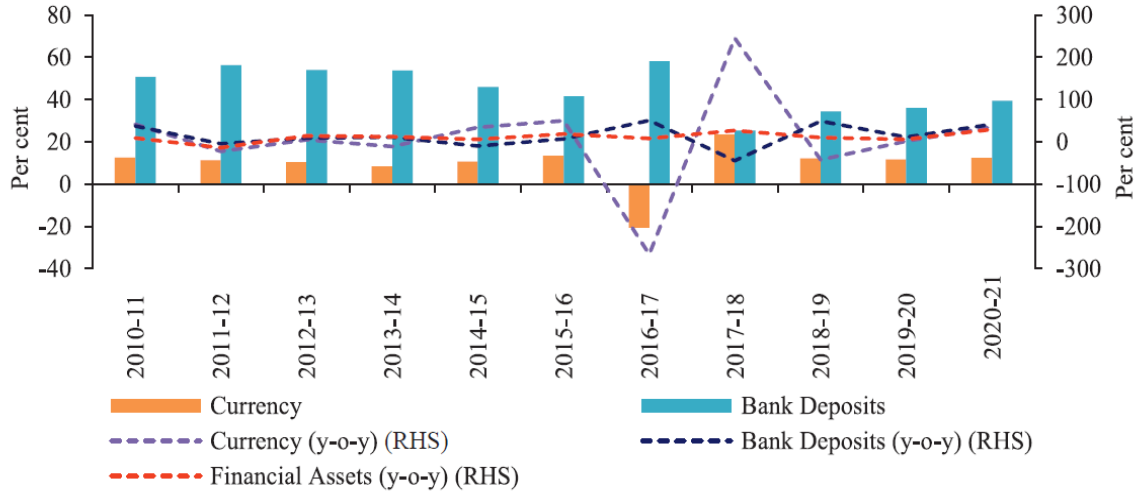
Source: RBI.

[7] In 2020-21, retail inflation, measured by CPI, increased by 6.6 percent, while CiC recorded a growth of 16.6 per cent.

A rise in demand for non-interest-bearing assets, such as money, may have resulted from the lower return on alternative investments (or negative real return) in the years preceding 2022–2023. It is noteworthy that, despite a consistent decline in the currency portion of M3 during 1951–1952, at times of crisis and significant policy changes, it has grown more quickly than total deposits (Chart 16). The surplus savings of families, which increased to 15.5% of GNDI in 2020–21 from 11.7% in the previous year, further demonstrates the cautious behaviour in cash usage[8]. The readjustments in household budgets brought about by stimulus measures, such targeted assistance programs and the deferment of loan and interest repayments, may have had a role in this.

Furthermore, a considerable drop in private consumer spending brought on by transportation limitations and the hazy future for work and income might have resulted in a rise in family savings. In 2020–219, physical money and bank deposits were the majority of household financial movements (Chart 17). In 2020–21, the proportions of currency and bank deposits both rose over the prior year. Although currency holdings should normally be replaced by deposits, a concurrent increase in both showed that people were consistently using cash as a savings option during financial emergencies (Jobst and Stix, 2017).

Chart 17: Financial Assets of Households - Composition and Change



Sources: RBI and MoSPI.

This section's stylized facts demonstrate that the high CiC is due to both store-of-value and precautionary factors. Additionally, the data points to the growing replacement of digital methods for the transactional demands that currency once fulfilled.

[9] As a component of household financial assets, the share of currency increased from 11.8 percent in 2019-20 to 12.3 percent in 2020-21, while deposits grew from 36.1 percent to 39.5 percent, respectively.

6. Quantitative Currency Demand Forecasting

We examine the primary factors that influence the credit-to-deposit ratio (CDR), which indicates the role of income, financial and technological innovations, and precautionary demand, in accordance with the

body of literature currently in publication. These factors include the GDP, deposit interest rates, value of digital transactions, uncertainty, and CDR. To separate the influence of prices on CiC, we carry out an analogous empirical experiment for modelling the actual currency demand. We do our empirical research based on the fortnightly series accessible from Q2:2009 to Q2:2022, even though the statistics on digital payments date back to April 2004. This is due to the fact that the PSS Act, which was passed in 2008, gave the digital payment ecosystem its primary acceleration. We also reduce the influence of the worldwide economic downturn on our findings by using this subsample.We do our empirical research based on the fortnightly series accessible from Q2:2009 to Q2:2022, even though the statistics on digital payments date back to April 2004. This is due to the fact that the PSS Act, which was passed in 2008, gave the digital payment ecosystem its primary acceleration. We also reduce the influence of the worldwide economic downturn on our findings by using this subsample.

In terms of interest rates, we take into account the lower bound of the rates offered on deposits with a maturity of less than a year by large banks. While information for other series is obtained from the RBI, the uncertainty index is derived from Baker et al. (2016). Using the X-13 ARIMA filter, the nominal and real GDP data, as well as the nominal and real CiC, are seasonally adjusted. All the variables used in the empirical analysis are transformed to natural logarithms, with the exception of interest rates and the CDR. Using dummy variables, we additionally account for the impact of the first statewide lockdown prompted by COVID-19 (2020Q2) and the removal of SBN from distribution (2016Q4, 2017Q1).

In order to estimate the long-run currency demand function, we employ the autoregressive distributed lag (ARDL) model (Pesaran and Shin, 1995; Pesaran et al., 2001). Other multiple equation modelling time series techniques, including vector autoregression (VAR) and vector error correction models (VECM), are not appropriate due to the small sample size of 50 observations. For estimating outcome and predictor variables that show correlation both contemporaneously and over lagged values, the ARDL model is frequently regarded as a workhorse model because of the one-to-one relationship between the ECM of a VAR model and an ARDL model (Banerjee et al., 1993). A fair estimation of the underlying short-run error correction and long-run cointegration relationships may be obtained with ARDL for smaller samples, while also maintaining degrees of freedom.Its ability to include a combination of stationary and non-stationary variables is another benefit; this is something that traditional cointegration methodologies, as proposed by Engle-Granger (1987) and Johansen (1995), usually cannot accomplish. This is because it is not constrained by variations in the order of integration. We verify stationarity using the Augmented Dickey-Fuller (ADF) test of unit root as the ARDL model cannot be used if the variables under consideration are integrated of order 2 or above (Annex 2). For the following long-run models, we provide a nominal formulation and estimate:

Baseline Model 1:

$$LCIC_t = \delta_0 + \delta_1 LYN_{1t} + \delta_2 INT_{2t} + \varepsilon_t$$

We may model the log of CiC as a function of log of nominal income (LYN), which gives the income effect, and log of short-term interest rates (INT), which gives the opportunity cost effect, under the standard money demand equation. One important factor influencing currency demand in an economy is shifts in economic activity as shown by nominal GDP growth (Knell and Stix, 2005). With all else being

equal, it is anticipated that the circulating currency will rise in tandem with the growth in income. Since there is no nominal rate connected with money, the opportunity cost of keeping cash is determined by the return on deposits. Interest rates have an impact on the transactional cash demand according to the Baumol-Tobin framework. But compared to the transactional component, the precautionary demand is anticipated to be more interest-sensitive (Bech et al., 2018).

Model 2:

$$LCIC_t = \delta_0 + \delta_1 LYN_{1t} + \delta_2 INT_{2t} + \delta_3 LDIGVAL_{3t} + \varepsilon_t$$

The log of the total value of digital payments is added to the baseline model in the second model. This inclusion reduces the impact of cash and digital methods substituting for one another, given the possibility for transaction technology advancements to change the need for money. We anticipate this indication to be negative in accordance with the body of existing research as the switch to digital methods lowers the transactional expenses related to the acquisition, handling, and management of currency. Omitted variable bias might result from leaving this variable out of the contemporary currency demand function model (Columba, 2009). While studies often utilize ATM/PoS densities and card densities to measure technical innovation, we consider the overall value of digital payments because Indian customers have access to a variety of digital payment methods.

Model 3:

$$LCIC_t = \delta_0 + \delta_1 LYN_{1t} + \delta_2 INT_{2t} + \varepsilon_t + \delta_3 LDIGVAL_{3t} + \delta_4 LU_{4t} \quad \text{...(a)}$$

$$LCIC_t = \delta_0 + \delta_1 LYN_{1t} + \delta_2 INT_{2t} + \delta_3 LDIGVAL_{3t} + \delta_4 LU_{4t} \delta_5 CDR_{5t} + \quad \text{…(b)}$$

To capture the cautious effect and determine the underlying beneficial impact of uncertainty on cash usage, we add a set of variables to the currency demand function in the third model. In order to protect liquidity during uncertain times, the public often holds more cash, thus we first consider the log values of the uncertainty index (LU)[10], which supports a positive correlation with CiC (Ivanovski and Churchill, 2019). Furthermore, we employ the CDR as a stand-in for uncertainty in the unorganized sector. The lower values of CDR might indicate uncertain periods and therefore, greater demand for cash since the credit flow decreases with rise in uncertainty due to risk aversion on the side of banks and reduced credit demand by consumers due to tapering economic activity (Valencia, 2017).

We also include the actual credit-to-GDP ratio and the BIS-sourced credit-to-GDP gap (CGAP)[11] for robustness tests. The latter is predicted to have a negative sign since declining credit in the economy might lead to an increase in currency demand.

Although other factors like the population's sociodemographic profile and the tax-to-GDP ratio might be included to strengthen the study, we choose a frugal approach because of data limitations. Lastly, we also utilize a similar set of additional explanatory factors as those used for the nominal currency demand analysis to estimate the real currency demand function using real income and actual digital payments.

[10]Highervalueoftheindexisassociatedwithgreateruncertainty.

[11]BIS computes the credit-GDP gap as the difference between the actual credit-to-GDP andthe expected credit-to-GDP trend computed using the HP filter. The definition of credit includesfundsprovidedbyallthesectorstotheprivatenon-financialsectorintheeconomy.

7. Analytical Findings

Across all models, income is found to be the primary driver of cash demand. Comparing models with digital innovations and cautious incentives for money demand, Table 1 shows that the income coefficient in the baseline model is overestimated. The enhanced currency demand function was used because the addition of these factors causes the income coefficient to approach unity. Broadly speaking, the long-run income coefficient, which indicates a coefficient of one, is consistent with the empirical research on the conventional quantity theory of money (Brunner and Meltzer, 1967). The coefficient of 0.5 proposed by inventory theoretic models is not followed, though.

Table1:Long-runCoefficientsofNominalCurrencyModellingRegression

DependentVariable:LCIC(NaturalLogofCurrencyinCirculation)

	Baseline Model 1	**Model 2**	**Model 3 (a)**	**Model 3 (b)**
ModelType	ARDL (3,1,0)	ARDL (3,3,0,2)	ARDL (3,2,0,2,1)	ARDL (3,3,0,0,2,2)
	(a)	(b)	(c)	(d)
NominalIncome(LYN)	0.88***(0.04)	1.19***(0.20)	1.26***(0.18)	1.47***(0.18)
Interest Rate (INT)	-0.06***(0.01)	-0.07***(0.01)	-0.07***(0.01)	-0.06***(0.01)
DigitalPaymentsValue(LDIGVAL)		-0.30**(0.16)	-0.31**(0.15)	-0.42***(0.14)

Uncertainty(LU)			0.06**(0.03)	0.08**(0.03)
Credit-Deposit Ratio(CDR)				-0.008 (0.008)
Intercept	1.53**(0.81)	1.96**(0.84)	0.83 (0.84)	0.16 (0.84)
Error Correction	-0.24***(0.01)	-0.24***(0.01)	-0.27***(0.01)	-0.27***(0.01)
BoundsTest:Fstatistic #	48.52	33.89	33.73	27.35
ModelTests				
AdjustedR-squared	0.99	0.99	0.99	0.99
Akaike InformationCriterion (AIC)	-4.81	-5.06	-5.08	-5.29
Schwartz InformationCriterion (SIC)	-4.46	-4.52	-4.50	-4.59
Durbin-WatsonStat.	2.18	1.84	2.05	1.71

Note: The standard errors are in parentheses.

* p<10 per cent; ** p<5 per cent; *** p<1 per cent.

#CriticalvaluesforFstatisticat5percentlevelarearound3.0and4.0forI(0)andI(1)assumptions,respectively.

Source: Authors 'calculations.

A higher income elasticity of currency, or a more sensitive currency demand to changes in income levels, is the outcome of including uncertainty in the model. This increased reactivity can be explained by variables that are typical of uncertain times, such as high-risk aversion, a rise in precautionary reserves, lower confidence levels, and increased volatility in financial markets.

More to the point, an increase in income usually has two different consequences. The first effect is a rise in consumption and a greater use of all payment methods, including digital and cashless ones. Furthermore, according to Titov et al. (2021) it may expedite the transition from cash to electronic

payments. It is possible that a higher "consumption" effect of income exists inside the Indian payment ecosystem (Model 2) due to the positive sign and increasing income coefficient, even with digital payments included in the model.

In both nominal and real terms, the coefficient associated with the opportunity cost of maintaining cash balances—that is, the interest rate on deposits—is negative and statistically significant for all models. The inclusion of digital payment methods in the model enhances the sensitivity of currency demand to changes in interest rates. This may imply that, for example, in times of monetary tightening, the availability of digital alternatives will encourage people to forgo currency in favour of interest-bearing bank deposits, resulting in a relatively more pronounced decline in currency demand for a given increase in interest rates (Model 2). Furthermore, because of people's propensity for safety and stronger preference for liquidity, uncertainty might potentially enhance the interest elasticity of currency demand (Model 3 a). These results are consistent with the body of research showing that, in spite of the digital revolution, currency continues to play a significant function as a store of value (Attanasio et al., 2002).

Growing digital adoption might cause people to become less inclined to carry cash, as seen by the negative link between digital modes and currency demand that Model 2 captures in both nominal and real terms. But even with its significance, the substitution effect is subordinated to the predominate income effect. However, considering the notable rise in digital payment methods, this also implies that, in the long run, digital transactions may be able to mitigate the effect of income on currency demand and reduce the currency-to-deposit ratio. The results align with the body of current literature (RBI, 2023; Chaudhari et al., 2019).

The influence that cautious factors have on cash usage is highlighted by Model 3 (a and b). Positive and statistically significant coefficients for the uncertainty index show that there is a larger CiC in uncertain periods. CDR has a negative effect on the nominal currency demand function, although one that is statistically not significant. We employ both the actual credit-GDP ratio and other estimates of the credit-GDP gap to assess the robustness of the uncertainty factors. The negative influence of both these factors on cash usage suggests that during times of crisis, cash holdings may rise due to limited access to formal and rapid sources of credit. With the coefficient of log uncertainty (LUt) rising from 0.06 to 0.12, the influence of these uncertainty factors is more noticeable in the real currency demand function (Table 2). This is explained by people's adaptive response to uncertain times, when they change the way, they store their cash in order to protect their purchasing power and reduce the danger of inflation. Our hypothesis that the anomalous rise in CiC during the pandemic era was largely affected by the cautious reasons is supported by the robustness tests performed using other uncertainty factors.

In the sample period, we additionally account for significant occurrences that were marked by a high degree of ambiguity. The loss of SBN resulted in a negative and statistically significant dummy coefficient for the fourth quarter of 2016 and the first quarter of 2017; in contrast, the pandemic dummy variable was positive and statistically significant, indicating that the increase in currency demand during the lockdown was motivated by store-of-value and precautionary reasons.

Table 2: Long Run Coefficients of Real Currency Modelling Regression

Dependent Variable: LCICR (Natural Log of Real Currency in Circulation)

	Baseline Model 1	**Model 2**	**Model 3(a)**	**Model 3(b)**
ModelType	ARDL(3,1,0)	ARDL(3,0,1,1)	ARDL(3,0,3,1,1)	ARDL(3,0,3,1,1,1,)
	(a)	(b)	(c)	(d)
RealIncome(LYR)	0.71***(0.06)	1.01***(0.14)	1.18***(0.10)	1.23***(0.12)
Interest Rate (INT)	-0.05***(0.01)	-0.06***(0.01)	-0.07***(0.01)	-0.07***(0.02)
RealDigitalPaymentsValue(LRDIGVAL)		-0.26**(0.11)	-0.32***(0.08)	-0.35***(0.10)
Uncertainty(LU)			0.12***(0.02)	0.12***(0.03)
Credit-Deposit Ratios (CDR)				-0.01 (0.00)
Intercept	4.00***(1.09)	2.46**(1.18)	0.44 (0.94)	0.01 (1.41)
Error Correction	-0.23***(0.01)	-0.24***(0.01)	-0.30***(0.01)	-0.29***(0.01)
BoundsTest:Fstatistic#	46.72	50.29	57.92	43.87
ModelTests				
AdjustedR-squared	0.99	0.99	0.99	0.99

AkaikeInformationCriterion(AIC)	-5.32	-5.39	-5.70	-5.68
SchwartzInformationCriterion(SIC)	-4.98	-4.96	-5.12	-5.02
Durbin-WatsonStat.	1.34	1.44	1.85	1.87

Note: The standard errors are in parent thesis and significance levelsare*p<10percent;

** p<5 per cent; *** p<1 per cent.

#CriticalvaluesforFstatisticat5percentlevelarearound3.0and4.0forI(0)andI(1)assumptions, respectively.

Source: Authors 'calculations.

There is no discernible change in the rate of convergence of the short-run coefficients to the long-run cointegrating dynamics provided by the error correction coefficient. Between 23 and 30 percent of the divergences among the models are resolved and brought into line with the long-term trend in a single run. We discover that the residuals are homoscedastic across specifications and uncorrelated after doing further checks. Because the cumulative sum (CUSUM) and CUSUM of squares tests are satisfied, these empirical results are sustainable. We may conclude that there is a long-run equilibrating connection between the variables we use since the F-statistic's value is larger than the I (1) critical value bound; Annex 2 has the error-correction form.

The empirical analysis is not without a caveat. It can be used to determine the effects of exclusive precautionary factors, such uncertainty, but it is not possible to fully break down the cash demand into precautionary and transactional reasons. This is a result of the intertwinement of these two motivations with the income impact, which makes it difficult to separate them. Consequently, we use comparative numerical analysis to evaluate the part that cash plays in India's transaction demand. Based on the body of research already in existence, transactional cash demand is defined as the total amount of cash taken out of ATMs, PoS, and Micro ATMs, as well as small-denomination notes and coins[12] and cash kept in banks. A flow measure of currency demand may be obtained by adding together the monthly averages of these factors.

Furthermore, as private final consumption expenditure (PFCE) is frequently strongly associated with monetary payments, we utilize it to mimic economic transactions (Reimers et al., 2020)[13]. According to our data, the predicted average monthly cash-based transactions as a percentage of average monthly PFCE decreased from 47% in 2020–21 to 40% in 2022–23. This shows that the role that cash plays in enabling transactions is decreasing as digital payment options become more common.

8. Conclusion

Growth in both digital and cash payments at the same time may seem counterintuitive given their apparent interchangeability. An investigation into the fundamental causes of various payment methods is warranted by this unusual situation. Cash demand is significantly impacted by precautionary and income factors, as demonstrated by an empirical examination of the long-run currency demand function.

The usage of digital payments has a statistically significant negative correlation with the use of cash; however, the income effect has a greater impact than this replacement effect. This implies that in an expanding country such as India, there is room for growth for both cash and digital payments due to the increased intensity of transactions. However, over time, the positive income effect on currency demand may be moderated by the digital payments industry's high development speed.

Cash is not only a transaction medium; it also acts as a buffer against uncertain times, as the COVID-19 epidemic, when there is a surge in the demand for cash due to precautionary reasons. Precautionary factors raise the demand for money, according to empirical data. All things considered, it is evident that electronic payments are replacing the need for cash in transactions, but the incentive to have cash on hand for storage of value is still present. This may be seen, for example, from the fact that the demand for large-denomination banknotes—whose share of the total is on the rise—has been the main driver of CiC growth. The percentage of low denomination notes has also decreased, which is partially explained by the replacement of small-value payments with UPI and mobile wallets, as seen by the tickets' shrinking dimensions. Further reduced cash withdrawals from ATMs also point to a decrease in transactional cash demand.

Cash remains prevalent in spite of the growing popularity of digital payments because people still prefer to save and conduct business with cash. Cash also acts as the de facto basis for all other forms of payment. It is also essential for enabling transactions with financial excluded and non-digitally literate populations, as well as between the formal and informal sectors of the economy. Furthermore, areas with greater levels of development continue to have a disproportionate share of usage and adoption of digital payments.

[12]This figure is taken in outstanding terms for computation of transactional cash demand, asthesenotes andcoins arenot typically returnedand thus,circulate withinthesystem.

[13]PFCE can be taken as a proxy for transactions in place of GDP as a) it comprises nearly 60percentshareintotalincome;andb)investmentsinvolvelargeticket-sizetransactionsthatarefacilitatedviadigitalmodes,c)governmentspendingandtransfersarerouteddigitally;and

d) import and export related payments are typically facilitated digitally through bank accounttransfers.

In order to maintain the momentum that the pandemic has created towards digital payments, concerted efforts are required to: (a) guarantee the affordability of payment methods and the necessary infrastructure for acceptance from the demand (consumers) and supply (merchants and intermediaries); (b) guarantee universal access to enablers, like smartphones and internet connectivity; (c) support financial inclusion and literacy; and (d) protect cybersecurity and customer protection. The Reserve Bank of India (RBI) has implemented various measures to incentivize the digital drive. These include making centralised payment systems operational 24/7, creating a Payment Infrastructure Development Fund to support the subsidised deployment of payment acceptance infrastructure, introducing UPI123Pay for users of feature phones, facilitating the interoperability of prepaid payment instruments (PPIs), and initiating pilot projects for central bank digital currency (CBDC) in retail and wholesale sectors (Annex 3).

In the end, the benefits of digitalization go beyond only replacing cash; they also have wider ramifications for household financial well-being, financial market development, economic growth, and efficient government. In conclusion, the high cash usage seen during the pandemic may not translate into a permanent change given the continuous spread of digital payments and the decrease in the increase of currency demand recorded post-pandemic.

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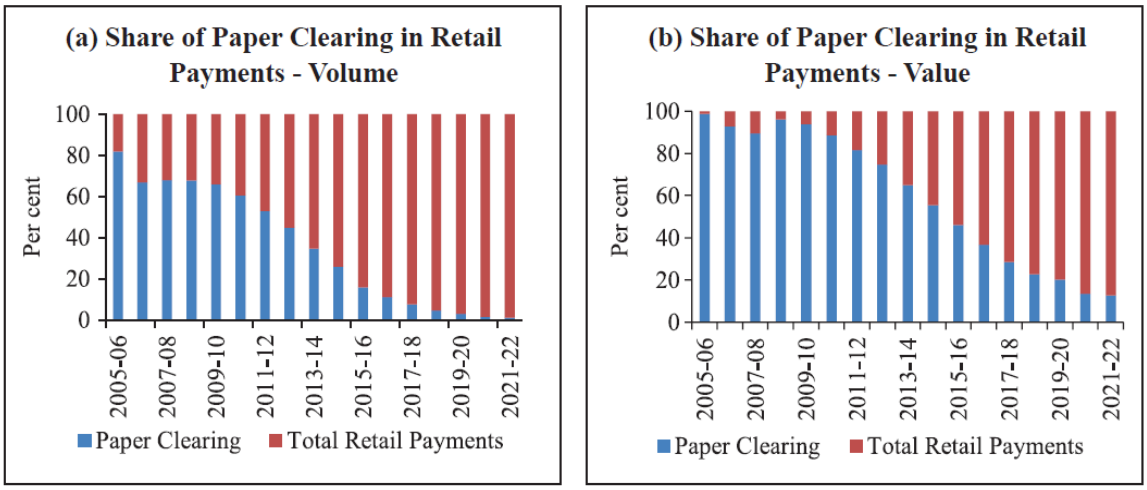
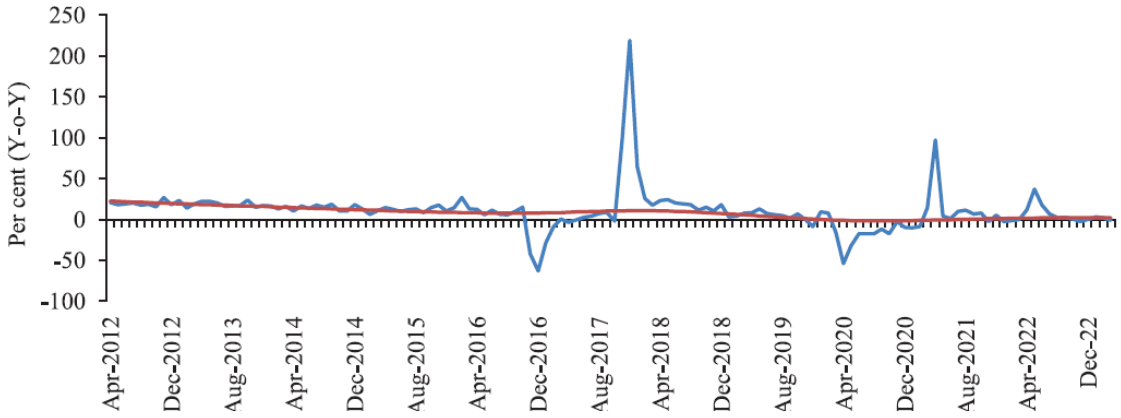
Annex 1

Chart 1



Source: RBI.

Chart 2: Cash Withdrawals through Cards – Long Term Trend



Note: This trend was obtained by applying the Hodrick Prescott filter to seasonally adjusted growth (y-o-y) in monthly ATM withdrawals data.
Sources: RBI and Authors' calculations.

Annex2

Table A1: Unit Root Test of Variables

Variable	ADFTestStatistic
LevelForm	
LCIC	-0.35
LCICR	-0.38
LYN	-1.09
LYR	-1.27
INT	-0.32
LDIGVAL	-0.91
LRDIGVAL	-1.26
LU	-2.86*
CDR	-3.12**
FirstDifferenceForm	
D(LCIC)	-6.89***
D(LCICR)	-6.29***
D(LYN)	-8.61***
D(LYR)	-10.2***
D(INT)	-4.12***
D(LDIGVAL)	-2.95**
D(LRDIGVAL)	-3.07**
D(LU)	-8.51***
D(CDR)	-5.30***

Note: (a) D:firstdifferences;LCIC:NaturalLogofseasonallyadjustedCurrencyinCirculation;LCICR:NaturalLogofseasonallyadjustedRealCiC;LYN:NaturalLogof seasonally adjusted Nominal Income; LYR: Natural Log of seasonally adjustedReal Income; INT: Deposits rates of major banks; LDIGVAL: Natural Log

Of DigitalPaymentsValue;LRDIGVAL:NaturalLogofRealDigitalPaymentsValue;LU:NaturalLog ofUncertaintyIndex;CDR: Credit-to-DepositRatio.

(b)***,**,and*denotesignificancelevelsat1%,5%and10%,respectively.

Source: Authors 'calculations.

Table A2: Error Correction Model Regressions

DependentVariable:LCIC(NaturalLogofNominalCurrencyinCirculation)

	Baseline Model 1	**Model 2**	**Model 3a**	**Model 3b**
ModelType	ARDL (3,1,0)	ARDL(3,3,0,2)	ARDL(3,2,0,2,1)	ARDL(3 ,3,0,0,2,2)
	(a)	(b)	(c)	(d)
D(LCIC(-1))	-0.27***(0.04)	-0.24***(0.01)	-0.20***(0.04)	-0.26***(0.01)
D(LCIC(-2))	-0.16***(0.04)	-0.15***(0.04)	-0.13***(0.03)	-0.12***(0.03)
D(LYN)	0.43***(0.07)	0.31***(0.08)	0.30***(0.07)	0.59***(0.05)
D(LYN(-1))		-0.24***(0.07)	-0.23**(0.06)	
D(LDIGVAL)		-0.01(0.03)	-0.02*(0.01)	
D(LDIGVAL(-1))		-0.16***(0.03)	-0.16***(0.03)	
D(LU)			-0.001(0.008)	-0.006(0.00)
D(LU(-1))				-0.01*(0.00)

D(CDR)				-0.002 (0.00)
D(CDR(-1))				0.01 (0.00)
DUM2020Q2^	0.16*** (0.02)	0.10*** (0.02)	0.11*** (0.02)	0.16*** (0.02)
DUM2016Q4+ DUM2017Q1^	-0.32***(0.01)	-0.32***(0.01)	-0.31***(0.01)	-0.29***(0.01)
ErrorCorrectionCoefficient	-0.24***(0.01)	-0.25***(0.01)	-0.27***(0.01)	-0.26***(0.01)
ModelTests				
AdjustedR-squared	0.92	0.95	0.95	0.96
AkaikeInformationCriterion(AIC)	-4.93	-5.23	-5.28	-5.53
SchwartzInformationCriterion(SIC)	-4.71	-4.84	-4.89	-5.07
Durbin-WatsonStat.	2.18	1.84	2.05	1.71

Note: Thestandarderrorsareinparenthesisandsignificancelevelsare*p<10percent;

** p<5 per cent; *** p<1 per cent.

^FixedRegressors:DUM2016Q4+DUM2017Q1forSBNwithdrawalandDUM2020Q2for COVID.

Lag Selection Criteria:AICwithmaximum 3 lags.

Source:Authors'calculations.

Table A3: Error Correction Model Regressions

Dependent Variable: LCICR (Natural Log of Real Currency in Circulation)

	Baseline Model 1	Model 2	Model 3a	Model 3b
Model Type	ARDL (3,1,0)	ARDL (3,0,1,1)	ARDL (3,0,3,1,1	ARDL (3,0,3,1,1,1

			)	)
	(a)	(b)	(c)	(d)
D(LCICR (-1))	-0.14*** (0.04)	-0.14*** (0.04)	-0.11*** (0.03)	-0.10*** (0.01)
D(LCICR (-2))	-0.10*** (0.04)	-0.11*** (0.04)	-0.07** (0.03)	-0.07** (0.03)
D(LYR)	0.30*** (0.07)			
D (INT)		-0.01 (0.00)	-0.01 (0.00)	-0.00 (0.00)
D (INT (-1))			0.01** (0.00)	0.01* (0.00)
D (INT (-2))			0.01** (0.00)	0.01* (0.00)
D (LRDIGVAL)		-0.01 (0.02)	-0.02* (0.01)	-0.05** (0.02)
D (LRDIGVAL (-1))		-0.16*** (0.03)		
D(LU)			0.00 (0.00)	0.00 (0.00)
D(CDR)				0.00 (0.00)
DUM 2020Q2 ^	0.10*** (0.02)	0.10*** (0.02)	0.10*** (0.02)	0.10*** (0.02)
DUM 2016Q4 + DUM 2017Q1 ^	-0.28*** (0.01)	-0.28*** (0.01)	-0.28*** (0.01)	-0.27*** (0.01)
Error Correction Coefficient	-0.23*** (0.01)	-0.24*** (0.01)	-0.30*** (0.01)	-0.29*** (0.01)
Model Tests				
Adjusted R-squared	0.93	0.95	0.95	0.99
Akaike Information Criterion (AIC)	-5.45	-5.23	-5.70	-5.68

Schwartz Information Criterion (SIC)	-5.21	-4.84	-5.12	-5.02
Durbin-Watson Stat.	1.34	1.84	1.84	1.88

Note: Thestandarderrorsareinparenthesisandsignificancelevelsare*p<10percent;

** p<5 per cent;*** p<1 per cent.

^FixedRegressors:DUM2016Q4+DUM2017Q1forSBNwithdrawalandDUM2020Q2for COVID.

Lag Selection Criteria:AICwithmaximum 3 lags.

Source: Authors'calculations.

Annex3

ChronologyofMajorPolicyMeasuresinIndia'sPaymentSystems–2020-21 to 2022-23

Month/Year	MajorMeasures
March2020	• Pressreleaseinformingroundtheclockavailabilityofpaymentsystems. • Issuanceofguidelinescoveringregulationofpaymentaggregators and payment gateways. • Extensionoftimelineforcompliancewithvariouspaymentsystemrequirements due to COVID-19.
June2020	• Furtherextensionintimelineforcompliancebypaymentsystemoperators. • Authorisedpaymentsystemoperatorswereadvisedtoundertaketargetedmulti-lingualcampaignstoaugmentdigitalawareness.
July2020	• ReportoftheCommitteeforAnalysisofQR(QuickResponse)Codewasreleased.
August2020	• OnlineDisputeResolution(ODR)systemsmandatedforuseinphasedmannerforPaymentSystemOperators(PSOs). • Pilotprojectforofflinepaymentsolutionsannounced. • Releaseof'Frameworkforauthorizationofpan-Indiaumbrellaentity for retail payments'.

September2020	• Positivepaysystemforchequetruncationannouncedforallcheques of value- ₹50,000 and above.
October2020	• Framework forrecognitionofaSelf-RegulatoryOrganization(SRO)for PSOs. • MeasuresannouncedforstreamliningQRcodesfordigitalpayment transactions.
November2020	• Establishmentof Reserve BankInnovation Hub(RBIH). • Commencementofthetestingphaseoffirstcohort-RetailPaymentsunder theregulatory sandbox(RS).
December2020	• RTGSmadeoperational24*7*365fromDecember14,2020. • ThepertransactionlimitforrelaxationofAdditionalFactorof Authentication (AFA) for contactless card transactions wasenhanced from ₹2,000 to ₹5,000. • Guidelines to grant authorization for all PSOs (both new andexisting) on a perpetual basis issued.

Chronology of Major Policy Measures in India's Payment Systems – 2020-21 to 2022-23 (Contd.)

Month/Year	**MajorMeasures**
	• SecondcohortundertheRSwiththemeof'CrossBorderPayments'was announced. • Thethemeforthirdcohortwasalsoannouncedas'MSMELending'. • NetworthrequirementforentitiesunderRSwasreducedfromthe existing ₹25 lakh to ₹10 lakh.
January2021	• DigitalPaymentsIndex(DPI)wasintroduced. • Frameworkforoperationalizationofpaymentsinfrastructuredevelopmentfund (PIDF) schemeintroduced. • LegalEntityIdentifier(LEI)forpaymentsof₹50croreandaboveusing centralized payment systems(CPS).
February2021	• Majorpaymentsystemoperatorswouldberequiredtofacilitatesetting-upofa centralizedindustry-wide 24x7helpline.

March2021	• Guidelines for extending cheque truncation system across allbank branches issued. • ExtensionprovidedtillDecember31,2021,toPAsandmerchants on-boarded for ensuring no storing of customercard credentials on database. • Timeline extended to September 30, 2021, for processing andregistering e-mandates for recurring online transactions.
May2021	• Guidelineswereissuedmandatingprepaidpaymentinstruments(PPIs)interoperability,enhancingthelimitforfullKYC PPIs to ₹2 lakh, and permitting cash withdrawals usingfull-KYCPPIsof non-bank PPIissuers.
June2021	• NationalAutomatedClearingHouse(NACH)madeavailableon all days ofthe week,effectiveAugust1, 2021. • Guidelineswereissuedwiththerevisedinterchangefeeandcustomer charges forATM transactions. • MobileprepaidrechargewaspermittedasabillercategoryinBharatBill PaymentSystem(BBPS).
July2021	• Authorized non-bank PSOs, viz., PPI issuers, card networksand white label ATM operators allowed to participate in CPSas direct members.
August2021	• Aframeworkforoutsourcingofpaymentandsettlement-relatedactivities by PSOswasissued.

Chronology of Major Policy Measures in India's Payment Systems -2020-21 to2022-23(Contd.)

Month/Year	MajorMeasures
	• Scope of device-based tokenisation was extended to includeconsumer devices – laptops, desktops, wearables, Internet ofThings (IoT) devices,etc. • PIDFbeneficiarylistexpandedtoincludeStreetvendors,identifiedunderPradhanMantriStreetVendor'sAatmaNirbharNidhi (PM SVANidhi Scheme) in tier-1 and tier-2centres.

September2021	• Instructionswereissuedtoextendthedevice-based tokenisationframeworktoCard-on-FileTokenisation(CoFT). • LinkageoffastpaymentsystemsinIndia(UPI)andSingapore(PayNow).
October2021	• Theper-transactionlimitinImmediatePaymentService(IMPS)wasincreased from ₹2 lakh to ₹5 lakh.
December2021	• Enablementofsmallvaluetransactionsthroughan"on-device"walletinUPIapplication wasannounced. • The transaction limit for payments through UPI for RetailDirect Scheme and IPO applications was increased from ₹2lakh to ₹5 lakh.
January2022	• Frameworkforsmallvaluedigitalpaymentsinofflinemodeissued.
February2022	• TheNACHmandatelimitwasincreasedfrom₹1croreto ₹3croreforTradeReceivablesDiscountingSystem(TReDS)settlements. • PaymentandSettlementSystemsRegulations,2008wereamended.
March2022	• UPI123PaywaslaunchedtoenableUPIpaymentsforfeaturephone users. • DigiSaathi,a24x7helplinewaslaunched. • Frameworkforgeotaggingofpaymentsystemtouchpointsprescribed.
April2022	• IssuanceoftheMasterDirection–CreditCardandDebitCard –IssuanceandConductDirections,2022.
May2022	• Interoperablecard-lesscashwithdrawalfacilityintroduced. • ReductionintheminimumnetworthcriterionforBharatBillPaymentOperatingUnits(BBPOUs)from₹100croreto ₹25 crore.

Chronology of Major Policy Measures in India's Payment Systems – 2020-21 to 2022-23 (Concld.)

Month/Year	MajorMeasures
	• Commencement of the test phase under the third cohort of theRS on 'MSME Lending'. • OpeningofthefourthcohortwithPreventionandMitigationofFinancial Frauds'as the theme under RS.
June2022	• Enhancementinlimitfore-mandatepaymentsfrom₹5,000to ₹15,000. • ModificationofthePIDFScheme.
July2022	• Linkageof UPIand RuPayCredit cards proposed. • Relaxationofthecard-on-filedatastoragenormsrelatedtoguest accounts on e-commerce platforms.
August2022	• EnablementoftheBharatBillPaymentSystem(BBPS)toaccept cross-border inward payments. • DiscussionPaperonChargesinPaymentSystemsfloated.
September2022	• ApilotprojectforEnd-to-enddigitalizationofKisanCreditCard (KCC)-based lendinglaunched. • FirstlegoftheGuidelinesonDigitalLendingissuedforimplementation.

Source: RBI.