

Chapter III

Digitalisation and the Indian Household*

The India Stack unlocked India's digital revolution by platforming identity, payments and consent onto a single layer and alongwith open banking, it ushered in a new era of financial inclusion for households by expanding credit access to the underserved and bringing millions of Indians under the ambit of the formal financial system. The evolution of digital payment systems led to increasing retail stock market participation, and deepening capital markets. In the digital age, the role of regulation in facilitating scaling-up while protecting identity and privacy assumes crucial importance.

Introduction

III.1 The Indian economy is the third most digitalised economy in the world, and has the second fastest growing number of mobile subscribers (Mishra et al., 2024). 86.5 per cent Indians use mobile phones (including smartphones), while 60 per cent are able to competently use the internet (Ministry of Statistics and Programme Implementation, 2024). The cornerstone of India's digital revolution is the India Stack, which has opened the door for rapid financial inclusion for millions of individuals and businesses. Digitalisation has affected all aspects of Indian household balance sheets from access to credit on the liabilities side, to deposits and stock market participation on the savings side.

III.2 India has played a pivotal role in the global digital revolution. It's digital economy, currently accounting for 10% of its GDP, is projected to rise to 20% by 2026. India has also rapidly adopted AI, with its integration in Indian firms increasing from 8% in 2023 to 25% in 2024, and has the potential to contribute \$359 - \$438 billion to India's GDP by 2029–30. (Patra, 2024)

III.3 As digitalisation has affected households, regulatory architecture is also evolving to ensure competition and innovation whilst ensuring data protection and privacy. In fact, the Digital Personal Data Protection Bill, 2023, explicitly lays out the rights and responsibilities of the data consumer and processor.

III.4 This chapter studies how digitalisation is reshaping the Indian household finances. Section 3.1 explores the India Stack and how each layer is enabling households to access financial services, undertake transactions and store data in a safe and secure manner. Section 3.2 studies how digitalisation is affecting the liability side of household balance sheets by expanding credit access to hitherto underserved sections of the population. Section 3.3 examines the role of digitalisation in determining how households save, while Section 3.4 studies how it facilitated stock market participation.. Section 3.5 examines the digitalisation of the Indian economy in the context of

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household access to brick-and-mortar bank branches. Section 3.6 looks at the key regulatory measures governing the digital economy and its impact on consumers and businesses. Lastly, the conclusion discusses some forward looking perspectives.

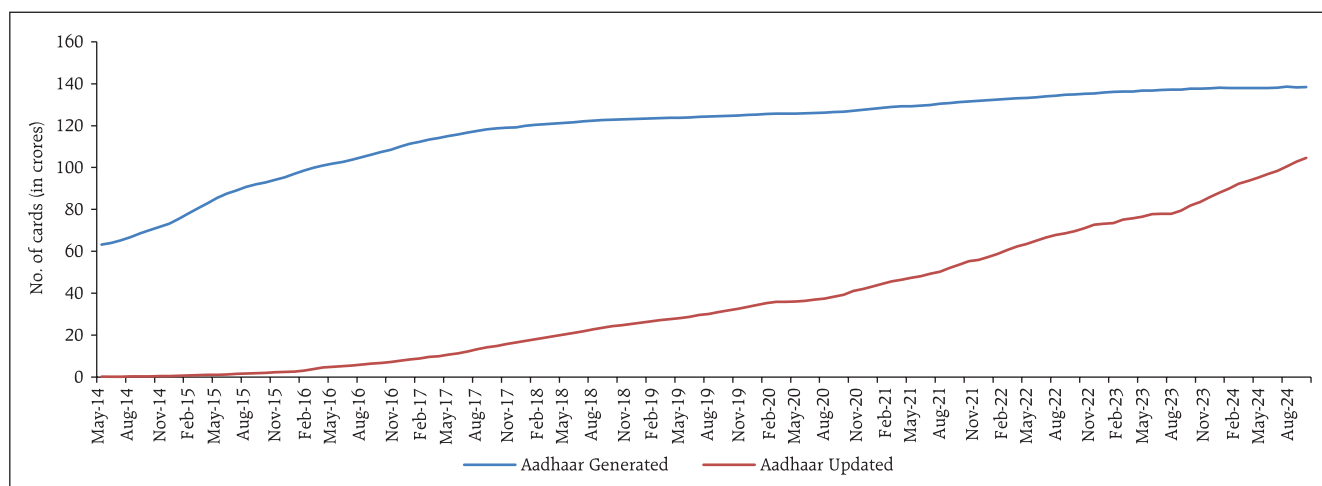
3.1 India Stack

III.5 The India Stack is a collection of Application Programming Interfaces (APIs) and digital goods using a unique digital infrastructure. It consists of four "stacked" layers: (a) a unique 12-digit biometric identity authentication named Aadhaar (b) an interoperable and instant real time payment system called the Unified Payments Interface (UPI), (c) a consent-based framework enabling secure sharing of financial information between borrowers and lenders in real time called Account Aggregator (AA) and (d) network-based commerce and lending platforms.

III.6 The underlying principle governing the India Stack is *"a set of technology building blocks powered by interoperable open standards/specifications operated under a set of enabling rules with open, transparent, and participatory governance to drive innovation, inclusion, and competition at scale"* (Center for DPI, 2024). The Digital Public Infrastructure (DPI) is a virtual analogue to the physical infrastructure of roads, highways, and railways. It has transformed the Indian household.

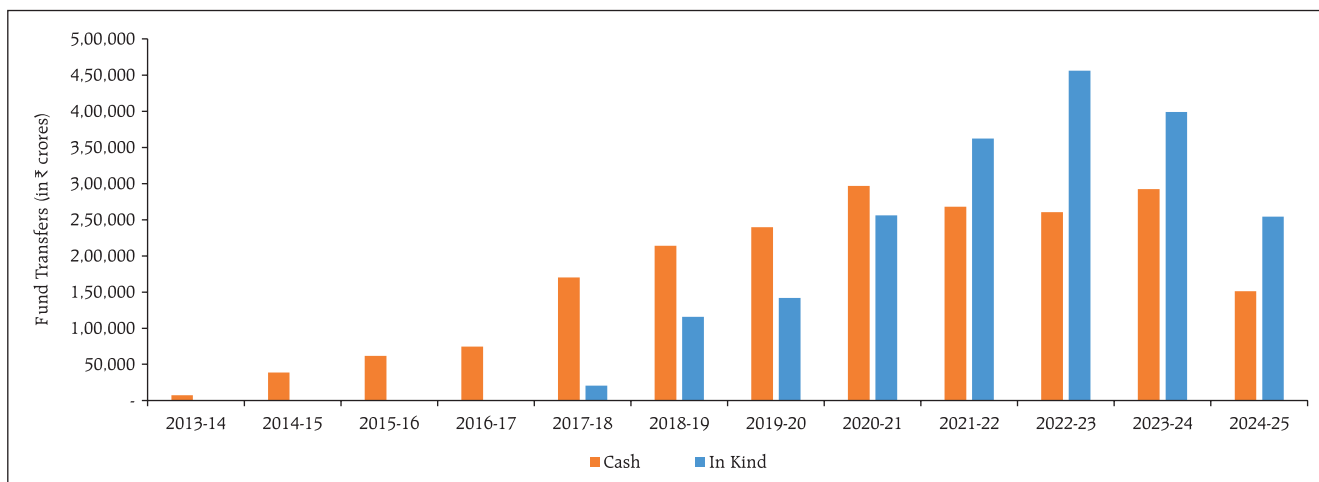
III.7 As of October 2024, 138 crore residents have an Aadhaar card, while 104 crore residents have fully updated Aadhaar cards (Chart 3.1), indicating its near-universal adoption. From 2016 onwards, Aadhaar is used to authenticate welfare schemes like the Public Distribution Scheme (PDS) and Direct Benefit Transfer (DBT) schemes, by making its linkage to bank accounts compulsory. The Central Board of Direct Taxes (CBDT) has mandated the linking of Aadhaar and Permanent Account Number (PAN) to verify taxpayer identity. This expansion has enabled Aadhaar to become a one-stop platform for identity verification across multiple domains, improving consumer service experience.

Chart 3.1: Aadhaar Enrollment Over Time



Source: Digital India Dashboard, National Data and Analytics Platform (NDAP).

Chart 3.2: Rapid Growth in DBT Transfers



Note: Numbers for 2024-25 are latest as of 23rd December 2024.

Source: Digital India Dashboard, NDAP.

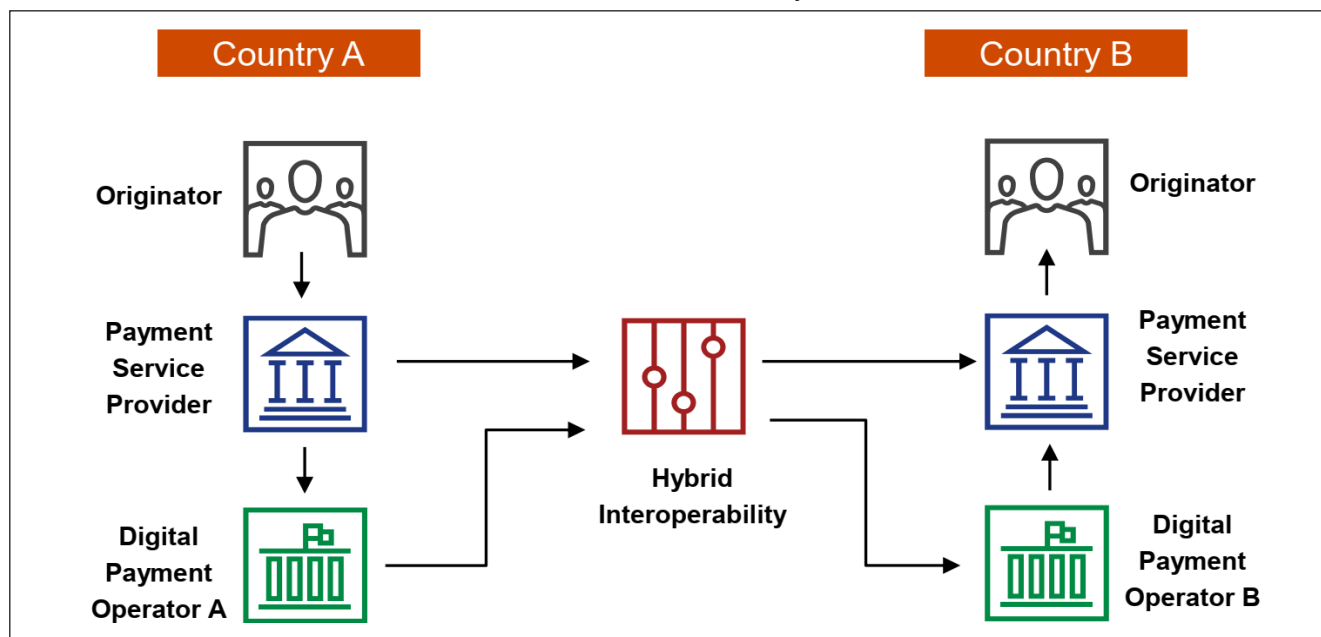
III.8 The linking of Aadhaar to bank accounts has enabled systematic targeting of welfare by plugging leakages. Combined with the Pradhan Mantri Jan Dhan Yojana (PMJDY) which provided bank accounts to more than 47 crore beneficiaries, the DBT scheme has enabled households to access entitlements using their Aadhaar linked accounts. DBT cash transfers rose from ₹7,367 crore in 2013-14 to ₹1,50,913 crore in 2024-25, while in kind transfers rose rapidly from ₹20,500 crore in 2017-18 to ₹2,50,000 crore in value by 2024-25 (Chart 3.2). The DBT has also been successful in reducing leakages for fuel subsidies by 17-19 per cent, by ensuring that the benefits directly reached the intended recipients' bank account (Barnwal, 2024).

III.9 Unified Payments Interface (UPI), introduced in 2016, forms the payments layer of the India Stack. UPI is an instant, real-time payment network built, owned, and operated by the National Payments Corporation of India (NPCI). This payment system is built as an interoperable protocol and allows third-party vendors to build apps to provide payments as a service to all customers of participating banks. Due to interoperability, customers with bank accounts can use a payments app built by any payment service provider adhering to the protocol to send money from their account in one bank to self or other party accounts of any other bank, or Payment Service Provider (PSP) participating in UPI via Quick Response (QR) codes, mobile numbers, or other identifiers (NPCI, 2016).

III.10 With the enabling of cross-border payments, consumers can now seamlessly convert local currency to foreign currency in real time using UPI. The activation of QR codes in Nepal, Bhutan and Singapore now allows an Indian originator using a PSP in India with a bank account in India to instantly send money to the receiver in any of these countries (Chart 3.3). The integration with Singapore's payment processing system PayNow has further simplified this process.

III.11 Another important milestone in India's digitalisation journey is the introduction of the Account Aggregator (AA) framework. AAs are entities that utilise technology to enable consent-based sharing of consumer financial data between organisations like banks, mutual funds and insurance companies. UPI and AA, together, mark the advent of open banking in India. Open

Chart 3.3: UPI and Cross-Border Payments

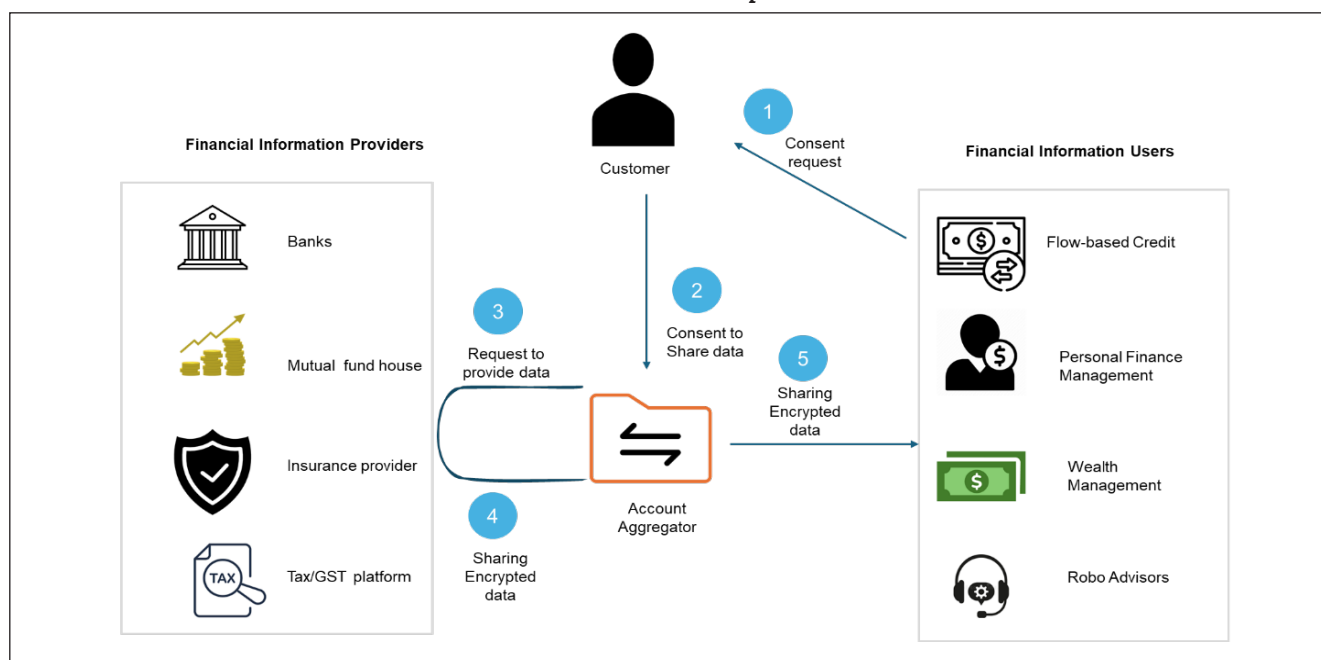


Source: NPCI and PricewaterhouseCoopers (PwC).

banking refers to the “sharing and leveraging of customer-consented data by banks with third-party developers and firms to build applications and services, such as those that provide real-time payments, greater financial transparency options for account holders, and marketing and cross-selling opportunities” (Basel Committee on Banking Supervision, 2019). The framework relies on customers triggering requests to their bank/financial institution, prompting them to share their data with a third party post authentication. Open banking allows FinTechs and other lenders to access customer data and compete for business, which helps improve lending quality (He *et al.*, 2023; Parlour *et al.*, 2022). India was among the first countries to fully implement open banking in 2016 out of 49 other countries that have enabled open banking, as of October 2021 (Babina *et al.*, 2024).

III.12 AAs are NBFCs recognised by the RBI that facilitate exchange of data between Financial Information Providers (FIPs) and Financial Information Users (FIUs). Based on consent requests to customers by FIUs, customers can request account aggregators to share financial data by FIPs in a secure and encrypted manner (Chart 3.4). FIPs are organisations that hold consumer data. These are typically banks or NBFCs, and their role is to securely share data to FIUs via requests processed by the AA. As of June 2024, there were 151 FIPs operating across banking, investment, tax, insurance and pension. Cumulatively, they have undertaken close to 11.2 crore data sharing transactions, as of November 2024. FIUs receive digitally verified data from FIPs and use this to provide services to customers such as, consumer loans and wealth management. As of June 2024, there were 435 FIU across more than 20 license types. Cumulatively, they have fulfilled more than 13.3 crore consent requests, as of November 2024.

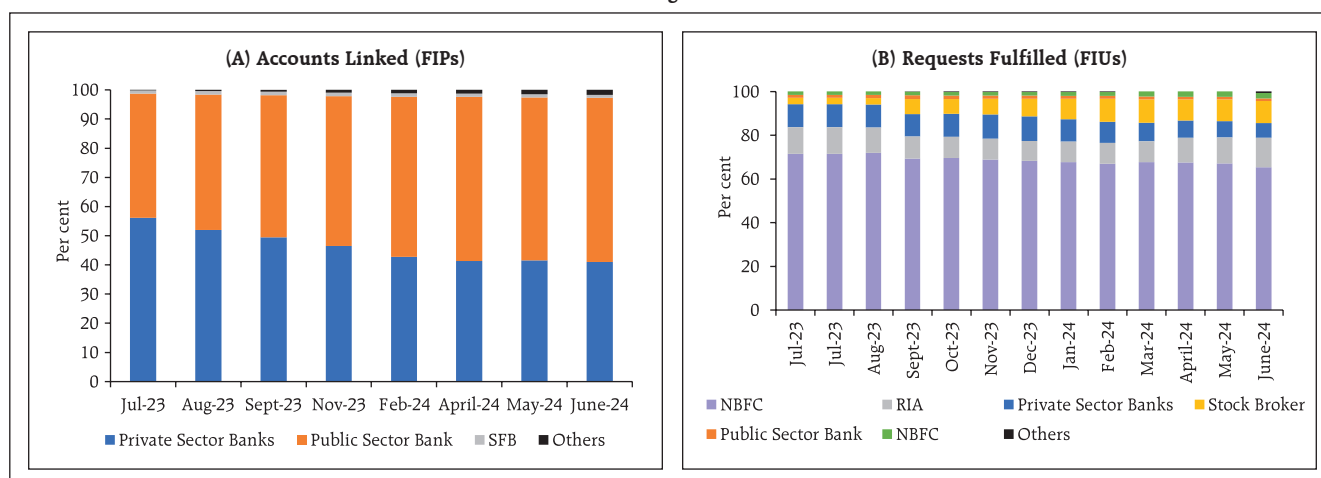
Chart 3.4: AA Setup



Source: Setu.

III.13 Of the total accounts linked as FIPs Public Sector Banks (PSBs) and Private Banks (PVBs) comprise the highest shares with 43 per cent and 56 per cent in July 2023 (Chart 3.5A). The share for PSBs has gone up to 56 per cent in March 2024, indicating improved coverage. The distribution of share of requests processed by FIUs shows maximum contribution by NBFCs, as they account for more than 70 per cent of all requests (Chart 3.5B). This is followed by Registered Investment Advisors (RIA) and PVBs at 12 per cent and 10 per cent respectively. The share of the latter has since fallen to 6 per cent in June 2024, while the share of requests processed by stock brokers has shown a sharp rise, from 1 per cent to 11 per cent in a year.

Chart 3.5: License Categories for FIPs and FIUs



Source: Sahamati and CAFRAL Calculations.

III.14 RBI's Innovation Hub launched a pilot on Public Tech Platform for Frictionless Credit (PTPFC), now renamed Unified Lending Interface (ULI). ULI is a platform facilitating smooth flow of a borrower's digitalised financial and non-financial records in a consent-based manner to lenders, to enable efficient underwriting of credit. ULI brings together multiple fragmented lenders into one platform by allowing them to access a range of customer information, including land records. By facilitating secure information flow between borrowers and lenders, the ULI has the potential to reduce multiple lender blind spots and enable speedy disbursal of credit with accurate pricing. All these innovations in digitalisation in UPI, AA and ULI have the potential to transform Indian household finances.

3.2 Credit in the Digital Age

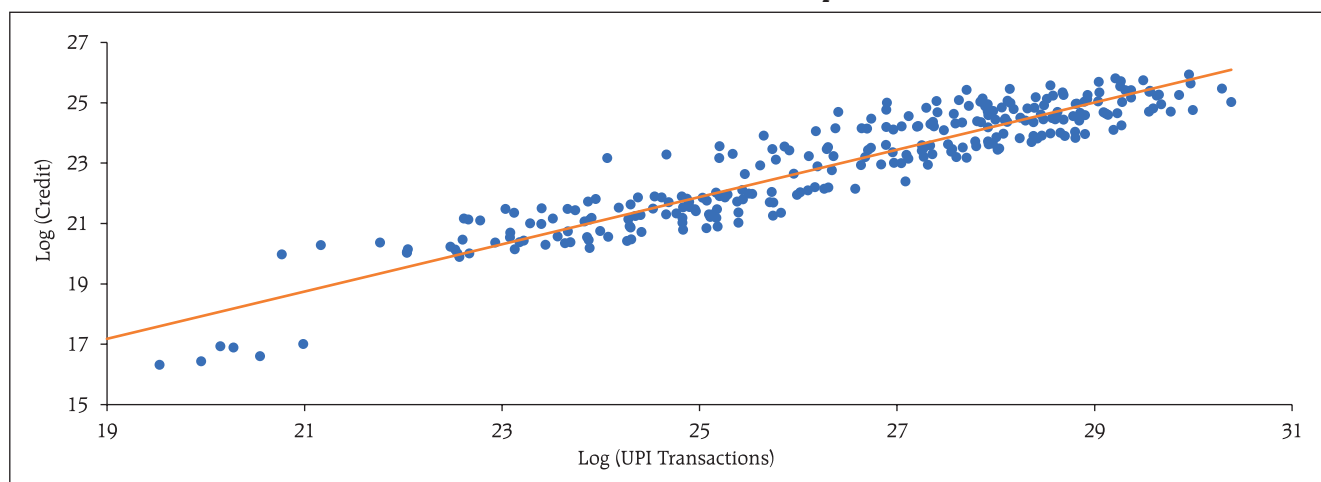
III.15 Historically, Indian households have difficulty in accessing formal credit, and are relatively underserved. As of 2021, 50 per cent of the adult population is excluded from formal credit, while 20 per cent is underserved (TransUnion CIBIL, 2021). However, digitalisation has changed how households borrow and who gets access to credit.

III.16 One of the key reasons for the persistence of informal credit in the Indian economy is the lack of a verifiable record of transactions, which significantly diminishes perceived creditworthiness. UPI creates a digital history of transactions for all consumers. Given its widespread adoption, many households working in low-income and underserved regions now have a robust record of transactions. Given that the UPI interface charges no transaction fees, the creation of digital history is not only in real time, but also at low cost. UPI allows safe and secure sharing of the data to multiple platforms, including banks and other operators like FinTechs. This enables *ex-ante* excluded customers to now access a wide variety of financial services in a customised and tailor-made format.

III.17 The rise in UPI has significantly affected credit access for the Indian household. Evidence suggests that UPI enables financial inclusion by expanding the domain of formal credit to underserved borrowers. There is a strong positive relation between UPI transactions and retail credit, at the state level, between 2018-19 (Chart 3.6). Specifically, a 10 per cent growth in UPI transactions is associated with a 7 per cent growth in credit (Box 3.1).

III.18 While credit expansion is seen across the board (Box 3.1), the natural question that arises is whether this is driven by the traditional formal credit system *i.e.*, banks, or new lenders who rely heavily on digital technology, *i.e.*, FinTechs. Post the UPI launch, banks have seen a significant increase in credit to prime borrowers in high exposure areas, relative to low UPI exposure areas. However, in relative terms, there has been no significant impact on new borrowers (new-to-credit (NTC)), while loans to subprime borrowers have increased marginally (Chart 3.7A). Hence, banks expand the ease of access to already existing customers, rather than bringing new customers into

Chart 3.6: UPI – Credit Relationship



Note: Each point is a state, and the data covers the period 2018Q1-2019Q4.

Source: Alok et al., (2024), NPCI and CAFRAL Calculations.

the net of formal credit. Loans made by FinTechs to existing, credit-worthy (prime) borrowers also see an increase, as FinTechs offer these borrowers speed and convenience.

Box 3.1: UPI and Household Credit

The relationship between UPI and household credit is important, yet understudied. While a simple correlational study across state-year observations suggests that a 10 per cent increase in UPI transactions is associated with a 7 per cent increase in credit, this result may be biased due to endogeneity - high credit areas might also be areas with high UPI transactions. To systematically tackle this issue, granular data on credit and UPI transactions at the pin code-quarter level are used over the period 2015 Q3- 2019 Q1. A unique feature of UPI is that a bank account is required to be linked. Hence, places with more banks onboarded to UPI will see greater uptake. Specifically, the staggered uptake of UPI by banks is exploited to address this endogeneity.

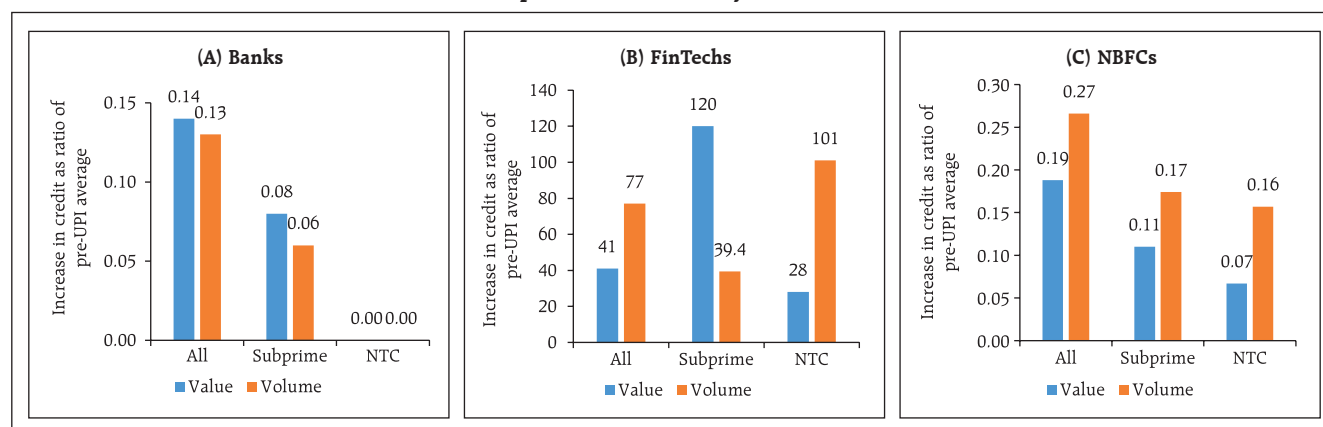
Banks which platformed onto UPI in 2016 are classified as early adopters, and the rest as late adopters (Dubey and Purnanandam, 2024). UPI Exposure is calculated as the fraction of banks belonging to early adopters. The data is divided into two periods – before 2016 Q3 (the quarter in which UPI was launched and after. A difference-in-differences specification is estimated to causally identify the impact of UPI exposure on credit in the post period. The results (Appendix A), which show that UPI has a strong, causal effect on total credit. In areas with high UPI exposure, total lending increases, in aggregate, by ₹76,832 crore in value, and 55.28 lakh in volume compared to areas with low UPI exposure. The increase is large and statistically significant across the board – relative to low exposure pin codes, subprime credit increases by ₹2,346 crore in value, and 2 lakh in number of loans, while prime credit increases by ₹61,840 crore in value and 39.35 lakh in number of loans, in aggregate, in high exposure areas (Alok et al., 2024).

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Alok, S., Ghosh, P., Kulkarni, N., & Puri, M. (2024). Open Banking and Digital Payments: Implications for Credit Access [CAFRAL Working Paper].

Dubey, T. S., & Purnanandam, A. (2024). Can Cashless Payments Spur Economic Growth? (SSRN Scholarly Paper 4373602). <https://doi.org/10.2139/ssrn.4373602>

Chart 3.7: Impact of UPI on Credit, by Scoreband and Lender



Note: Each column is the regression coefficient for the respective credit score band, divided by the pre-period average (Appendix A).

Source: Alok *et al.*, (2024) and CAFRAL Calculations.

III.19 In contrast, FinTech lenders have seen increased credit across borrower risk profile (Chart 3.7B). Overall FinTech credit has increased by 41 times in value, and 77 times in volume. While the absolute magnitudes are lower compared to banks, the economic effects are much more significant – compared to the pre-UPI period. The effects are even larger when excluded borrowers are considered: subprime credit has grown 120 times in value, while loans to NTC borrowers has grown by 28 times in value and 102 times in volume. Compared to this, overall and subprime bank credit has grown 14 per cent and 8 per cent in value, respectively (Chart 3.7A). On the other hand, subprime and NTC NBFC credit has grown by 19 per cent, 11 per cent and 7 per cent in value, respectively mainly driven by a low base effect in the period before UPI (Chart 3.7C). This analysis highlights the fact that UPI-era growth in credit is driven largely by FinTechs—as they successfully leveraged technology to use digital history to expand credit access to previously excluded and underserved borrowers (Agarwal *et al.*, 2019; Parlour *et al.*, 2022).

III.20 Aided by large scale financial inclusion schemes like PMJDY, India has made massive strides in expanding access to formal credit by ensuring access to bank accounts, informal practices and financial behaviours of its citizens in terms of ensuring bank account access. In a short span of ten years (2011-2021), bank account/financial account ownership has more than doubled from 35 per cent to 77.5 per cent. This rapid growth makes it a significant outlier in comparison to other countries, as such high levels of financial inclusion are typically seen at much higher levels of per capita income (Chart 3.8).

III.21 The other ingredient that amplified India's UPI was the advent of 4G-enabling cheap and fast internet access across the country. Currently, there are 5.3 lakh 4G towers, catering to 95 per cent of the country's population (Chart 3.9). Average distance from a pin code to a tower falling to approximately from 16.7 km in 2016 to 3.7 km in 2020 (Chart 3.10). This has accelerated the closure of the digital gap in the country.

Box 3.2: How PMJDY and UPI Improved Household Access to Credit

The PMJDY served as a precursor to UPI by enabling bank account access to large segments of the population. To study how PMJDY propelled financial inclusion with the help of UPI, data on credit at the pin code-quarter level, over the period 2015 Q3-2019 Q1 are used. Then a set of regressions are estimated, with an additional source of variation, namely whether a pin code had a high number of PMJDY accounts, or low. This allows the implementation of a triple differences (difference-in-difference-in-differences) specification which yields the impact of high UPI exposed pin codes and pin codes with high PMJDY accounts, post the introduction of UPI relative to low pincodes with low PMJDY accounts (Appendix C).

The results show that PMJDY has had a positive and significant effect on credit. In aggregate, areas with high pre-period share of PMJDY accounts and high UPI exposure, total credit increases by ₹92.385 crores in value, and 79.4 lakhs in number of loans, relative to areas with low share of PMJDY accounts. Total FinTech lending also increases by ₹2,990 crores in value and 12.5 lakhs in volume, in relative terms. This increase is largely driven by new borrowers whose credit increased by ₹560.7 crores in value and 3.7 lakhs in volume. The results are economically significant as well — total, FinTech, and NTC FinTech lending increased by 17 per cent, 42 times and 36 times respectively, relative to the pre-UPI period (Alok *et al.*, 2024).

Hence, the creation of 28 crore new bank accounts (Agarwal *et al.*, 2017), combined with the seamless functioning of the DPI, led to the creation of a new trail of digital transaction history. This, in turn, heralded the entry of erstwhile excluded borrowers, namely NTC and subprime borrowers into the financial system to access formal credit at an unprecedented scale.

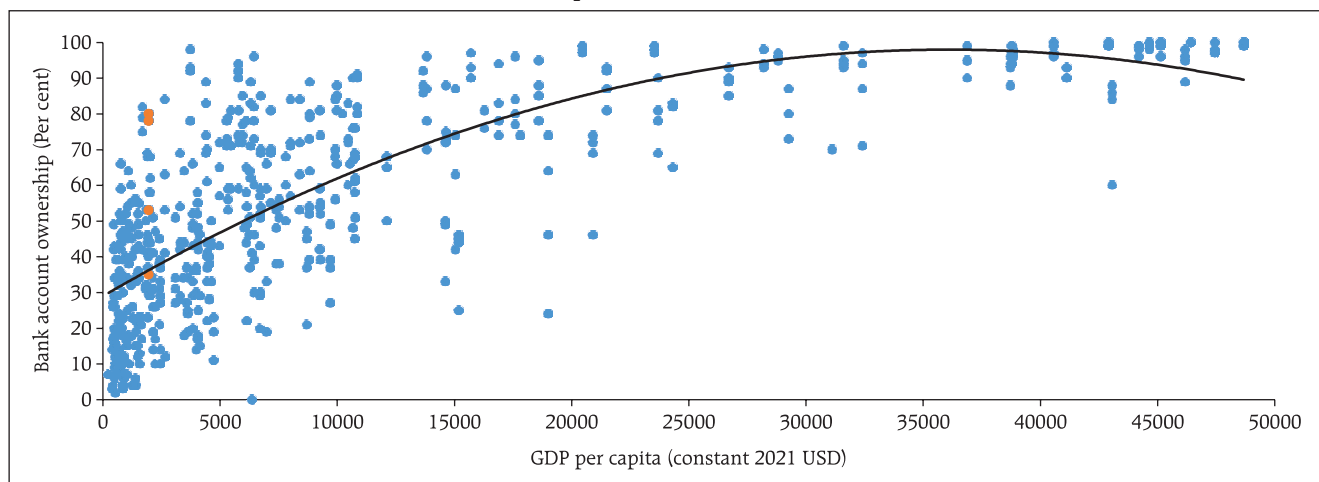
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Alok, S., Ghosh, P., Kulkarni, N., & Puri, M. (2024). Open Banking and Digital Payments: Implications for Credit Access [*CAFRAL Working Paper*].

III.22 Areas which had active towers early (2017 Q1), and high exposure to UPI have a strong head start relative to similar pin codes that got a 4G tower later. Hence, pin codes with a higher

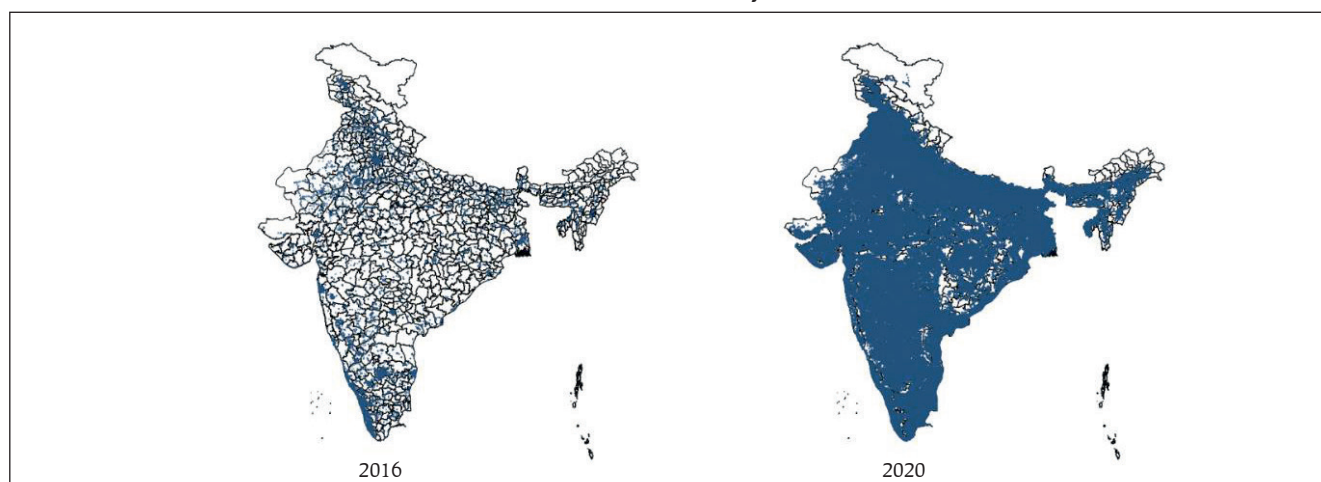
Chart 3.8: Rapid Bank Account Growth in India



Note: Orange dots represent India. Curve of best fit is a quadratic polynomial. Sample of countries restricted to countries with GDP per capita lesser than or equal to 50,000 USD, and covers the years 2011, 2017, 2020, and 2021.

Source: World Bank and CAFRAL Calculations.

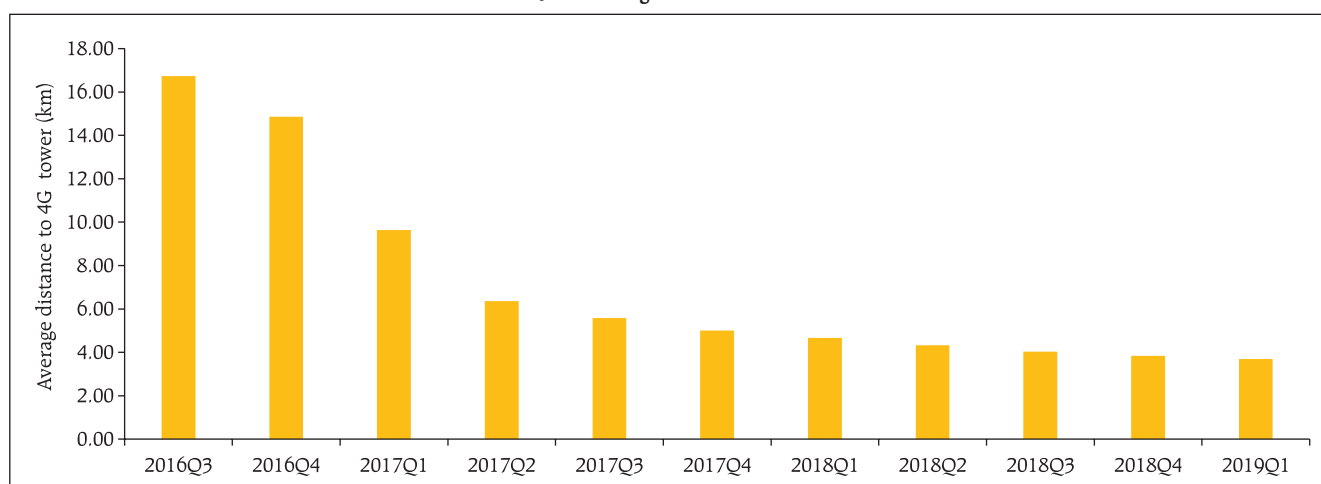
Chart 3.9: 4G Tower Density in India



Note: Each dot represents an active 4G tower.

Source: Alok et al., (2024) and CAFRAL Calculations.

Chart 3.10: Falling Distance to 4G Towers



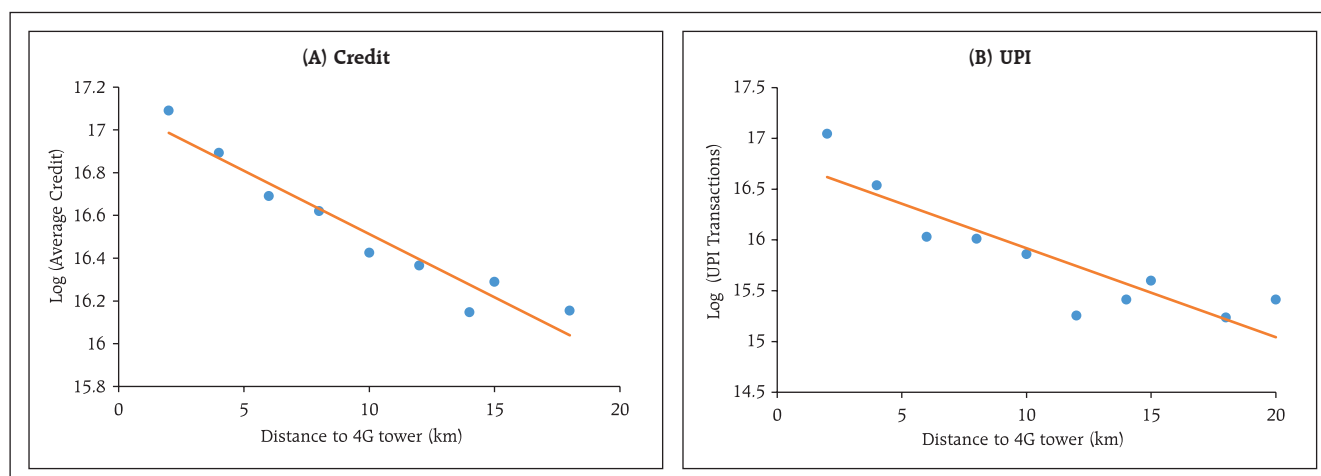
Source: Alok et al., (2024) and CAFRAL Calculations.

4G tower density *i.e.*, with lower distances to 4G towers, on average, see greater disbursement of credit (Chart 3.11A). Similarly, 4G internet enables users to seamlessly and speedily conduct UPI transactions on their smartphone, leading to more online payment transactions in areas where tower density is higher (Chart 3.11B). Hence, access to 4G towers is strongly related to, both, higher UPI transactions, as well as higher overall credit supply.

III.23 The staggered installation of 4G towers across the country serves as a natural experiment allowing the evaluation of the effect of 4G towers on credit (Appendix B). Bank credit in pin codes that adopted 4G early, and had high UPI exposure, increased by ₹52.8 lakhs (19 per cent) in value on average per quarter (Chart 3.12A), while average FinTech credit increased by ₹2.5 lakhs per quarters (Chart 3.12B), relative to areas which adopted 4G late. Similarly, starting from a low base, there has been 61-fold relative increase in FinTech credit.

III.24 The impact of 4G on credit is unequal across lenders. Overall credit rose significantly for both FinTechs and Banks, and by economically substantial amounts. However, the impact of early

Chart 3.11: Distance to 4G Tower and UPI/Credit Transactions



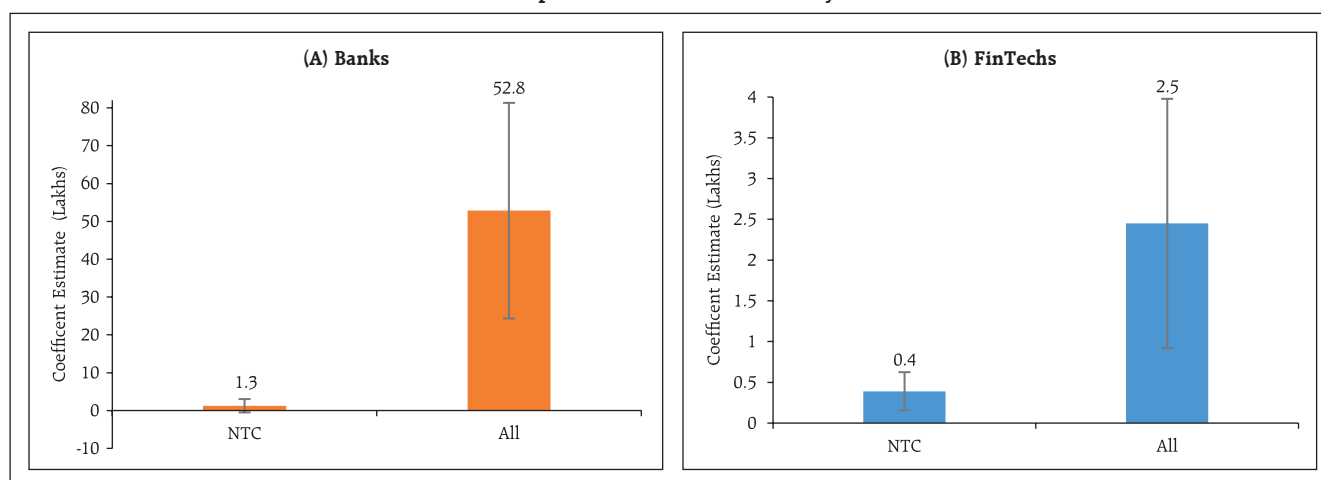
Notes: Each point represents the log of average credit/UPI transactions in distance bands of 2 km (0-2 km, 2-4 km etc.) across pin codes and quarters. Data for Panel A is from 2015 Q3-2019 Q1, while data for Panel B is from 2017 Q1-2019 Q1.

Source: Alok *et al.*, (2024) and CAFRAL Calculations.

4G adoption for disbursement of NTC loans by banks is noisy. Instead, the impact on FinTech credit is strongly positive, rising by ₹0.4 lakhs in mean value, a 40-fold increase from the pre-UPI period. This heterogeneity highlights how banks and FinTechs cater to different segments of the population - the former relies on traditional, long-term prior relationships, making them slow to adapt to new digital practices (Mishra *et al.*, 2022). In contrast, FinTechs rely heavily on digital technology for their lending infrastructure, and aided with the 4G revolution and financial inclusion schemes like PMJDY, cater to young and underserved borrowers.

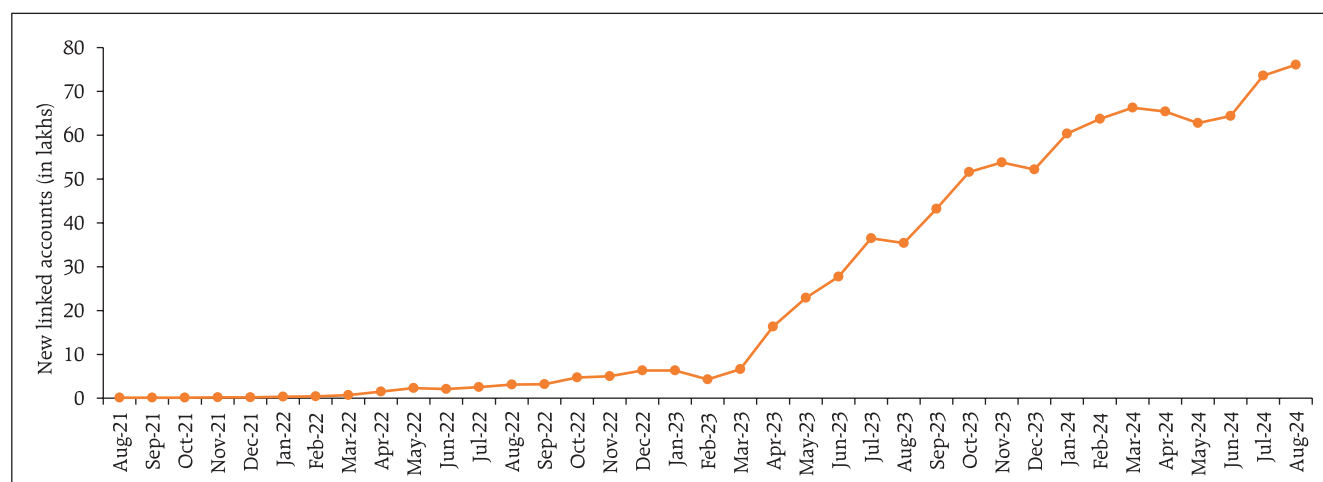
III.25 Account Aggregator (AA) constitute the latest addition in India's quest for financial inclusion. This open banking framework brings together FIPs and FIUs on a common platform via consent-based sharing of data, AAs have the potential to smoothen credit access to the underserved by eliminating erstwhile information asymmetries between borrowers and lenders.

Chart 3.12: Impact of 4G Internet on Credit, by Scoreband



Source: Alok *et al.*, (2024) and CAFRAL Calculations.

Chart 3.13: Rise in Linked AA Accounts

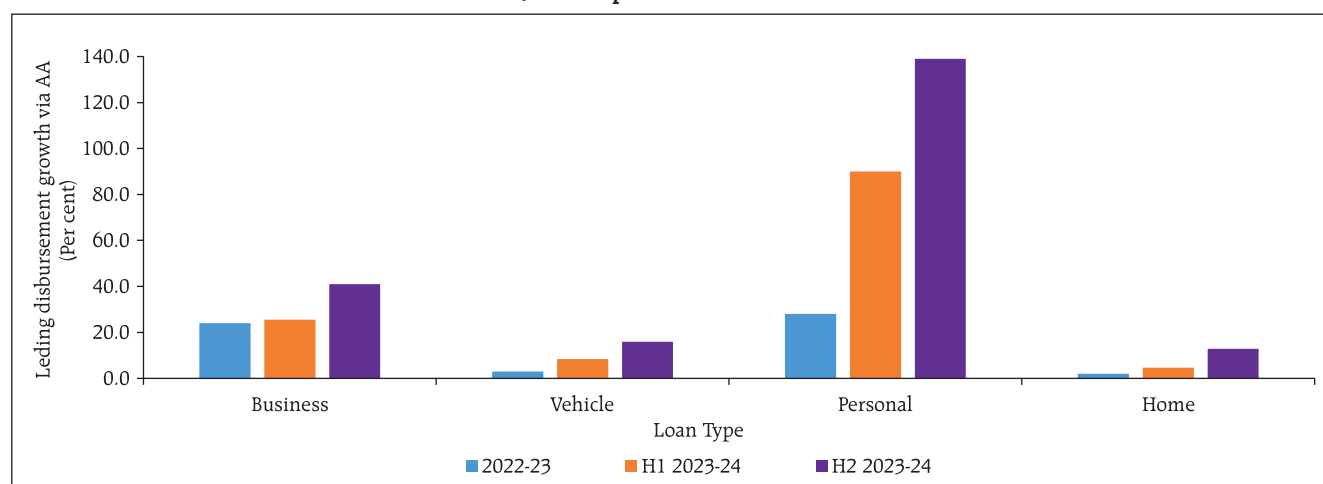


Source: AA Dashboard, Sahamati.

III.26 The AA framework has grown steadily over the last three years. Since February 2023, new account linkages have been rising, going from 4.3 lakh new accounts to 76 lakh new accounts in August 2024 (Chart 3.13). Cumulatively, close to 9.9 crore accounts have been linked to AA, catering to approximately 7 per cent of India's population. Consent requests fulfilled grew by 1,059 per cent in 2023-24, making AA the largest growing open finance ecosystem in the world.

III.27 Credit disbursed through AA has grown commensurately in the recent past. Personal loans have shown the highest growth, more than tripling from 28 per cent in Financial Year 2022-23 to 90 per cent in H1 Financial Year 2023-24, and continuing to rise to 139 per cent in H2 Financial Year 2023-24. This was followed by business loans, whose growth increased from 24 per cent to 41 per cent, in the same time period. Finally, vehicle and home loans have seen a steady increase in growth from 3 to 16 per cent and 2 to 13 per cent, respectively (Chart 3.14).

Chart 3.14: Composition of AA Credit Growth



Source: AA Adoption Update August 2024, Sahamati.

III.28 A strong increase in overall credit across the board viz. consumer (including personal loans, consumer durables and credit card loans), mortgage and business segments is observed (Box 3.3).

III.29 The impact of AA on consumer loans has been positive and significant across lenders. Post 2021, number of consumer loans by NBFCs grew, in aggregate, by 23.5 lakhs in the prime segment, 3.7 lakhs in the subprime segment, and 38.3 lakhs overall in areas with high AA exposure, relative to areas with low AA exposure, during a quarter¹ (Chart 3.15A). NTC loans however, did not show any significant increase reflecting a divergence from the effect of UPI on credit, as NTC loans by FinTechs showed relatively high growth. A robust increase was also observed in bank credit in high AA areas, with average prime credit growing by 15.8 lakhs and overall credit by 20.8 lakh loans, in aggregate, per quarter loans (Chart 3.15B). Overall, AA credit growth in the consumer loan segment by banks is driven by prime loans, while lending growth by NBFCs has been comparatively more broad based.

III.30 Mortgage loans by NBFCs also saw positive increase across the board. The volume (number of) prime loans rising, in aggregate by 33,150 subprime loans going up by 5,636, and NTC loans increasing by 2,486 over a quarter (Chart 3.15C). Mirroring the pattern of consumer loans, bank

Box 3.3: Did Account Aggregators Increase Household Access to Credit?

How did AAs affect credit across segments since its rollout a few years back? To study this question, data on consumer, mortgage, and unsecured business loans at the pin code level from TransUnion CIBIL, covering the period 2019 Q1 to 2024 Q2 are used. The staggered on boarding of SCBs as FIPs onto the AA Ecosystem is exploited, and onboarders are classified as early and late AA providers (using 2021 as the cut-off). AA Exposure is constructed as the pre-period above-median early AA adopters. This measure serves as a source of exogenous variation in AA adoption, and helps address potential bias due to endogeneity.

Using a difference-in-differences specification, the effect of AA in the post period (2021 Q3) on credit is estimated (Ghosh *et al.*, 2024). On average, in a quarter, consumer credit increases by ₹2.6 crore in value and 357 loans in volume, in pin code areas with high AA Exposure in the post-period, relative to pin codes areas with low AA Exposure. This amounts to 32 per cent and 30 per cent increase in value and volume respectively, relative to the pre-period average. Subprime credit also increases, to the tune of ₹0.04 crore in value and 26.7 loans in volume, on average, while the increase is largely driven by prime loans, which grew by ₹2.2 crore in mean value and 243 loans in average volume. New to credit (NTC) loans do not show any statistically significant increase.

High AA areas also see a significant increase in mortgage credit, with total loans rising by ₹3.8 crore in value on average. This increase is largely dominated by prime loans, rising on average, by ₹3.3 crore in value in a pin code-quarter. The impact on subprime and NTC loans is noisy - while the value of loans grew for both, there was no statistically significant change in volume, indicating that AA only impacted prime loans overall. Business loans also showed a strong rise, going up by ₹1.2 crore on an average. NTC loans showed no significant change, in value or volume, while subprime loans rose in value, but fell in volume. Prime credit showed significant growth, rising by ₹0.9 crore in mean value.

References

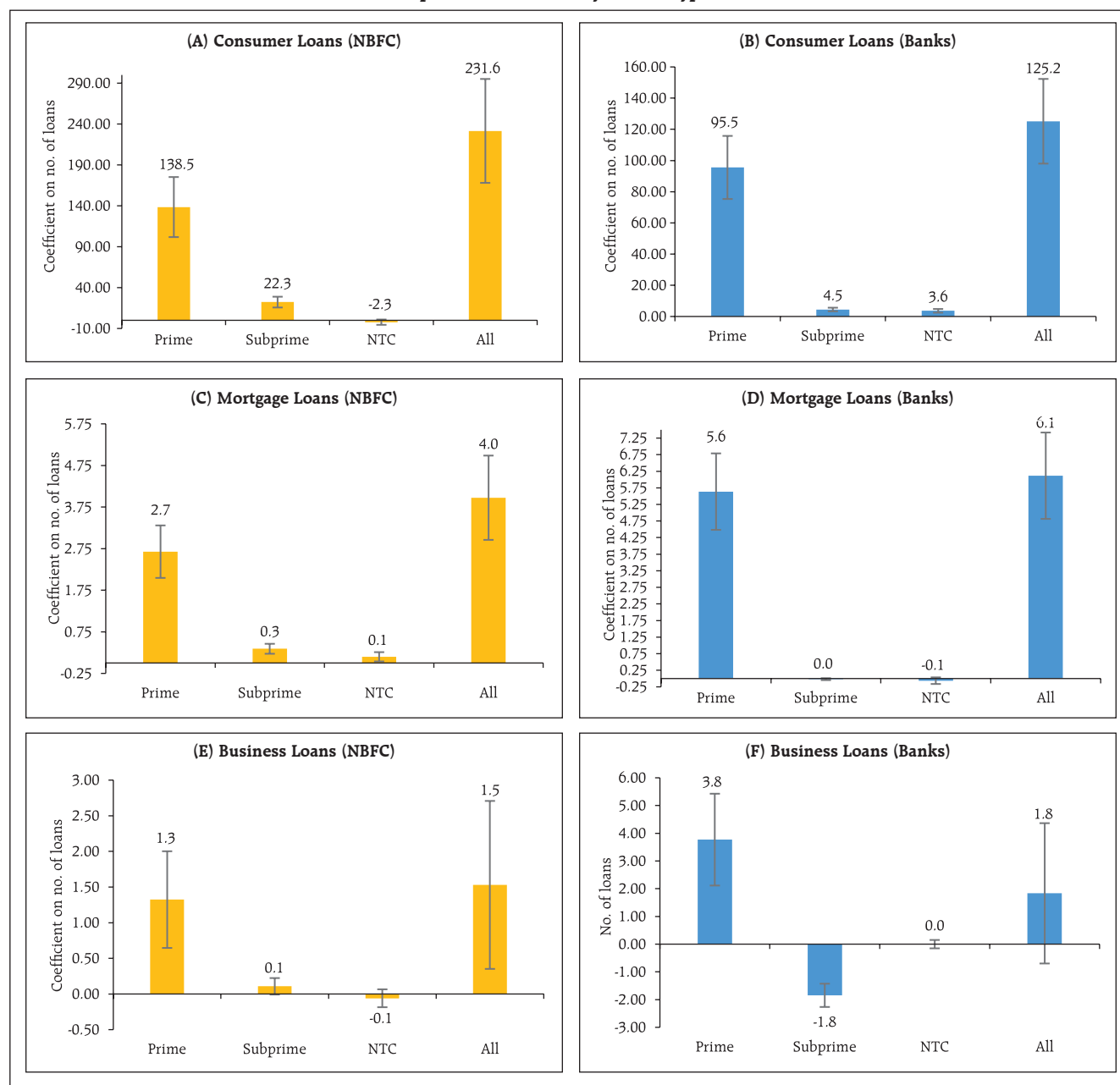
Ghosh, P., & Kulkarni, N. (2024). How do Account Aggregators Affect Credit Access? [Work in progress].

¹ Aggregate values are obtained by multiplying the regression coefficients by 16,575 (no. of pincodes in the study).

mortgage credit rose only in the prime and overall segments respectively (Chart 3.15D). Overall, mortgage credit grew less than consumer credit.

III.31 Unlike consumer and mortgage loans, AA had a positive effect on prime loans (Chart 3.15E). Furthermore, business loans by banks saw an uptick only in the prime segment -- while NTC loans remain unchanged, and subprime loans see a decrease (Chart 3.15F).

Chart 3.15: Impact of AA on Loans, by Product Type and Score Band



Source: Ghosh et al., (2024).

III.32 AA has facilitated broad-based access to credit. NBFCs credit increased across different categories of credit scores while bank credit has primarily grown in the prime and overall segment. Thus, AAs are emerging as a useful tool for screening high quality credit for banks, along with smoothening access *via* speed and convenience.

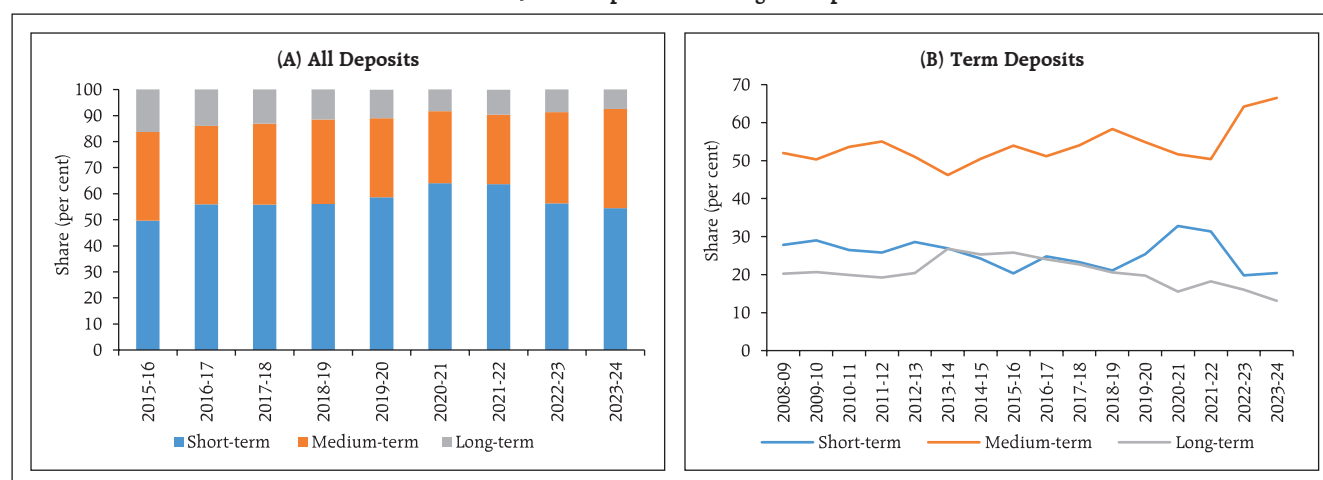
3.3 Digitalisation and Household Deposits

III.33 Bank deposits continue to be the major financial instrument of savings for Indian households mainly in the form of savings deposits and term deposits. Aggregate deposits have doubled between January 2016 to April 2024 (RBI). The share of long-term deposits *i.e.*, term deposits with a maturity tenure of three years and more have been falling. Secondly, the share of short term deposits containing current, saving and term deposits of tenure less than a year, rose briefly during the COVID-19 pandemic to 65.4 per cent, but since then has fallen back to 54.4 as of 2023-24 (Kaul, 2024). Finally, the share of medium term deposits (tenure of one to three years), is at its highest in the last fifteen years, commanding a share of 38 per cent (Chart 3.16A).

III.34 A similar pattern is observed within term-deposits as well, with the share of medium term deposits increased from 52 per cent in 2008-09 to 65 per cent in 2023-24, while the share of long term deposits declined from 20 per cent to 13 per cent in the same time period (Chart 3.16B). The overarching trend points to households withdrawing from long-term deposits and shifting their savings to other instruments, like mutual fund and stock market (Das, 2024). Concurrently, the corporate sector saw record profits post-pandemic, leading them to park this improved cashflow in deposits, leading to a shift in the composition of deposits in favour of corporates.

III.35 The shortening of the average tenure of deposits over the last few years widens the already existing gap between short-term deposits and long-term loans and leads to an asset-liability mismatch. Further, the rise in financial savings, relative to physical savings, in an environment of rising household indebtedness raises concerns of financial fragility. If households are unable to

Chart 3.16: Compositional Change in Deposits



Source: Centre for Monitoring Indian Economy (CMIE).

meet their interest commitments, there is potential deterioration of the financial sector income and balance sheets, leading to falling credit supply to the non-financial sector.

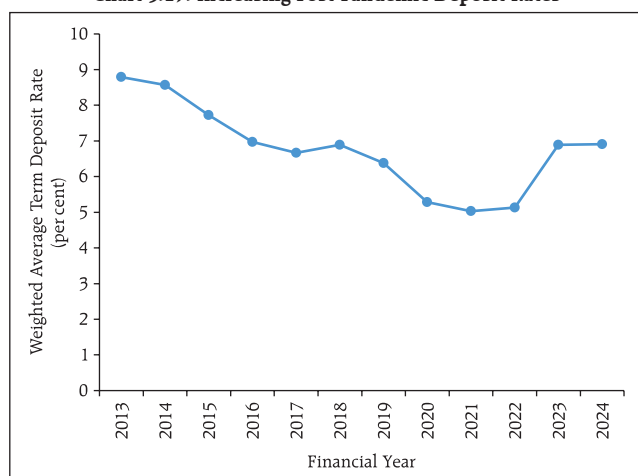
III.36 In order to attract deposits, banks have responded by increasing deposit rates (Patra et al., 2024) (Chart 3.24). The RBI also unveiled the UPI Interoperable Cash Deposit (UPI ICD) functionality in August 2024. This allows customers to deposit money in their bank accounts at ATMs without physical card, using only their UPI ID. This is expected to reduce the frictions faced by customers in depositing their income and savings at various bank branches, as it allows ATM deposits from banks other than those in the customers' names. Overall, these measures are expected to ramp up household deposit growth over the next few quarters.

3.4 Digitalisation and Household Stock Market Participation

III.37 The adoption of UPI led to unprecedented levels of digital payment transactions after COVID-19. In its tow, another trend has emerged in the economy – that of rising stock market participation. This is partially reflected in the rapid growth in standard indices like the Nifty 50, growing from a pandemic low of 7,735 in March 2020 to more than three times to hit a high of 25,000 in early September 2024 (Chart 3.18). Throughout 2024, the Nifty 50 has outpaced the S&P 500 index, growing by 11.8 per cent compared to the latter's 9 per cent.

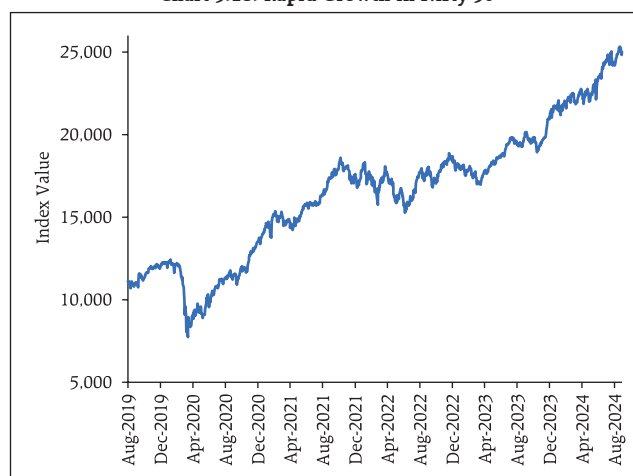
III.38 Multiple statistics point towards the present era being a unique one for India's stock market. India's market capitalisation to GDP ratio rose from 79 per cent in December 2019 to 124 per cent in December 2023 (Ministry of Finance, 2024). Between September 2020 and September 2024, the number of active dematerialised (Demat) accounts on the National Securities Depositories Limited (NSDL) has increased from 2 crore to 3 crore (NSDL, 2024). 20 per cent of all Indian households invest in the stock market as of March 2024 (Ministry of Finance, 2024). The role of India Stack and DPI has been key here — as PAN-Aadhaar linkage allows platforms to uniquely identify and track investors, enabling speedy creation of Demat accounts.

Chart 3.17: Increasing Post-Pandemic Deposit Rates



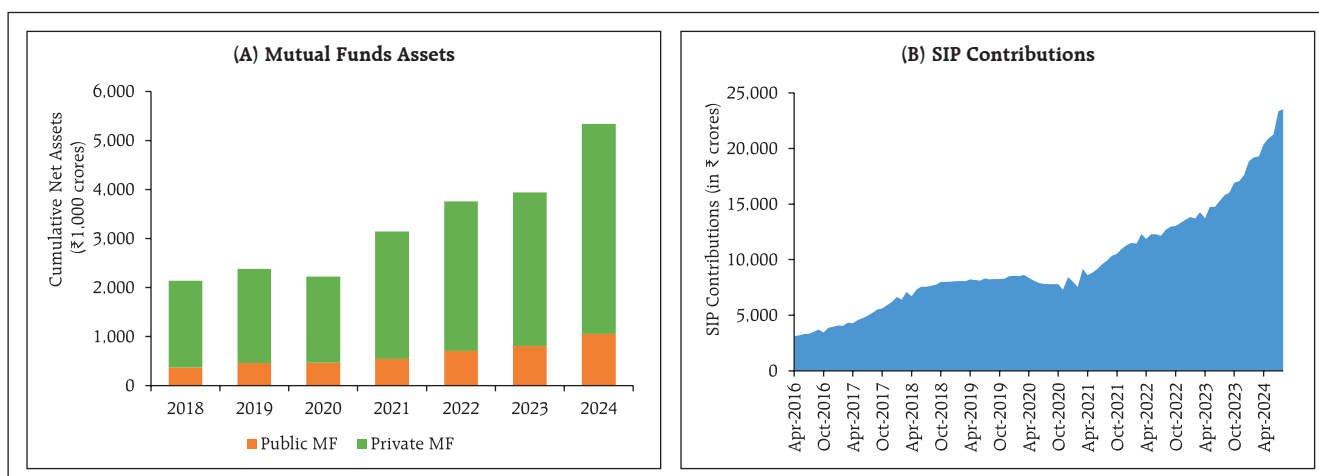
Source: RBI.

Chart 3.18: Rapid Growth in Nifty 50



Source: NSE.

Chart 3.19: Growth in Mutual Fund Investments



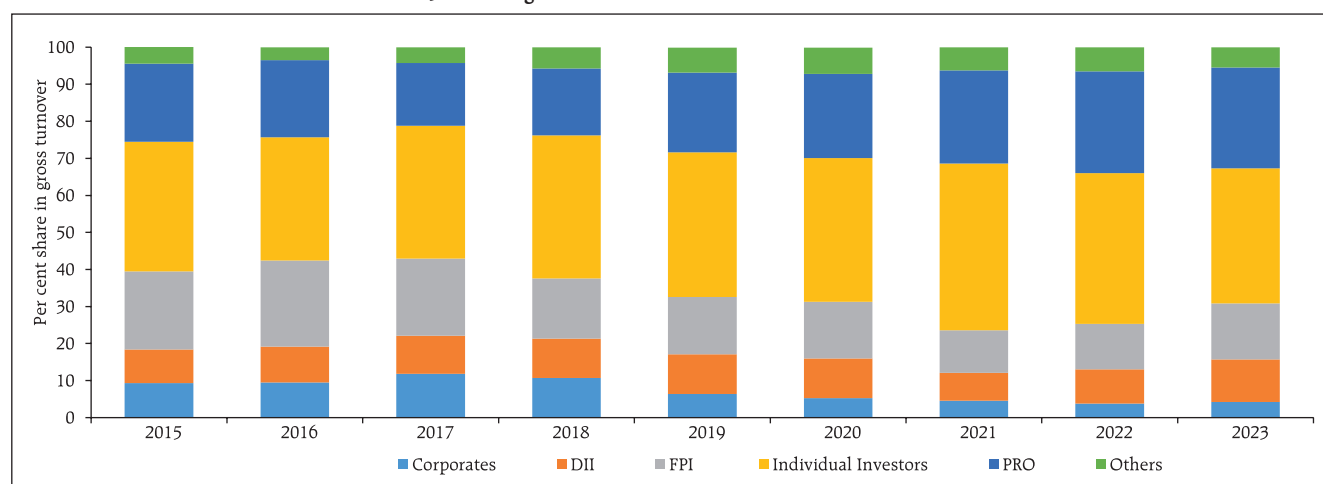
Source: NSE and CAFRAL Calculations.

III.39 Between December 2019 and December 2024, assets under management (AUM) of mutual funds rose from ₹26.5 lakh crore to ₹68 lakh crore. This growth was largely driven by private mutual funds, whose cumulative net assets grew by close to 2.5 times from ₹17.7 lakh crore in 2018 to ₹42.9 lakh crore in 2024. The assets of public mutual funds grew from ₹3.7 lakh crore to ₹10.5 lakh crore during the same period (Chart 3.19A). A large contribution to this growth came through a spurt in SIP contributions, which have tripled from roughly ₹8,000 crore in March 2019, to ₹23,500 crore in August 2024 (Chart 3.19B). UPI has been key in driving this growth by reducing investment time from 2-3 days to less than a day, and offering autopay options to smoothly automate debit transactions for SIP investments (NPCI, 2024).

III.40 A defining feature of the post-pandemic period has been the rise of household sector investments in the stock market. Traditionally, the stock market was dominated by promoters, to raise capital for firms in the stock market via marketing strategies. However, this has changed recently, as promoters have been selling off their stakes, and individual investors have been buying them. The latter's share in gross turnover rose from 35 per cent to 40.7 per cent between 2015 and 2022, while the share of corporates and foreign portfolio investors (FPI) declined from 9.3 per cent and 21.1 per cent to 4.2 per cent and 15 per cent, respectively between 2015 and 2023 (Chart 3.20).

III.41 Entry into financial markets was also facilitated by a slew of low-fee brokers, also known as discount brokers. Traditionally, market participants relied on full service brokerage firms, which, in addition to providing trading platforms, offer a full suite of services like issuing trading calls, providing extensive market research and industry reports. Consequently, they tend to charge higher fees. Discount brokers on the other hand, charge low/flat fees and close to zero maintenance charges for Demat accounts. They offer a narrower suite of services, and rely on online application based registration to ensure seamless opening of Demat accounts within the same working day. Discount brokers have successfully leveraged the many informational externalities of UPI and India's DPI to attract a young clientele into the stock market.

Chart 3.20: Rising Share of Individual Investors in Gross Turnover



Source: Patnaik (2023).

III.42 UPI has been a crucial bridge between new investors and the stock market. Even before COVID-19, areas with high exposure to UPI saw higher number of transactions and new investors in the stock market (Box 3.4). The average investor's age has fallen from 39 in 2018 to 32 in 2024 indicating that new investors are younger (Patnaik *et al.*, 2024). These investors also drive the shift towards use of digital platforms and rely heavily on online applications relative to brick-and-mortar bank branches. Mobile applications with user-friendly interfaces seamlessly integrate payment systems made available to them via the DPI created by the India Stack, allowing them to transact in financial markets with great speed and efficiency in a secured environment.

Box 3.4: UPI and Stock Market Participation

UPI's role in inducing stock market participation in India is analysed by using the universe of data on individual investors' daily trading activity from the NSE, covering the period 2015 Q1 – 2020 Q1. This data is then combined with UPI exposure (Box 3.2), yielding an aggregated pin code-month-year data consisting of information on transaction date, execution price, investors' demographic information, as well as mobile algorithmic and internet trades.

Using a difference-in-differences specification, the effect of UPI exposure in the post period (September 2016) on retail stock market participation is estimated. The results show that across India UPI exposure increases retail transactions by 4.5 crores and the number of investors by 44.6 lakhs. The effects are positive and significant across the board. Post the adoption of UPI, the number of small transactions increased by 89.2 lakhs relative to large transactions, and the number of small investors increased by 18.4 lakhs, relative to large investors. Overall, stock market participation has grown and is driven by small ticket investments (Ayyagari *et al.*, 2024).

The results also unearth a variety of differences by demographics – men invest in higher amounts and in higher numbers compared to women, and middle-income participants dominate others in terms of number of transactions. However, lower-income investors undertake more transactions compared to higher income (by 1 lakh), and have more participants compared to both middle-income (by 34,106) and higher income (by 1.2 lakhs). Hence, men and residents with relatively lower income dominate entry in stock markets post UPI.

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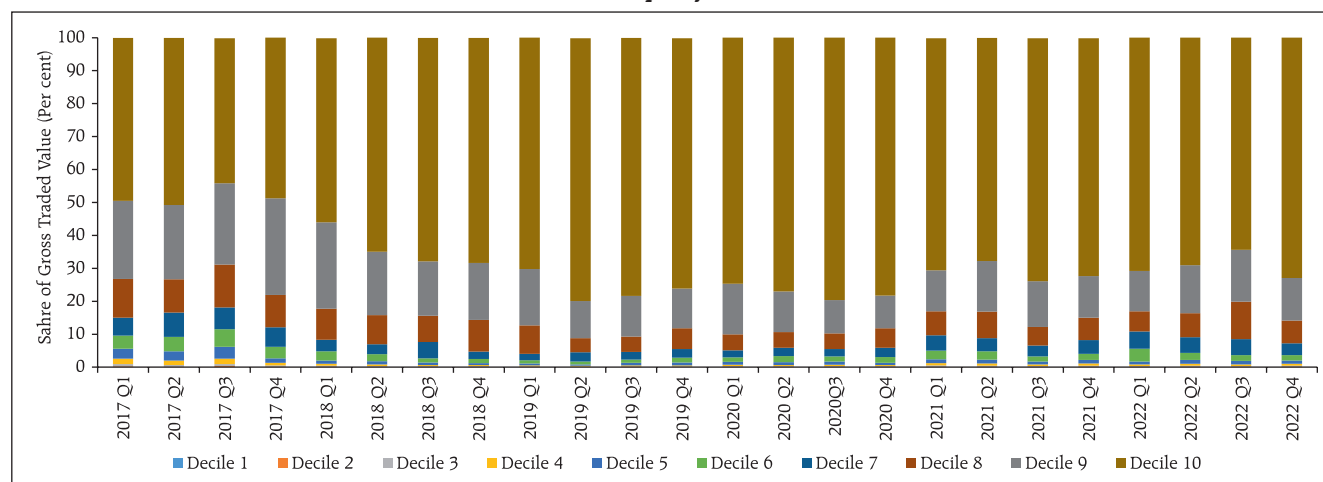
Ayyagari, M., Cheng, Y., Ghosh, P., & Kulkarni, N. (2024). Open Payment Infrastructure and Stock Market Trading. *Work in progress*

III.43 In 2019, UPI was enabled as a payment option for live subscriptions to Initial Public Offerings (IPOs). Since January 2024, UPI was introduced to the secondary market in the form of an Application Supported by Blocked Amount (ASBA) type facility. This allows customers to directly block a certain amount to be used for buying assets like equity in their bank accounts. This amount is then debited by the associated clearing houses on confirmation of the trade, settlements and payouts are made to the involved party on a t+1 basis. This ensures customer protection, as they no longer have to rely on transferring blocked amounts to brokers and improves transparency, as all transactions are directly reported between the clearing house and customers. In August 2024, upon a successful beta launch, the Securities and Exchange Board of India (SEBI) proposed to make this mandatory.

III.44 Rising retail participation in the stock market is beneficial as it helps improve market liquidity, by encouraging price discovery (Barrot *et al.*, 2016; Boehmer and Song, 2020; Kaniel *et al.*, 2008). However, the welfare impact of increased participation is ambiguous if participation *via* digital payment systems is dominated by inexperienced investors, as they are prone to return chasing, attention-based trading, and herding behaviour (Barber *et al.*, 2021; Bianchi, 2018; Goetzmann and Kumar, 2008; Greenwood and Nagel, 2009). Hence, it is important to highlight the risks emerging from speculative behaviour in order to balance increased participation with financial stability.

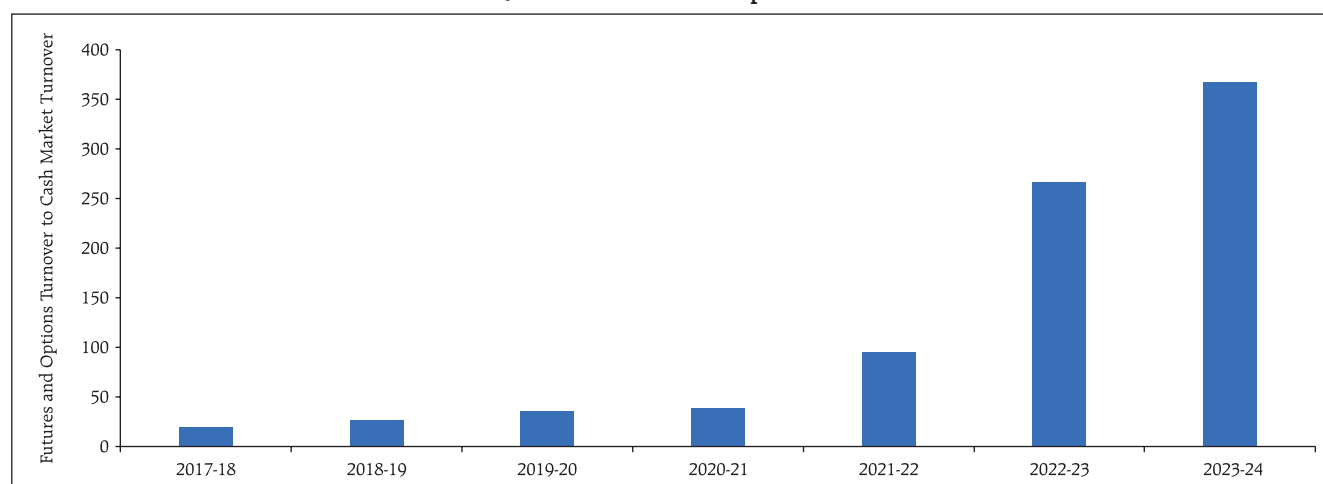
III.45 While participation and trading has increased in the aggregate, the composition remains staggeringly skewed. Investor inequality has not only been high for the past seven years, but has also increased, as the share of the top decile in the gross traded value rose from 50 per cent to 73 per cent between 2017 and 2024 (Chart 3.21). In contrast, the shares of the other deciles have remained constant or declined, giving outsized power to few high net worth individuals to determine the flow of finance in the markets.

Chart 3.21: Inequality in Trade Value



Source: Patnaik (2023), NSE.

Chart 3.22: Rise in Futures and Options Turnover



Source: SEBI.

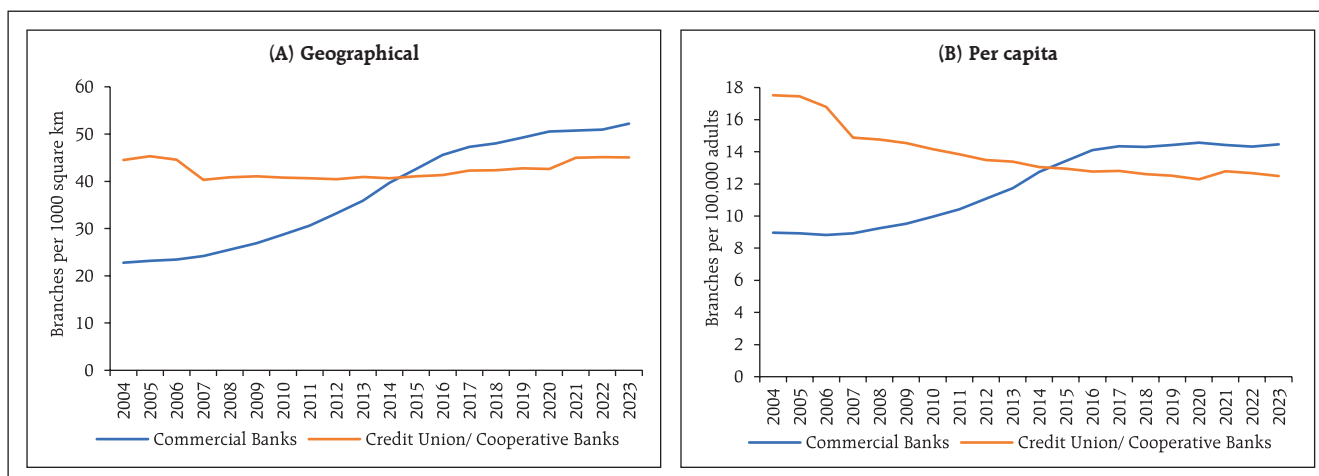
III.46 While digitalisation has enabled rapid entry into the markets, quarterly data from the NSE shows that these new entrants do not stay in the market for very long *i.e.*, while number of unique investors show an increase every quarter, a large share of each cohort do not trade the next cohort (Patnaik, 2023). These behavioural patterns indicate that the current crop of entrants fuelling market activity may not be stable participants, as they may not possess the necessary knowledge base and skills to hold out for long-term gains. This reveals the double-edged nature of entry enabled by the digital revolution – while entry may be fast and seamless due to advances in technology, the quality and stability of participants may be compromised.

III.47 Finally, volatility and changing dynamics in derivatives markets in recent times has been a cause of concern. Volumes in futures and options trading have increased staggeringly, with Indian options accounting for 84 per cent of traded equity worldwide in the Q1-2024 (ICICIdirect, 2024). Derivative options are far more popular than cash segments, as the turnover ratio has increased manifold from 19.8 in 2017-18 to 367.8 in 2023-24 (Chart 3.22). However, 93 per cent of active investors in this segment incurred losses between 2021-22 to 2023-24 (Department of Economic and Policy Analysis, 2024).

3.5 Household Access to Bank Branches in the Digital Age

III.48 The digital revolution in India has resulted in streamlining of various administrative and logistical tasks related to banking. A natural consequence has been an improvement in the ease of access for many individuals across the country. With the smartphone and 4G revolution ensuring affordable internet access to the remotest corners of the country, multiple banking services including transactions, account creation and verification are now possible online. The digital revolution in India is built on an impressive edifice of physical bank branch expansion. Particularly, the number of branches per 1000 square km doubled from 25 to 50 between 2008 to 2023 (Chart 3.23A). Concurrently, the number of commercial bank branches per 1,00,000 adults

Chart 3.23: Bank Branch Growth



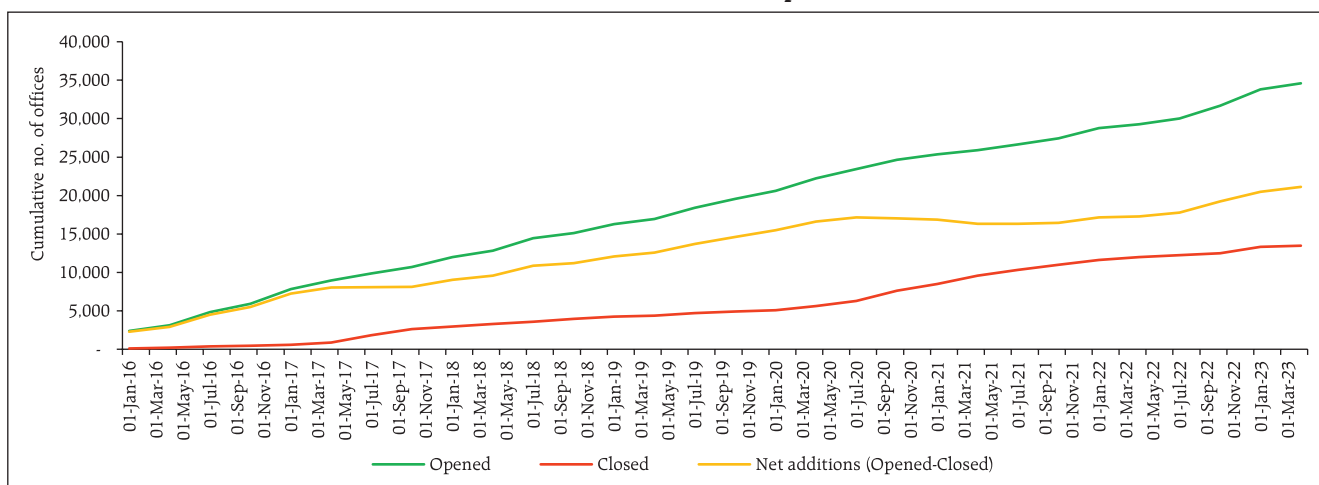
Source: Financial Access Survey, IMF.

also rose from 9 to 14 (Chart 3.23B). Much of the expansion took place over the period 2006-2016, with both per capita and geographical branch growth stabilising ever since.

III.49 The trends in bank offices over the last few years show that while new bank branches have been steadily opening every quarter, the rate of bank office closures saw a sharp uptick between March 2020 and November 2021. Consequently, net bank branch openings flattened and even reduced slightly during this period, before regaining momentum towards the end of Q2 2023 (Chart 3.24).

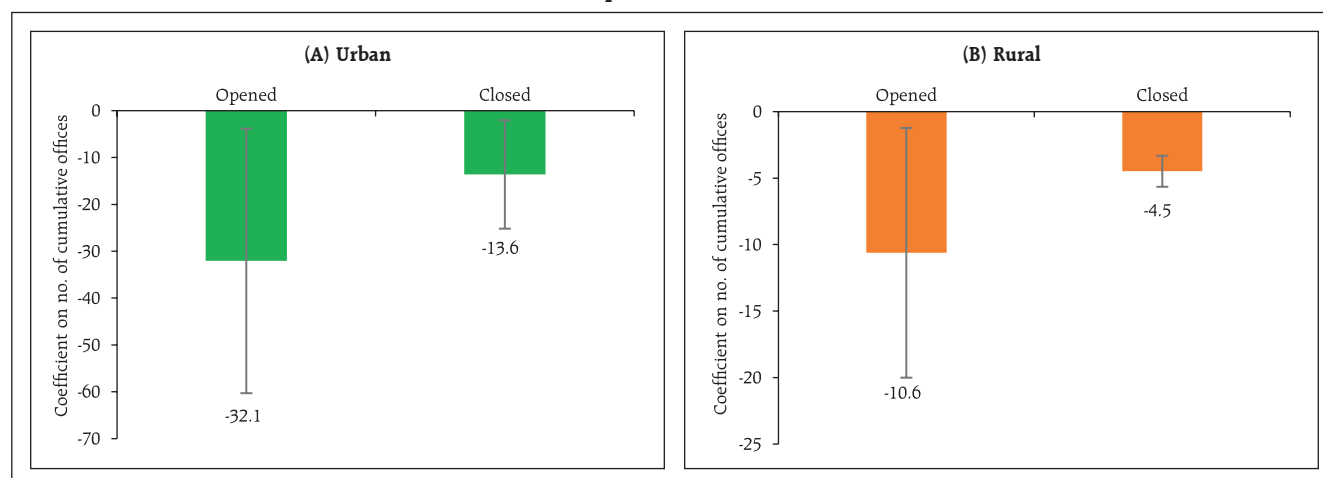
III.50 India's digitalisation has affected the pace of opening of new physical bank branches. Empirical analysis on district-level bank branch data covering the period 2016 Q1 to 2022 Q4 yields the following insights: One, there was a fall in physical bank branches in districts with high UPI exposure (Box 3.2), for both cumulative number of accounts opened and closed. Two, the average decline in the number of bank branches opened exceeded the decline in the number of bank

Chart 3.24: Number of New Bank Offices Opened and Closed



Source: RBI.

Chart 3.25: Impact of UPI on Bank Branches

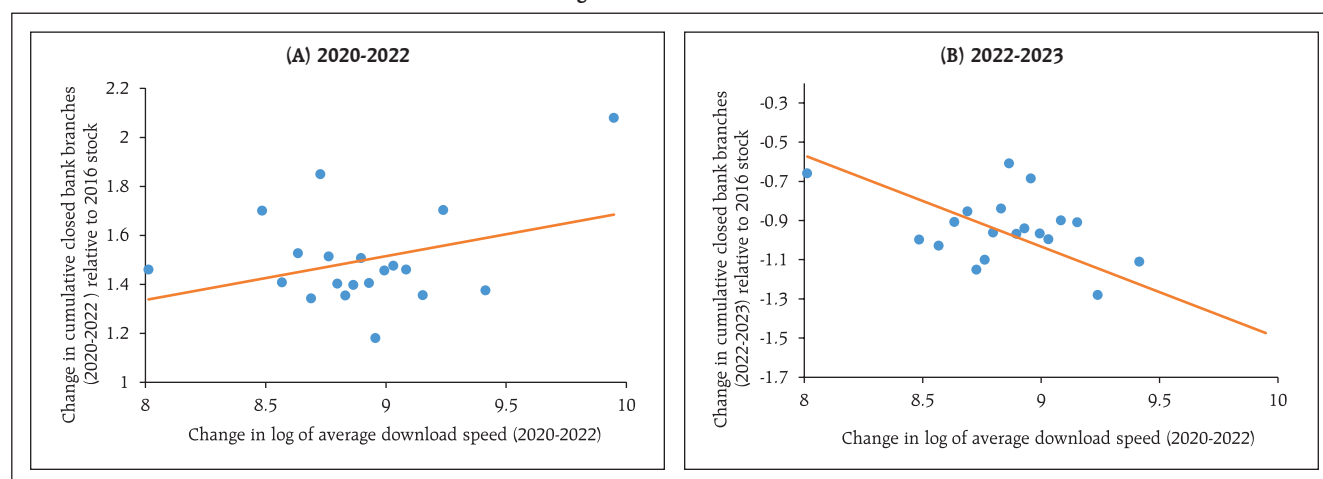


Source: BSR and CAFRAL Calculations.

branches closed, both for rural and urban bank branches. Three, the fall in bank branches, both opened and closed, was approximately three times higher on average, for urban branches relative to rural branches (Chart 3.25). Indeed, net bank branches declined in areas with a large digital footprint, with stronger effects in urban areas.

III.51 The results are similar using internet speed as a measure of digitalisation. From 2020-2022, districts with higher increase in average download speed saw larger closures in physical bank branches in the same period, relative to the number of branches in 2016 (Chart 3.26A). These districts have higher levels of income and consumption (as proxied by nightlight intensity). However, post 2022, the trends reversed as districts with improved digitalisation between 2020-2022, saw lower bank office closures between 2022 and 2023 (Chart 3.26B). This period coincided

Chart 3.26: Digitisation and Bank Branch Closure



Note: Each observation represents a bin of 30 districts.

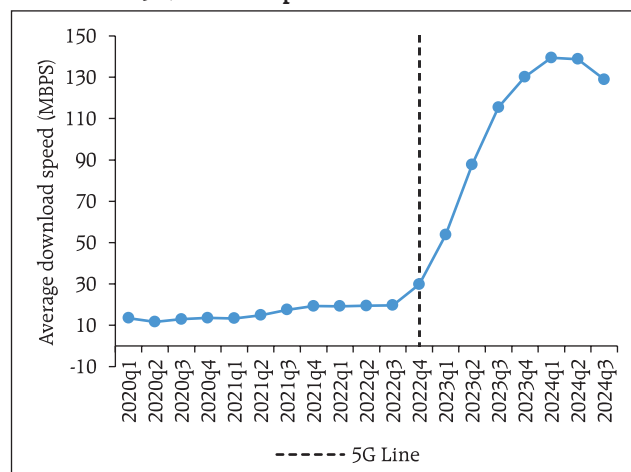
Source: RBI, Ookla Open Data, and CAFRAL Calculations.

with a significant growth spurt in internet speed with the nationwide launch of 5G technology in October 2022 (Chart 3.27).

III.52 The rise in digital banking, followed by the increase in bank branch closure (July 2020 - December 2022) and the subsequent reversal in trend over the last three years marks a period of significant churn in Indian banking. The COVID-19 pandemic forced banking operations to go fully online, while innovations like e-KYC smoothened crucial customer needs like bank account opening. This allowed for some level

of physical branch operations to be substituted digitally. However, survey data reveals that across the world, customers still prefer branches for important tasks (Abbott and Oon, 2023). Banks in India, especially private banks, oversaw a major expansion of physical branches post-COVID, to mobilise deposits and provide credit (Kulkarni *et al.*, 2023). Bank branches also help impart financial education by spreading awareness about group-specific schemes, possibly cross-selling relevant financial products like mutual funds and insurance. Hence, by combining the power of the digital revolution while continuing to expand their physical presence, Indian banks are entering a "phygital" era, demonstrating that distance does still matter.

Chart 3.27: Internet Speed and Bank Branch Closures



Source: Ookla Open Data and CAFRAL Calculations.

3.6 Regulatory Environment

III.53 As India accelerates the process of digitalisation, the question of regulation becomes one of paramount importance. With more and more data being digitalised and large sections of the economy moving from physical to digital spaces, multiple legal challenges emerge. In this context, a robust regulatory framework is needed to maintain a fine balance between protecting user privacy/enhancing data security, as well as fostering innovation and growth.

III.54 A key legislation defining the regulation of the digital space is the Digital Personal Data Protection Bill, 2023 (DPDP). The law defines the rights and duties of the person whose data is being processed (data principal) and the obligations of entities determining the processing (data fiduciaries). Data principals now have the right to seek data without processing, ask for the erasure of data, nominate other right holders in events of death as well as seek grievance redressal. Fiduciaries are obligated to maintain data accuracy, ensure security, and notify the affected individual in the event of a breach. Most importantly, all data obtained for processing is done so only after obtaining clear and voluntary consent of the data principal (Surya, 2023).

III.55 The law also mandates the creation of the Data Protection Board of India to monitor compliance, redress grievances and impose penalties where needed.

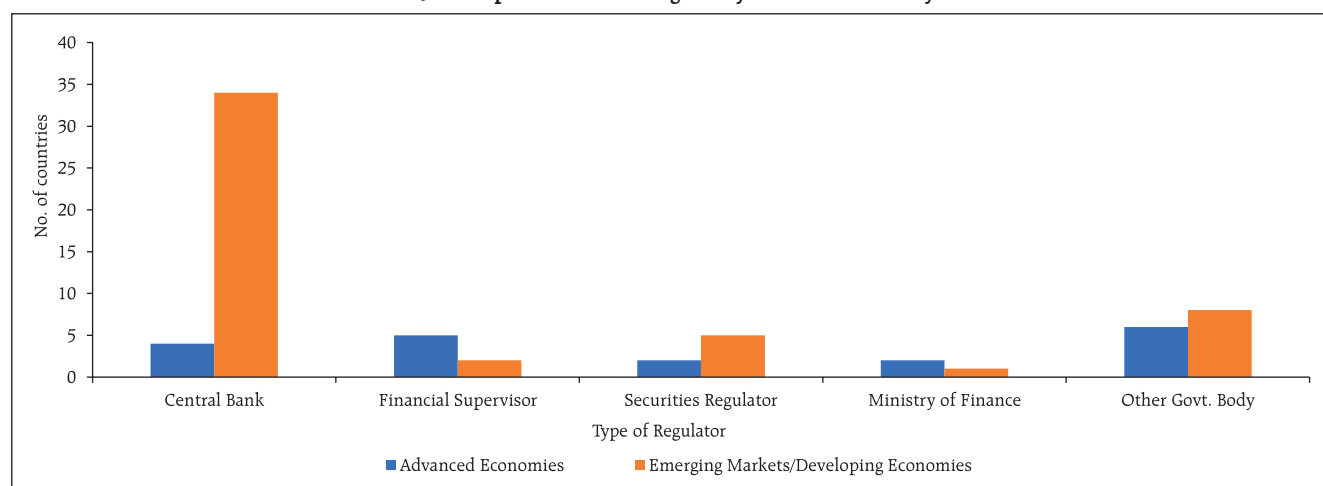
III.56 While safeguarding privacy, the DPDP has taken several steps to foster innovation. First, it removes localisation requirements for data storage, allowing firms to choose cloud storage services anywhere across the globe and minimise costs. Second, it significantly reduces compliance by allowing cross-border transfer of data. Only firms possessing highly sensitive user data are now required to conduct impact assessments, further reducing unwieldy paperwork.

III.57 A pioneering effort by the RBI is the creation of a regulatory sandbox for FinTechs. A regulatory sandbox is a closed, controlled environment, which allows for live testing of experiments and innovations. The regulator controls the environment, while FinTechs and other firms experiment with products, services and designs in a live and time bound manner. This environment helps spur innovation and helps firms identify potential benefits and costs of their products before launching into the marketplace. Sandboxes can also help build internal discipline and establish consumer protection safeguards. These kinds of setups are being tried across the world, more prominently in emerging market economies, with the respective country's central bank serving as the key supervisor in most cases (Chart 3.28).

III.58 While providing an innovative and secure environment for firms to beta tests their products, sandboxes are subject to some concerns, viz., (i) implementing such environments is costly and resource intensive, requiring upto ₹8.5 crore in some countries, as well as a dedicated workforce; (Shashidhar KJ, 2020). (ii) the incentives of the regulator and the FinTech may not align. Given these concerns, the iteration being implemented in India must be carefully designed, taking into consideration the expectations of industry, while staying true to its own mandate.

III.59 In addition to the sandbox, the RBI, in January 2024, proposed a framework for Self-Regulatory Organisations (SROs) in the FinTech sector. An SRO is an entity created with an objective of regulating the business standards and practices of its members and representatives. As per the proposal, an SRO can be one of the FinTechs themselves, fostering a culture of self-governance whilst empowering themselves to innovate and set a standard of conduct in a largely unregulated environment.

Chart 3.28: Implementation of Regulatory Sandboxes: Country-wise



Note: Data covers the period 2016-2020.

Source: World Bank.

III.60 The draft envisions SROs as serving a variety of functions, including but not limited to, establishing and enforcing standards for the FinTech sector, deploying oversight mechanisms, fostering a culture of research and development within the FinTech sector by encouraging compliance, data sharing, and support, as well as dispute resolution. In addition, it spells out responsibilities towards the central bank, including (a) acting beyond self-interest to serve as a voice for its members (b) updating the RBI of developments and protocol violations, (c) aid sectoral development by creating scalable technology solutions to keep the bank abreast of all new products (d) submitting annual reports to the Bank.

III.61 In order to harmonised the regulatory framework for NBFCs and HFCs, the RBI has introduced several changes in the regulatory framework (Reserve Bank of India, 2024) to be applicable from 1st January 2025. First, the minimum number of liquid assets to be held by deposit-taking HFCs has gone up from 13 per cent to 15 per cent. Second, in order to harmonise regulations for safe custody of liquid assets, the bank has mandated that regulations applying to NBFCs will now also apply to HFCs. Third, multiple changes have been introduced on the rating, amount and period of deposits held by HFCs – for instance, the limit to accept or renew payable deposits has been reduced from 120 months to 60 months.

III.62 Additionally, the guidelines for deposit-holding NBFCs have also been revised. NBFCs now need to intimate deposit holders with the details of maturity 14 days prior instead of two months prior. Depositors are now allowed to access "tiny deposits" (amount not exceeding ₹10,000), as well as 50 per cent of the principal deposit amount (or ₹5 lakhs, whichever lower), three months prior to expiry on request without interest penalty. Finally, the RBI has published several guidelines as to other administrative issues like holding regular audits, revamping the system of nomination and maintaining a register of deposits.

III.63 Rapid digitalisation has simplified not only the process of bank account creation, but also facilitated instant, real-time banks withdrawals and transfers. While this is undoubtedly a new benefit to the consumer and the economy, it concurrently amplifies risks in the banking sector, specifically that of deposit flight. Taking a forward looking view of this, the RBI has modified its liquidity coverage ratio (LCR) requirements to reflect this risk – deposits with internet and mobile banking enabled now carry a risk weight of 15 per cent relative to purely physical deposits with a risk weight of 10 per cent. This enables the entire banking system to re-evaluate the risks posed by digital banking and ensure appropriate liquidity management in the future.

III.64 The financial sector in India is seeing the entry of new players and business models such as digital lending and peer-to-peer (P2P) lending which has expanded people's access to institutional finance. However, it is essential to protect consumers from unsuitable practices and ensure competition, fairness and transparency in the financial markets. The regulatory structure is guided by the goal of ensuring the sustainability of household debt through four broad strategies: (1) customer awareness and literacy; (2) protection of customers including from frauds and usurious interest rates; (3) establishing fair practices, transparency and accountability; and (4)

grievance redressal. This approach helps ensure that people trust formal financial institutions which is important because a lack of trust is often cited as one of the reasons for inadequate use of formal financial products (Cole *et al.*, 2013).

III.65 Besides default risk from lending to lower quality borrowers, lending in the digital space may carry other risks, including cyber security risks where consumer data can be misused or used without authorisation. There is regulatory fuzziness in the digital lending space, as FinTech companies differ from purely financial companies or banks that are regulated with clear guidelines. Further, there are issues related to transparency in loans offered by FinTech platforms. The RBI has been issuing various guidelines to address these issues.² Guidance has also been issued regarding Lender Service Providers (LSPs) in provision of loan products. It has been observed that LSPs often aggregate information from multiple lenders. FinTechs have been advised to clearly display the names of lenders, the loan amount and rates, and other key conditions digitally to ensure transparency.

Conclusion

III.66 The digitalisation of the Indian economy has transformed the lives of Indian households, and has generated many positive spillovers. With the strong foundation of a large scale digital public infrastructure, the India Stack and open banking have brought millions of unserved and underserved Indians into the ambit of credit. Innovations like AA have enabled incumbent institutions like banks to screen borrowers, and improve both the quality and quantity of credit access. Concurrently, the rapid expansion of banking infrastructure combined with digitalisation with broadening the access and speed of internet and expansion of FinTechs has enabled households to participate in new forms of wealth creation via the stock market. The ambit of banking has now penetrated the digital space, while physical branches continue to onboard new customers, ushering an era of "phygital" banking.

III.67 The shift to a digital economy also brings with it new risks for households. The emergence of new institutions has necessitated forms of regulations that promote experimentation and growth, while maintaining financial stability. The growth of the digital economy and the exponential growth of sharable personal data means that issues of privacy, consent and data governance now occupy center stage in the policy discourse. As India enters the next era of growth, effective and efficient regulation, along with increased consumer education and awareness about the opportunities and risks of the digital world are key for a smooth and seamless transition.

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APPENDIX A: TABLE FOR BOX 3.1

Using pin code level credit data over the period 2015 Q3 – 2019 Q1, we estimate the following difference-in-difference specification:

$$y_{p(d)t} = \alpha_p + \gamma_{dt} + \beta * High\ UPI\ Exposure_p * Post_t + \varepsilon_{p(d)t}$$

where $y_{p(d)t}$ refers to either: (1) Loan Amount (in ₹ lakhs), (2) No. of loans, in pin code p , belonging to district d , in quarter t . α_p and γ_{dt} refer to pin code and district x time fixed effects respectively, and control for pin code and district-time unobservables. $Post_t$ is a dummy variable taking value 1 from 2016 Q3 onwards, and zero otherwise. $High\ UPI\ Exposure_p$ is a dummy taking value 1, for pin-codes with above-median share of early UPI adopters. $\varepsilon_{p(d)t}$ is the zero-mean error term. The coefficient of interest is β , which captures the effect of high UPI exposure districts in the post-period on the dependent variable, relative to low exposure UPI districts. The standard errors are robust to heteroscedasticity, and clustered at the pin code level to account for serial correlation. All tables display the pre-period (2016 Q3), post-period, and overall mean for the dependent variable. Each set of regressions is run separately for four sets of CIBIL credit score bands, namely, subprime loans, NTC loans, prime loans and all loans.

Scoreband	All		Subprime		New-to-credit		Prime	
Dependent Variable	Amount (₹ Lakhs)	Account	Amount (₹ Lakhs)	Account	Amount (₹ Lakhs)	Account	Amount (₹ Lakhs)	Account
High Exp x Post	41.59*** (10.72)	29.558*** (9.672)	1.35*** (0.49)	1.167** (0.556)	-0.45 (0.51)	2.252** (1.083)	33.56*** (8.50)	20.943*** (6.217)
Observations	1,86,900	1,86,900	1,86,900	1,86,900	1,86,900	1,86,900	1,86,900	1,86,900
R-squared	0.938	0.885	0.902	0.835	0.964	0.942	0.915	0.876
Pin code FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District-time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pre-AA Mean	28.323	182.802	1.652	10.971	7.651	60.515	15.101	86.761
Post-AA Mean	46.468	329.071	2.644	19.201	7.637	73.681	28.993	183.065
Dep. variable mean	41.630	290.066	2.379	17.007	7.641	70.170	25.288	157.384

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

APPENDIX B: TABLE FOR CHART 3.12

Using pin code level credit data over the period 2015 Q3 – 2019 Q1, we estimate the following triple-differences specification:

$$y_{p(d)t} = \alpha_p + \gamma_{dt} + \beta_1 * High\ UPI\ Exposure_p * Early\ Jio_p * Post_t + \beta_2 * High\ UPI\ Exposure_p * Post_t + \beta_3 * Early\ Jio_p * Post_t + \varepsilon_{p(d)t}$$

where $y_{p(d)t}$ refers to either: (1) Loan Amount (in ₹ lakhs), (2) No. of loans, in pin code p , belonging to district d , in quarter t . $Early\ Jio_p$ is a dummy taking value 1 if pin code p has an active Reliance Jio 4G tower as of 2017 Q1. $High\ UPI\ Exposure_p$ is a dummy taking value 1 for pin-codes with above-median share of early UPI adopters. $Post_t$ is a dummy variable taking value 1 from 2016 Q3 onwards, and zero otherwise. $\varepsilon_{p(d)t}$ is the zero-mean error term. The coefficient of interest is β_1 , which captures the effect of pin codes with high UPI exposure and early 4G access, in the post-period, on the dependent variable, relative to pin codes with low 4G access. Standard errors are heteroscedasticity robust, and clustered at pin code level to account for serial correlation. All tables display the pre-period (2016 Q3), post-period, and overall mean for the dependent variable. Each set of regressions is run for sub-sample consisting of (1) all loans and (2) loans scored as new-to-credit. Panel A shows the results for loans made by SCBs, while Panel B shows the results for loans made by FinTechs.

Panel A: Banks

Scoreband	All		NTC	
Dependent Variable	Amount (₹ Lakhs)	Account	Amount (₹ Lakhs)	Account
Early Jio x High Exp x Post	52.82*** (14.54)	39.324*** (10.471)	1.26 (0.90)	2.711*** (0.908)
High Exp x Post	6.28 (5.75)	-1.265 (3.882)	-1.44*** (0.51)	-1.044** (0.420)
Early Jio x Post	70.90*** (7.88)	47.049*** (5.811)	-3.44*** (0.68)	-0.062 (0.523)
Observations	1,86,900	1,86,900	1,86,900	1,86,900
Pin code FE	Yes	Yes	Yes	Yes
District-time FE	Yes	Yes	Yes	Yes
Pre-UPI Mean	28.320	182.502	7.662	60.459
Post-UPI Mean	45.862	296.040	7.527	64.922
Dep. variable mean	41.188	265.497	7.576	63.705

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Panel B: FinTechs

Scoreband	All		NTC	
Dependent Variable	Amount (₹ Lakhs)	Account	Amount (₹ Lakhs)	Account
Early Jio x High Exp x Post	2.45*** (0.78)	7.774* (4.160)	0.39*** (0.12)	1.972** (0.993)
High Exp x Post	0.08 (0.25)	0.772 (1.280)	0.03 (0.04)	0.348 (0.328)
Early Jio x Post	2.26*** (0.39)	16.709*** (2.227)	0.41*** (0.06)	4.156*** (0.542)
Observations	1,86,855	1,86,855	1,86,855	1,86,855
R-squared	0.525	0.453	0.570	0.488
Pin code FE	Yes	Yes	Yes	Yes
District-time FE	Yes	Yes	Yes	Yes
Pre-UPI Mean	0.004	0.076	0.001	0.016
Post-UPI Mean	0.606	33.039	0.110	8.761
Dep. variable mean	0.444	24.187	0.080	6.414

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

APPENDIX C: TABLE FOR BOX 3.2

Using pin code level credit data over the period 2015 Q3 – 2019 Q1, we Estimate the following triple-differences specification:

$$y_{p(d)t} = \alpha_p + \gamma_{dt} + \beta_1 * High\ UPI\ Exposure_p * High\ JDY_p \\ * Post_t + \beta_2 * High\ UPI\ Exposure_p * Post_t + \beta_3 * High\ JDY_p * Post_t + \varepsilon_{p(d)t}$$

where $y_{p(d)t}$ refers to either: (1) Loan Amount (in ₹ lakhs), (2) No. of loans, in pin code p , belonging to district d , in quarter t . $High\ JDY_p$ is a dummy taking value 1 if the cumulative number of bank accounts under PMJDY in pin code p , as of 2016 Q3, are above the first tercile. $High\ UPI\ Exposure_p$ is a dummy taking value 1 for pincodes with above-median share of early UPI adopters. $Post_t$ is a dummy variable taking value 1 from 2016 Q3 onwards, and zero otherwise. $\varepsilon_{p(d)t}$ is the zero-mean error term. The coefficient of interest is β_1 , which captures the effect of pin codes with high UPI exposure and high PMJDY accounts, relative to those with low PMJDY accounts, in the post-period, on the dependent variable, relative to pin codes with low PMJDY accounts. Standard errors are heteroscedasticity robust, and clustered at pin code level to account for serial correlation. All tables display the pre-period (2016 Q3), post-period, and overall mean for the dependent variable. Each set of regressions is run for sub-sample consisting of (1) all loans (2) FinTech loans and (3) FinTech loans scored as NTC.

Scoreband	All		FinTech		FinTech + NTC	
Dependent Variable	Amount (₹ Lakhs)	Account	Amount (₹ Lakhs)	Account	Amount (₹ Lakhs)	Account
High Exp x High JDY x Post	49.43*** (15.10)	42.503*** (13.664)	1.69** (0.78)	6.733* (4.055)	0.36*** (0.12)	2.180** (0.981)
High Exp x Post	9.56 (7.23)	2.130 (6.441)	0.53 (0.41)	1.365 (1.673)	0.05 (0.06)	0.214 (0.434)
High JDY x Post	142.66*** (9.80)	114.887*** (9.275)	4.69*** (0.51)	27.550*** (2.874)	0.77*** (0.07)	6.768*** (0.682)
Observations	1,86,900	1,86,900	1,86,855	1,86,855	1,86,855	1,86,855
R-squared	0.938	0.886	0.526	0.453	0.570	0.489
Pin code FE	Yes	Yes	Yes	Yes	Yes	Yes
District-time FE	Yes	Yes	Yes	Yes	Yes	Yes
Pre-UPI Mean	28.323	182.802	0.004	0.076	0.001	0.016
Post-UPI Mean	46.468	329.071	0.606	33.039	0.110	8.761
Dep. variable mean	41.630	290.066	0.446	24.249	0.081	6.429

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

APPENDIX D: TABLES FOR BOX 3.3

Using pin code level credit data over the period 2019 Q1 – 2024 Q2, we estimate the following difference-in-differences specification:

$$y_{p(d)t} = \alpha_p + \gamma_{dt} + \beta * High AA_p * Post_t + \varepsilon_{p(d)t}$$

where $y_{p(d)t}$ refers to either: (1) Loan Amount (in ₹ crores), (2) No. of loans, in pin code p , belonging to district d , in quarter t . α_p and γ_{dt} refer to pin code and district x time fixed effects respectively, and control for pin code and district-time unobservables. $Post_t$ is a dummy variable taking value 1 from 2021 Q2 onwards, and zero otherwise. $High AA_p$ is a dummy taking value 1, if for pin code p , AA Exposure, defined as the deposits belonging to banks that onboarded to AA as Financial Information Providers (FIP) "early" (in the year 2016), as a share of total deposits for the year 2016, for that pin code, is above the median. $\varepsilon_{p(d)t}$ is the zero-mean error term. The coefficient of interest is β , which captures the effect of high UPI exposure pincodes in the post-period on the dependent variable, relative to low exposure UPI districts. The standard errors are robust to heteroscedasticity, and clustered at the pin code level to account for serial correlation. All tables display the dependent variable's pre-period (2021 Q2), post-period, and overall mean. Each set of regressions is run separately for four sets of CIBIL credit score bands, namely, subprime loans, NTC loans, prime loans and all loans. Panels A, B and C show the results for subsamples of consumer, mortgage and business loans respectively.

Panel A: Consumer Loans

Scoreband	All		Subprime		New-to-credit		Prime	
Dependent Variable	Amount (₹ Crores)	Account	Amount (₹ Crores)	Account	Amount (₹ Crores)	Account	Amount (₹ Crores)	Account
High AA x Post	2.647*** (0.305)	356.791*** (45.417)	-0.014* (0.008)	1.353 (1.920)	0.045*** (0.007)	26.730*** (3.914)	2.243*** (0.257)	234.057*** (28.561)
Observations	3,63,779	3,63,779	3,63,779	3,63,779	3,63,779	3,63,779	3,63,779	3,63,779
R-squared	0.925	0.914	0.782	0.903	0.859	0.871	0.913	0.908
Pin code FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District-time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pre-UPI Mean	8.312	1201.706	0.724	151.867	0.363	75.839	5.710	662.669
Post-UPI Mean	16.771	2846.057	0.830	225.560	0.585	202.852	12.284	1654.749
Dep. variable mean	12.926	2098.657	0.782	192.064	0.484	145.121	9.296	1203.823

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Panel B: Mortgage loans

Scoreband	All		Subprime		New-to-credit		Prime	
Dependent Variable	Amount (₹ Crores)	Account	Amount (₹ Crores)	Account	Amount (₹ Crores)	Account	Amount (₹ Crores)	Account
High AA x Post	3.766*** (0.403)	6.158*** (0.668)	0.062*** (0.013)	-0.062 (0.051)	0.045*** (0.009)	-0.014 (0.016)	3.307*** (0.355)	5.663*** (0.590)
Observations	3,37,809	3,37,809	3,37,809	3,37,809	3,37,809	3,37,809	3,37,809	3,37,809
R-squared	0.912	0.944	0.833	0.825	0.736	0.841	0.902	0.941
Pin code FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District-time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pre-UPI Mean	8.615	36.151	0.631	3.209	0.366	1.596	6.441	26.043
Post-UPI Mean	13.892	47.567	0.733	3.146	0.434	1.595	10.983	36.160
Dep. variable mean	11.559	42.521	0.688	3.174	0.404	1.596	8.976	31.688

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Panel C: Business loans

Scoreband	All		Subprime		New-to-credit		Prime	
Dependent Variable	Amount (₹ Crores)	Account	Amount (₹ Crores)	Account	Amount (₹ Crores)	Account	Amount (₹ Crores)	Account
High AA x Post	1.170*** (0.114)	3.334** (1.528)	-0.014 (0.009)	-0.058 (0.098)	0.026** (0.012)	-1.588*** (0.205)	0.924*** (0.090)	4.858*** (0.990)
Observations	3,50,381	3,50,381	3,50,381	3,50,381	3,50,381	3,50,381	3,50,381	3,50,381
R-squared	0.710	0.702	0.240	0.625	0.231	0.432	0.658	0.712
Pin code FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
District-time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Pre-UPI Mean	2.052	36.333	0.140	3.492	0.155	6.626	1.275	14.108
Post-UPI Mean	4.213	74.938	0.176	5.762	0.246	6.354	2.822	39.696
Dep. variable mean	3.250	57.730	0.160	4.750	0.206	6.475	2.133	28.290

Standard errors in parentheses, * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.