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THE ROLE OF FINTECH IN FINANCIAL INCLUSION: ASSESSING JAN DHAN-AADHAAR-MOBILE IMPACT ON RURAL CREDIT ACCESS

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Abstract- **India's Jan Dhan–Aadhaar–Mobile (JAM) stack has largely solved the problem of access to a bank account, but it has only partly solved the problem of access to credit. This paper assembles official and survey data from 2011 to 2026 to measure how far the JAM trinity and its payment layer, the Unified Payments Interface (UPI), have moved rural households from account ownership to formal borrowing. The evidence shows three things. First, account access is near-universal: PMJDY reached 59.09 crore accounts by August 2026, with 77.8% in rural and semi-urban areas, and Global Findex account ownership rose from 35% (2011) to 89% (2024). Second, rural credit has formalised: the share of agricultural households borrowing only from institutional sources rose from 60.5% to 75.5% between NAFIS 2016-17 and 2021-22, and NABARD's 2026 survey puts the non-institutional share of rural credit at 16%. Third, a large account-to-credit gap remains: only 10–18% of Indian adults borrowed formally in 2024, the PMJDY overdraft reached just 1.18 lakh accounts by March 2024, and only 23% of rural households knew what a credit score was in 2026. We argue that payments-generated data, not accounts, is the binding link to credit. Quasi-experimental evidence that UPI adoption raised lending to subprime and new-to-credit borrowers without raising defaults supports this view. The paper closes with a research agenda centred on the Unified Lending Interface (ULI), consent-based data sharing and household-level panel evaluation.**

Keywords- **Financial inclusion, Fintech, JAM trinity, PMJDY, Aadhaar, UPI, rural credit, digital public infrastructure, India**

I. INTRODUCTION

India has built the world's largest experiment in digitally led financial inclusion, and the open question is whether it has translated into rural credit. In 2013 the country had roughly 450 million unbanked adults [1]. The government's response was a layered stack of digital public infrastructure: Pradhan Mantri Jan Dhan Yojana (PMJDY) accounts from August 2014, Aadhaar biometric identity and e-KYC, near-universal mobile telephony, and from 2016 the Unified Payments Interface (UPI). Together these are known as the JAM trinity.

The JAM model was designed first to deliver payments: direct benefit transfers (DBT), subsidies and pensions without leakage. Credit was always the harder promise. A savings account can be opened in minutes, but a loan needs a lender to judge a borrower's ability and willingness to repay. Rural households have historically lacked the documented incomes, collateral and credit histories that formal lenders rely on. They have therefore depended on moneylenders, traders and relatives.

This paper asks whether, and through which channel, the JAM stack has narrowed that gap. It addresses four research questions:

RQ1. How far has JAM expanded account access and active usage among rural and low-income households?

RQ2. Has formal (institutional) credit displaced informal credit in rural India over the same period?

RQ3. How large is the remaining gap between account ownership and formal borrowing, and what explains it?

RQ4. Which fintech mechanism (identity, accounts, payments data or lending rails) most plausibly links inclusion to credit?

The contribution is a consolidated, up-to-date evidence base running to 2026, which most published studies predate. It brings together administrative data (PMJDY, UPI, Aadhaar), the RBI Financial Inclusion Index, household surveys (NAFIS 2016-17 and 2021-22, NABARD 2026, Global Findex 2025) and the quasi-experimental literature. From these we build a simple inclusion-to-credit funnel that locates where rural households drop out.

The rest of the paper is organised as follows. Section II surveys the literature. Section III states the problem and hypotheses. Section IV describes data and method. Section V presents results. Section VI draws policy implications, and Section VII concludes with limitations and a programme of future work.

II. LITERATURE SURVEY

The literature agrees that digital infrastructure expands account access and payments quickly. It is far less settled on whether accounts alone expand credit. The strongest recent evidence points to payments data as the missing link.

A. Financial inclusion, finance and growth -

The finance–growth literature [8], [9] established that deeper financial systems support growth, mainly through better allocation of credit. For India specifically, Burgess and Pande [5] showed that the 1977–1990 social banking rule, requiring banks to open branches in unbanked rural locations, reduced rural poverty, largely through credit to non-agricultural activity. The lesson for this paper is that physical access raised rural credit when it came with a lending mandate. JAM is the digital successor to that branch expansion, but without an equivalent credit mandate.

B. Accounts without usage -

A consistent finding is that opening accounts does not guarantee their use. Dupas et al. [6] offered free accounts in Uganda, Malawi and Chile and found that most recipients rarely used them. For PMJDY, Agarwal et al. [1] studied account-level administrative data and found that about 77% of new accounts maintained a positive balance and usage slowly converged to that of previously banked households. Crucially for this paper, they also found that regions more exposed to the programme saw more lending and more defaults on new loans, consistent with banks meeting new credit demand from lower-quality borrowers.

C. Identity infrastructure: Aadhaar -

Biometric identity lowers the cost of know-your-customer (KYC) checks and of delivering transfers. Muralidharan, Niehaus and Sukhtankar [10] found in a large randomised rollout in Andhra Pradesh that biometric smartcards made welfare payments faster, more predictable and less corrupt. Aadhaar e-KYC brought the cost of opening an account close to zero and made remote onboarding possible. However, identity verifies who a borrower is; it does not reveal whether they can repay. On its own, it is a necessary but not sufficient input to credit.

D. Mobile money and payments -

Outside India, mobile money has been shown to change household outcomes. Jack and Suri [7] found that M-Pesa users in Kenya smoothed consumption better aftershocks, and Suri and Jack [12] estimated that access to M-Pesa lifted around 2% of Kenyan households out of poverty. In India, the payment layer is UPI, a bank-account-linked, interoperable real-time system rather than a telecom wallet. This design means every UPI transaction leaves a verifiable record inside the regulated banking system.

E. Fintech lending and alternative data -

A growing literature shows that digital footprints can predict default. Berg et al. [3] showed that simple digital footprint variables predict default as well as credit bureau scores in Germany. Buchak et al. [4] documented how fintech lenders exploit technology and regulatory differences to expand in the US mortgage market.

The most directly relevant Indian evidence is Alok, Ghosh, Kulkarni and Puri on UPI [2], [11]. Using pincode-level variation in exposure to banks that adopted UPI early, in a difference-in-differences design, they find that credit rose to subprime and new-to-credit customers, and the new-to-credit expansion was led by fintech lenders, especially in previously excluded regions. They report that a 10% increase in UPI transactions was associated with a 7% rise in credit availability and that the credit expansion did not raise default rates. They also find that digital payments complement first-time bank accounts in enabling formal credit.

F. Rural credit in India -

Rural credit research has long documented dependence on informal lenders and the poor fit of formal products to seasonal, irregular incomes. NABARD's two All India Rural Financial Inclusion Surveys (NAFIS 2016-17 and 2021-22) provide the main household-level benchmarks for the JAM period [21]. Earlier All-India Debt and Investment Surveys (NSS) track the long decline of the moneylender's share since 1951.

G. Research gap -

Three gaps motivate this paper. First, most quasi-experimental studies end in 2019–2020, before UPI's largest growth and before ULI. Second, studies of PMJDY measure usage of accounts, while studies of UPI measure credit; few place both on one funnel. Third, rural evidence is usually reported separately from fintech evidence. This paper links the three strands with data through 2026.

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III. PROBLEM IDENTIFICATION AND HYPOTHESES

The core problem is an account-to-credit gap: India has given almost every adult a bank account, but only a small minority borrow from formal lenders. In 2024, 89% of surveyed Indian adults had an account, yet formal borrowing was reported by only 10% of the poorest and 18% of richer adults [23].

Account access has therefore stopped being the binding constraint on rural credit.

Three frictions plausibly sustain the gap:

1) **Information friction.** Lenders cannot observe the income and repayment capacity of households with no credit history. An account that only receives occasional DBT credits says little about the holder.

2) **Product friction.** Formal products such as the Kisan Credit Card (KCC) and the PMJDY overdraft are small, documentation-heavy or tied to landholding, while average landholdings are shrinking.

3) **Capability and demand friction.** Low financial and digital literacy, distrust and debt aversion reduce demand for formal credit even where it is available.

From this we derive four testable hypotheses:

H1: (access) The JAM stack produced a large and sustained rise in rural account ownership.

H2: (formalisation) Over the JAM period, the share of rural borrowing from institutional sources rose, and the share from non-institutional sources fell.

H3: (gap) Despite H1 and H2, the share of adults borrowing formally remains far below the share holding accounts, and the account-linked credit product (the PMJDY overdraft) has had negligible reach.

H4: (mechanism) The link from inclusion to credit runs mainly through payments-generated data (UPI transaction histories), not through account ownership or identity alone.

IV. DATA AND METHODOLOGY

The study is a secondary-data, mixed-method assessment: descriptive trend analysis of administrative series, comparison of two household survey rounds, and a synthesis of quasi-experimental estimates. It tests whether the pattern in the data is consistent with each hypothesis, and Section V-F specifies a district-level panel design to estimate the causal effect once district data are assembled.

A. Data sources -

Table -1 Data Sources Used

Source	Coverage	Variables used	Hyp.
PMJDY progress reports, MoF / PIB	Mar 2015 – Aug 2026	Accounts, deposits, rural share, RuPay cards, overdrafts	H1, H3
UIDAI dashboards and releases	2022 – 2026	Authentication and e-KYC volumes	H1, H4
NPCI / MoF (UPI)	FY17 – FY26	Annual transaction volume and value, users	H4
RBI FI-Index	Mar 2017, Mar 2021 – Mar 2026	Composite score (Access 35%, Usage 45%, Quality 20%)	H1, H4
World Bank Global Findex	2011, 2014, 2017, 2021, 2024	Account ownership, inactivity, formal borrowing	H1, H3
NABARD NAFIS	2016-17, 2021-22 (>1 lakh households)	Indebtedness, institutional vs non-institutional borrowing	H2
NABARD Rural Credit Market Conditions	Feb 2026 (20,000 households)	Borrowing incidence, informal share, repayment stress, credit-score awareness	H2, H3
Quasi-experimental studies	2014 – 2020 samples	Effect of PMJDY and UPI exposure on lending and default	H3, H4

B. Analytical framework –

We organise the evidence as an **inclusion-to-credit funnel** with four stages: (1) identity (Aadhaar), (2) account (PMJDY), (3) active digital use (UPI transactions), and (4) formal credit. Each hypothesis is tested at one stage. Growth is summarised as a compound annual growth rate:

$$CAGR = (X_T / X_0)^{1/T} - 1 \quad (1)$$

The association between payments activity and inclusion is summarised by the Pearson correlation between the FI-Index and annual UPI volume, in levels and in first differences. With only five annual observations (FY22–FY26), this is descriptive, not causal. We report both forms because two trending series correlate strongly in levels even when unrelated; first differences remove the common trend.

The account-to-credit gap is measured as the difference between account ownership and formal borrowing (Findex), and as the share of PMJDY accounts with a sanctioned overdraft.

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C. Limitations of the design -
Administrative counts measure accounts opened, not individuals, and can include duplicates and dormant accounts. The rural share of PMJDY accounts is reported inconsistently across releases (Section V-A). NAFIS rounds bracket the COVID-19 shock, which raised distress borrowing. These constraints are discussed with each result.

V. RESULTS AND ANALYSIS

The data support H1, H2 and H3 clearly and H4 suggestively: access is near-universal, rural credit has formalised, but formal borrowing still reaches only a fraction of account holders, and the best evidence for closing the gap points to payments data.

A. Account access (H1) -
PMJDY grew from 14.72 crore accounts in March 2015 to 59.09 crore in August 2026, a 4.0-fold rise; deposits grew about 20-fold, from ₹15,670 crore in March 2015 to ₹3,16,514 crore [17]. The average balance rose from about ₹1,065 to ₹5,356 per account, a five-fold nominal increase that suggests the accounts are increasingly used to hold money, not only to receive transfers. By August 2026, 41.29 crore RuPay cards had been issued and 55.7% of holders were women [17].

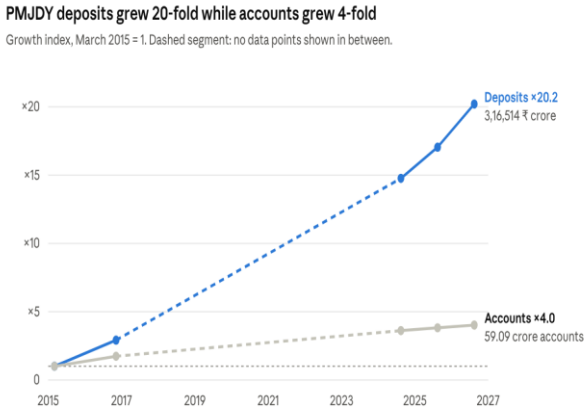


Fig. 1. PMJDY accounts and deposits, growth index (March 2015 = 1). Source: Ministry of Finance PMJDY releases [16]–[18]; Nov 2016 from [1].

The rural share needs care. The August 2026 release puts 77.8% (45.95 crore) of accounts in rural and semi-urban areas [17], whereas the August 2024 release reported 66.6% (35.37 crore) [18]. Since total accounts grew by only about 6 crore between those dates, the jump of over 10 crore rural accounts almost certainly reflects a change in classification rather than new rural accounts. Either figure shows that the programme is predominantly rural.
Survey data confirm the administrative picture. Global Findex account ownership in India rose from 35% in 2011 to 77% in 2021 and 89% in 2025, against a global average of 79% [23]. The RBI FI-Index rose from 43.4 (March 2017) and 53.9 (March 2021) to 70.0 in March 2026, with the latest gain driven mainly by the Usage sub-index [13]–[15]. H1 is supported.

B. Usage and the payments layer (H1, H4) -
Usage has improved but remains the weak point. Findex 2025 found that 16% of Indian account owners had no active account, against 4% for other low- and middle-income economies. That is an improvement on 2021, when 35% of Indian account holders had inactive accounts, including 42% of women [23].
The payments layer has grown far faster than accounts. Annual UPI volume rose from 4,595.61 crore transactions (₹84.16 lakh crore) in FY2021-22 to 24,161.69 crore (₹314.23 lakh crore) in FY2025-26, with 55.49 crore users onboarded by June 2026 [19].

Table -2 UPI Growth and the FI-Index, FY22–FY26

Indicator	FY22	FY23	FY24	FY25	FY26	CAG R
UPI volume (crore txns)	4,595.6	8,371.4	13,113.0	18,586.6	24,161.7	51.4%
UPI value (₹ lakh crore)	84.2	139.2	200.0	260.6	314.2	39.0%
Avg. ticket size (₹)	1,831	1,662	1,525	1,402	1,301	−8.2%
RBI FI-Index (March)	56.4	60.1	64.2	67.0	70.0	5.5%

Volume growing faster than value means the average ticket fell from ₹1,831 to ₹1,301. That is the signature of UPI

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spreading into small, everyday and lower-income payments. Payments below ₹500 make up 86% of person-to-merchant volume [19]. Every such payment adds to a borrower's verifiable cash-flow history.

Aadhaar is the identity rail beneath this. In November 2025 alone, Aadhaar recorded 231 crore authentications and 47.19 crore e-KYC transactions, with e-KYC growing over 24% year on year [20].

Correlation test. Across FY22–FY26, the FI-Index and UPI volume have a Pearson correlation of 0.99 in levels. In first differences the correlation is −0.70 (n = 4). The level correlation therefore reflects two rising trends, not year-to-year co-movement. Payments growth and inclusion rose together, but annual aggregate data cannot show that one drove the other. Causal evidence must come from the regional designs discussed in Section V-D.

C. Formalisation of rural credit (H2) -

Rural credit has shifted decisively towards institutions over the JAM period, as Table 3 shows.

Table -3 Rural Credit: NAFIS 2016-17 vs 2021-22

Indicator	**2016-17**	**2021-22**	**Change**
Households with outstanding debt	47.4%	52.0%	+4.6 pp
Agri-households borrowing from institutional sources only	60.5%	75.5%	+15.0 pp
Non-agri households borrowing from institutional sources only	56.7%	72.7%	+16.0 pp
Agri-households borrowing from non-institutional sources only	30.3%	23.4%	−6.9 pp
Avg. borrowing, institutional sources (₹)	25,576	32,484	+27%
Avg. borrowing, non-institutional sources (₹)	11,335	4,759	−58%
Average landholding (hectares)	1.08	0.74	−31%

Source: NABARD NAFIS [21]. NABARD's February 2026 survey of 20,000 households extends the trend: the non-institutional share of rural credit fell from 93% in 1951 to 16% in 2026, and 46% of rural households had taken a loan, up from 35% in 2019 [22]. H2 is supported.

Source: NABARD NAFIS [21]. NABARD's February 2026 survey of 20,000 households extends the trend: the non-institutional share of rural credit fell from 93% in 1951 to 16% in 2026, and 46% of rural households had taken a loan, up from 35% in 2019 [22]. H2 is supported.

Two caveats temper this. Rising indebtedness between the NAFIS rounds partly reflects COVID-era distress borrowing. And formal credit is not always productive: in the 2026 survey 24% of indebted households reported repayment difficulty and 57% reported no income gain after borrowing [22]. The fall in average landholding also matters, because KCC limits and collateral are tied to land.

D. The account-to-credit gap (H3) and its mechanism (H4) - The gap is large at every measure:

1) **Formal borrowing vs accounts.** About 89% of adults hold an account, but only 10–18% borrowed formally in 2024 [23], a gap of roughly 70 percentage points.

2) **The PMJDY overdraft.** By March 2024, only 1,17,701 overdraft facilities had been sanctioned, worth ₹190 crore, against about 52 crore accounts [18]. That is roughly 0.02% of accounts. The account-linked credit product has effectively not reached scale.

3) **Credit capability.** In 2026, only 23% of rural households were aware of credit scores [22].

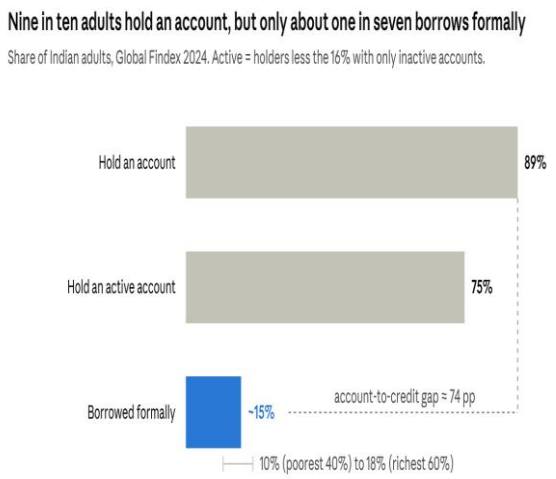


Fig. 2. The inclusion-to-credit funnel: share of Indian adults (Global Findex 2024 [23]); formal borrowing is a population-weighted mean of the poorest 40% and richest 60%.

H3 is supported. The mechanism evidence (H4) comes from the quasi-experimental studies. PMJDY exposure raised lending but also defaults [1], consistent with banks lending to new customers about whom they knew little. UPI

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exposure raised lending to subprime and new-to-credit borrowers without raising defaults [2], consistent with transaction histories giving lenders information they lacked. The contrast between these two results is the central finding of this paper: **accounts created demand for credit; payments data made supply safer.** H4 is supported by the best available causal evidence, though not by our aggregate correlations alone.

E. Discussion -

The JAM stack works as a sequence, and each layer solves a different friction. Aadhaar removed the identity friction. PMJDY removed the access friction. UPI began to remove the information friction by turning rural cash flows into data. What remains is the product friction and the capability friction, which no payment rail can solve on its own. This explains why formalisation (H2) has progressed faster than inclusion in credit (H3): households that already borrowed have switched lenders, but many who never borrowed still do not.

F. Econometric design: district-level panel -

This subsection specifies the district-level regression that tests H3 and H4 causally. The model is fully specified here; the estimates require district data that are not yet compiled for this paper and are therefore not reported.

Unit and period. About 700 districts, annual observations, FY2012-13 to FY2025-26. The pre-period (before August 2014 for PMJDY, before August 2016 for UPI) gives at least two years of pre-trends.

Baseline specification. For district *d* in state *s* and year *t*:

$$Y_{dt} = \alpha_d + \lambda_{st} + \beta \cdot \mathrm{JDY}_{dt} + \gamma \cdot \ln \mathrm{UPI}_{dt} + \delta \cdot (\mathrm{JDY}_{dt} \times \ln \mathrm{UPI}_{dt}) + X'_{dt}\theta + \varepsilon_{dt} \quad (2)$$

Here α is a district fixed effect and λ a state × year fixed effect, so identification comes from differences between districts in the same state and year. JDY is PMJDY accounts per adult; UPI is UPI transactions per adult. The interaction δ tests the paper's central claim that accounts and payments data are *complements* in producing credit: H4 predicts $\delta > 0$, and a γ larger than β.

Causal design. Account and UPI growth are endogenous to local demand, so the main estimates use predetermined exposure, following [1] and [2]:

$$Y_{dt} = \alpha_d + \lambda_{st} + \Sigma_{k \neq -1}\, \beta_k (\mathrm{Exposure}_d \times 1[t = k]) + X'_{dt}\theta + \varepsilon_{dt} \quad (3)$$

1) **PMJDY exposure:** the district's share of unbanked households in Census 2011 (low prior access means high exposure to the programme).

2) **UPI exposure:** the pre-2016 deposit share of banks that adopted UPI early, as in [2].

3) **Instrument check:** the district-level timing of a major operator's 4G rollout (2016), which cut data costs, as an alternative source of variation.

The event-study coefficients β_k show whether credit diverged only after each launch (pre-period $\beta_k \approx 0$). Because exposure is continuous and timing is common, the main design is a continuous-treatment event study; any staggered-adoption extension (for example ULI by state) should use a heterogeneity-robust estimator such as Callaway–Sant'Anna. Standard errors are clustered by district.

Table -4 Variables and Sources for the District Panel

Variable	Definition	Source
Small borrowal accounts per 1,000 adults (outcome)	Loan accounts with limits up to ₹2 lakh	RBI BSR-1 (DBIE), district-wise
Agricultural credit accounts per 1,000 adults (outcome)	Direct agricultural loan accounts, incl. KCC	RBI BSR-1; NABARD state focus papers
Credit per small account (outcome)	Outstanding small-loan credit ÷ accounts	RBI BSR-1
NPA ratio on small loans (credit quality)	Gross NPAs ÷ outstanding, small loans	Bank / SLBC returns
PMJDY accounts per adult	Accounts ÷ adult population	PMJDY reports via SLBCs
UPI transactions per adult	District transaction count ÷ adults	PhonePe Pulse district data (from 2018), proxy
Aadhaar saturation	Aadhaar holders ÷ projected population	UIDAI dashboard
Controls X	Rainfall deviation, night-lights, branches and BC outlets, 4G coverage	IMD; VIIRS; RBI; TRAI

Expected results and tests. H3 is supported if β (accounts) is small relative to the rise in account ownership. H4 is supported if $\gamma > 0$, $\delta > 0$, and the UPI-exposure event study shows credit growth with no rise in NPAs. Robustness

checks: dropping COVID years (FY21–FY22), excluding metro districts, and separate estimates for women-led accounts where SLBC data allow.

Limitation of the proxy. PhonePe Pulse covers one large app, not all of UPI, and begins in 2018; it therefore supports the post-2018 dose–response analysis, while the 2016 launch effect relies on the bank-exposure measure.

VI. POLICY IMPLICATIONS

The next phase of inclusion policy should be judged by credit outcomes, not account counts. Five priorities follow from the results.

1) **Make payments data usable for rural lending.** The Unified Lending Interface (ULI), rebranded and scaled for national rollout in August 2024, connects lenders by consent to land records, Aadhaar, GST and Account Aggregator data. Early results show over 6 lakh loans worth about ₹27,000 crore by December 2024, of which roughly 1.6 lakh loans (₹14,500 crore) went to MSMEs [24]. Agricultural use cases, especially KCC, should be prioritised, because that is where the account-to-credit gap is widest.

2) **Digitise land records state by state.** ULI's value for farm credit depends on clean, linked land data. Full land-record integration went live in Uttar Pradesh, Bihar and Karnataka in February 2026 [24]; the remaining states are the binding constraint.

3) **Redesign the PMJDY overdraft.** At about 0.02% uptake, the overdraft has failed as a credit on-ramp. Linking eligibility to UPI inflow history, rather than to account age and DBT receipts alone, would align it with the mechanism the evidence supports.

4) **Invest in credit capability.** With only 23% of rural households aware of credit scores, literacy programmes should explain credit histories, consent and repayment, not only how to open an account. Women deserve particular attention, given their higher account inactivity.

5) **Protect borrowers as digital lending scales.** Faster credit carries risks of over-indebtedness and fraud, already visible in the 24% repayment-difficulty rate. Consent mechanisms, grievance redress and limits on digital lending apps need to keep pace with ULI.

VII. CONCLUSION AND FUTURE WORK

A. Conclusion

The JAM trinity has achieved what it was built to do: near-universal, predominantly rural access to accounts, identity-based onboarding and cheap digital payments. It has also coincided with a decisive formalisation of rural credit, with institutional sources replacing moneylenders for most borrowers. But access to an account has not become access to credit. Roughly seven in ten adults have an account but do not borrow formally, and the credit product built into the Jan Dhan account has barely been used.

The evidence indicates that the missing link is information and that payments data supply it. Fintech's role in rural credit is therefore not the account or the app, but the verifiable cash-flow history that UPI creates and that consent-based rails like ULI can now carry to lenders. The success of the next decade should be measured by how many first-time rural borrowers obtain affordable, productive credit, not by how many accounts are opened.

B. Limitations -

1) **Aggregate data.** National series cannot isolate causal effects; the FI-Index–UPI correlation is driven by common trends.

2) **Measurement.** PMJDY counts accounts, not people, and its rural classification changed between releases. Findex samples are small at the sub-national level.

3) **Timing.** NAFIS 2021-22 was fielded after COVID-19, which inflated distress borrowing. The best causal studies use samples ending around 2019–2020.

4) **Missing outcomes.** Data on interest rates paid, loan purposes and welfare effects for new borrowers remain scarce.

C. Future course of work -

1) **District-level panel evaluation.** Build a district × year panel (2015–2026) of PMJDY accounts, UPI volumes, Aadhaar e-KYC, KCC and priority-sector lending from RBI's Basic Statistical Returns, and estimate the models in Section V-F.

2) **Evaluating ULI as a natural experiment.** Use the state-by-state timing of land-record integration (for example, UP, Bihar and Karnataka in 2026) to estimate the effect of ULI on KCC approval rates, loan size, turnaround time and default.

3) **Household-level linkage.** Link NAFIS microdata, or a new primary survey, to consented accounts and UPI histories to test whether payment activity predicts first-time formal borrowing at the household level.

4) **Gender and caste heterogeneity.** Test whether payments data narrow or widen the credit gap for women and marginalised groups, given women's higher account inactivity.

5) **Credit quality and over-indebtedness.** Track repayment stress, multiple borrowing and digital lending fraud as credit expands, to ensure that inclusion does not become over-indebtedness.

6) **Alternative-data scoring for agriculture.** Evaluate credit models that combine UPI flows with satellite crop data, weather and land records for tenant farmers and landless households, who are excluded by land-based lending.

7) **Cross-country comparison.** Compare India's JAM–UPI–ULI sequence with Brazil's Pix and Kenya's M-Pesa to identify which design features drive credit outcomes.

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