

Interoperable Payment Infrastructure and Retail Investment

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*Disclaimer: Views are personal. Not necessarily the official viewpoint of CAFRAL or RBI.

Motivation

The Economist Group

A new epoch for retail investors is just beginning

Technology may soon make markets for all kinds of assets as liquid as the stockmarket

Share



Rise of the Retail Investor:
Implications for Policy and Markets

Tuesday, June 29th
11:00 a.m. EST

A Zoom Event

Registration Required
econ.columbia.edu

The confluence of social media and technology has led to a resurgence of retail investor trading activity in financial markets around the world

Deloitte. Who we are ▾ What we do ▾

The rise of newly empowered retail investors

How they're changing customer expectations and investing dynamics

Recent dynamics in retail investing suggest that there is an emerging class of individual retail investors with distinctive motivations and behaviors. Here, we take a closer look at the factors that contributed to the rise of these empowered investors and what they mean for financial institutions.

Motivation

Role of payment systems in investor participation

- Previous work explores the role of infrastructure, technology & product innovation
- But one understudied aspect is the role of payments
 - Traditional payment systems create friction: processing delays, restricted operating hours, fees, and clunky interfaces
 - What if the ease of making a payment could also lower the barriers to investing?
- Solution: Open, real-time payment systems
 - By enabling instant, zero-cost transactions and seamless integration across platforms, they may dramatically increase who can participate in financial markets—and how *quickly* investors can respond.

This Paper

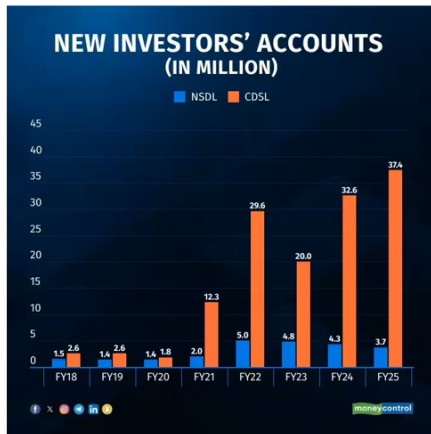
Does open payment infrastructure affect retail trading activity & market participation?
... What are its consequences?

Setting: Rise of India's Retail Investors and UPI

Business India

The rise and rise of retail investors

The number of demat accounts in India has skyrocketed to over 15 crore, marking a fundamental shift in the way Indian investors view the market



- World's 4th largest stock market at \$4.33 trillion with 151 million Investors.
- Rapid digitalization.
- As per a recent SEBI survey (September 2025) challenges faced while investing were (i) risk and uncertainty (91%), (ii) **followed by challenges related to making payment/moving funds** and user-friendliness of the platforms (51%), and (iii) lack of knowledge (47%).
- Role for Unified Payment Interface (UPI), an open, interoperable payment system introduced in November 2016.

How we do it?

1. Main dataset: Universe of all investors trading with demographics from 2004-2021; 20 million retail investor and 3 billion observations.

2. UPI exposure measure:

⇒ Multi-pronged Identification

- Staggered timing of banks joining the UPI platform and geographic variation in these banks' market presence across pincodes.
- Bartik specification.
- Within investor analysis across early adopter banks.
- Within narrow 12-hour windows around market crashes.
- Placebo tests: (i) Retail versus institutional investors, (ii) closed vs. open payment system (SBI's YONO vs. UPI), and (iii) stock trading through wireless technology (STWT) vs. physical trading.
- Complementarities to UPI:
 - Cheap and fast internet: 4G Jio connectivity.
 - Digital platforms.

What we find?

1. UPI increases retail investor participation in the market.

- A 1 S.D $\nearrow$ UPI exposure $\implies$ 10.5% $\nearrow$ active investors; 7.2% $\nearrow$ monthly transactions.
- Democratizes investment access
 - Strong effects (relative to mean) for women, young, rural investors.
 - Aggregate effects stronger for small-ticket investors.
- Complementarity of digital access: Effects stronger for fintech brokerages.

2. Implication for investor outcomes:

- $\nearrow$ risk-taking, $\searrow$ portfolio diversification for small-ticket investors.

3. Implication for stock markets:

- High exposure stocks exhibit $\nearrow$ trading volume, but have $\nearrow$ volatility.

Related Literature

Reduced frictions and financial access:

- Campbell (2006), Beck et al. (2007), Bruhn and Love (2014)
- We examine how digital architectural choices — open versus closed payment systems — shape who participates in capital markets and mechanisms through which interoperability operates

Payment systems and financial infrastructure:

- Duffie (2019); Parlour et al. (2022); Goldstein et al. (2022); He et al. (2023); Copestake et al. (2025); Ouyang (2021); Ghosh et al. (2022); Sarkisyan (2023); Liang et al. (2024); Gonzalez et al. (2024); Hong et al. (2020).
- We examine how payment architecture affects equity market participation with democratizing benefits but behavioral costs of interoperability.

Behavioral finance literature on retail trading:

- Odean (1999); Barber et al. (2022); Huang et al. (2025); Eaton et al. (2022).
- Retail how access without knowledge support may instead exacerbate problematic trading. Retail trader sophistication and stock market quality (?).

Institutional Details

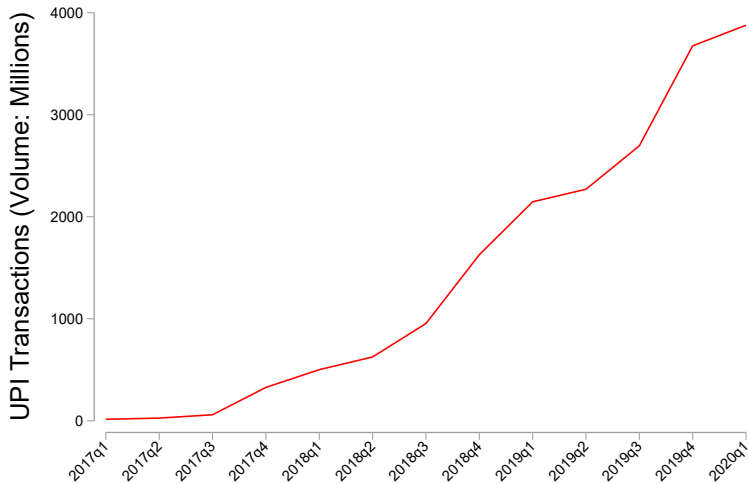
What is the Unified Payments Interface (UPI)?

- A payment system built as an interoperable protocol that allows third-party vendors to build apps to provide payments as a service to all customers of participating banks.
- Launched in November 2016.
- Users need a bank account to use UPI.
- Phenomenal Growth of UPI & DPI:
 - More than 430 million unique UPI account [India's adult population is 952 million].
 - UPI does average 650 million daily transactions as of July 2025, surpassing Visa daily transactions.
 - As per a survey by Artha (2025), more than 50% of all the payments and 75% of all retail digital transactions are on UPI.
 - 1 billion smart phones in India, 738 million smart phone user.
 - As of 2023, the average Indian mobile user consumes 24.1 GB of data per month.

UPI - An open payment infrastructure

- Open Payments connects you to **multiple banks through one single unified API**. Eliminates the complexity and frictions of many diverse integrations.
- Salient Features Include:
 - **Interoperability** → customer to merchant to bank to customer
→ Transfer funds to and from any bank account to any brokerage account and back
 - **Ease of Access** → multiple bank accounts into a single mobile application
 - **Democratized** → The users are not locked within an app, unlike Venmo, Zelle, etc
→ For instance, a Paytm user can receive and transfer funds to a PhonePe/Gpay user.
 - **Digital inclusion** → Transfer money through mobile 24x7, to any accounts: absolutely free
 - **Enables instant, interoperable, zero-cost transfer of funds to and from bank account and brokerage account**

UPI growth

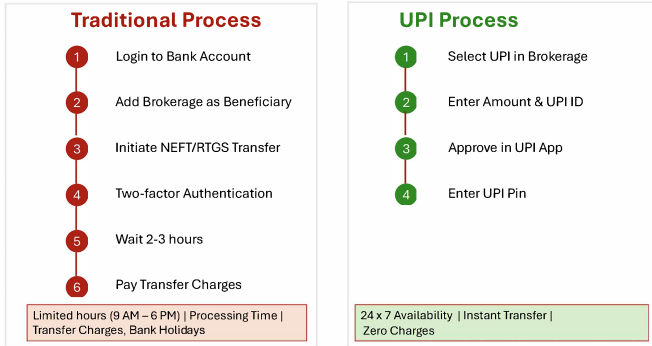


Source: NPCI

How does UPI affect stock participation?

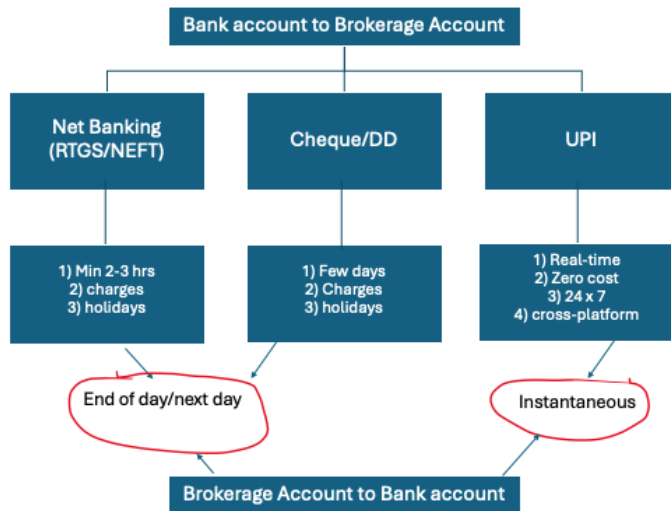
Fixing ideas

Stock Market Fund Transfer: Traditional vs UPI



JPM To Robinhood: Moving funds in and out of JPM account to Robinhood is challenging: Waiting period (few days), Fees & limits.

Comparison with Traditional Systems



Institutional Details: UPI and Stock Market Trading

UPI's Role in Stock Market Participation

- Eliminates funding delays, enabling real-time trading account top-ups.
- Enhances liquidity access for retail investors.
- Bridges retail banking and securities operations.

UPI in IPO Subscriptions

IPO Subscriptions

IPO-1

IPO-2

- Replaces complex mandates with a seamless UPI-based blocking mechanism.
- SEBI's One Time Mandate (OTM) system simplifies IPO applications.
- The UPI interface facilitates seamless fund blocking and ensures a smoother and more efficient IPO application experience for investors

Market Impact

- Democratizes capital market access, boosting retail investor participation.
- Standardized by NPCI, ensuring transparency and security.

Why India?- A Unique Setting- World Leader in DPI

- Globally, policies are still nascent regarding the structure and regulation of Open Payment Systems
- “India has become a leader in developing world-class digital public infrastructure (DPI).”—IMF
- Massive growth in retail investors participation in last decade → nearly fifteen-fold increase in the number of people actively participating in the stock market
- Indian stock market – the rising star of the global market → Economist
- Digitalisation and technology have been critical in driving the retail investment boom → 2023 Budget speech, FM, GOI
- UPI → Free interoperable instant payment systems- → [Bank to brokerage to Bank]- OUR FOCUS

Major Data Collection Exercise:
Proprietary data obtained from four
different sources.

Data-1: National Stock Exchange of India

- Universe of all investor data from 2004 to 2021: retail, institution, FII etc
- Includes daily trade details: date, stock ticker, quantity sold (buy) , price at sold (buy) .
- Investor demographics: age, gender, and pincode
- brokerage information- mapped

Data-2: Tick by tick data

- High-frequency time-stamped transaction level (tick by tick) data: 2019-2023

Data-3: Deposit Data (Reserve Bank of India - Basic Statistical Returns)

- Bank-wise deposit data at the pincode level.

Data-4: Telecom Tower location data

- lat/long for every Telecom tower : 2G/3G/4G; time and provider (airtel/JIO/BSNL etc)

Empirical Strategy

UPI Exposure

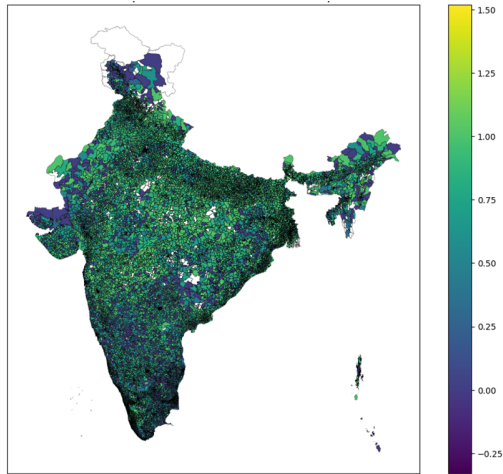
Dubey and Purnanandam (2024); Alok et al., (2024)

$$\text{UPI Exposure}_p = \frac{\text{Total Deposits of Early Adopter Banks}_p}{\text{Total Deposits of All Banks}_p}$$

Exploit two sources of variation:

- Variation in bank-level adoption timing
 - Early adopter banks live on UPI as of November 2016 (Gol website).
- Geographic deposit variation
 - Strong network effects (Higgins, 2022; Crouzet et al., 2023)
 - ⇒ Areas with early adopter banks see higher UPI usage .

Geographic Variation in UPI Exposure



(a) UPI Exposure

Stock Market Measures

Pincode level

Number of Transactions: Total stock trades in a pincode per month.

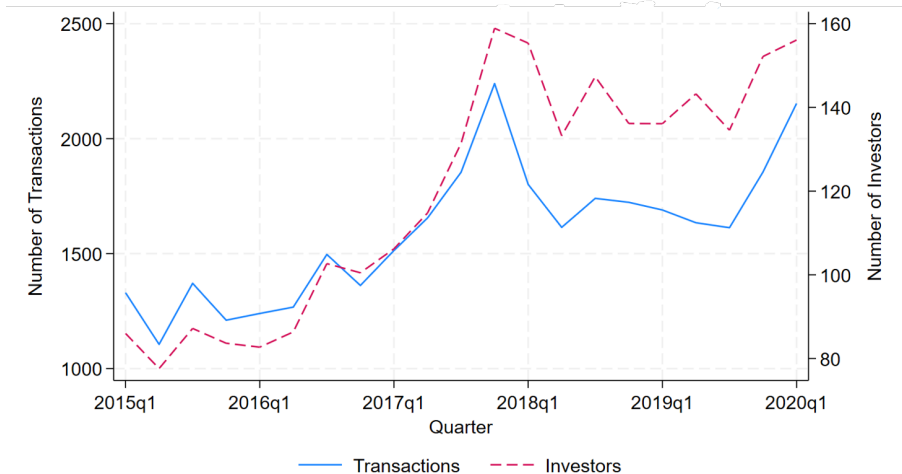
$$\text{Transactions}_{p,t} = \sum_{i \in p} \text{Trades}_{i,t}$$

Number of Investors: Count of active investors trading in a pincode per month.

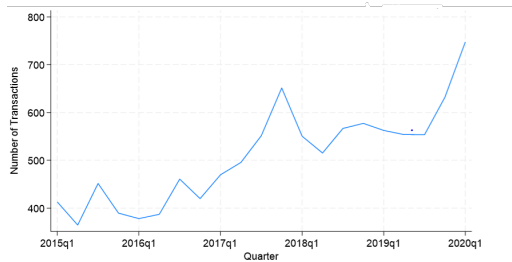
$$\text{Investors}_{p,t} = \sum_{i \in p} \mathbf{1}(\text{Trade}_{i,t} > 0)$$

Retail Stock Market Participation

Analysis period: 2015 to February 2020.



UPI and Stock Market Participation



(a) Diff. in # Transactions (High-Low)



(b) Diff. in # Investors (High-Low)

Summary Statistics: Pincode level

Variable	N	Mean	S.D.	Min	P25	Median	P75	Max
UPI Exposure	12,576	0.650	0.347	0	0.433	0.764	0.957	1
Number of Transactions	1,124,040	1108	2935	0	55	205	654	27006
Number of Investors	1,124,040	81	217	0	5	16	47	2059

Balance Test

Variable	(1) High UPI Exposure		(2) Low UPI Exposure		(3) Mean Difference
	N	Mean/(SE)	N	Mean/(SE)	(1)-(2)
Pincode: NSE Sample					
Economic Activity	9,306	10.684 (13.894)	9,307	8.059 (13.323)	2.625
Number of Transactions	203,007	1104.105 (3051.367)	203,444	805.929 (2464.830)	298.176
Number of Investors	203,470	78.093 (222.382)	203,631	55.666 (175.687)	22.427
Investor: NSE Sample					
Age	656,889	37.998 (13.253)	656,357	37.768 (12.849)	0.230
Female	626,393	0.134 (0.340)	629,007	0.119 (0.324)	0.015

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Does UPI Adoption lead to increased stock market participation?

Empirical Methodology

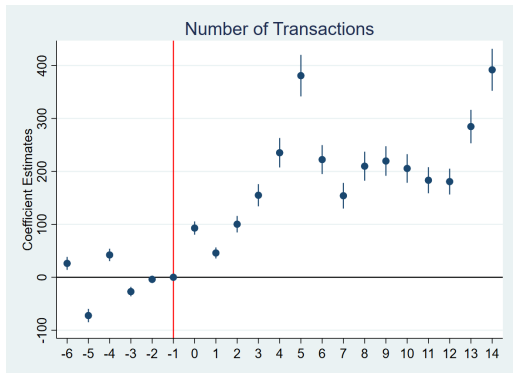
$$Y_{p,t} = \alpha_{d(p),t} + \gamma_p + \beta \times \text{Post} \times \text{UPI Exposure}_p + \epsilon_{p,t}$$

for pincode p in district $d(p)$ in month t .

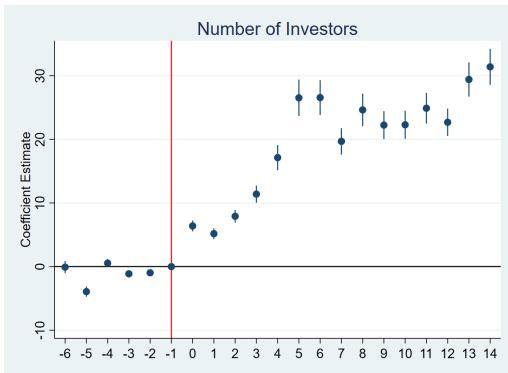
- The dependent variable $Y_{p,t}$ is the no. of transactions or investors.
- Post is a dummy that equals 1 post November 2016 and 0 otherwise.
- UPI Exposure $_p$ is as defined before.
- $\alpha_{d(p),t}$ and γ_p represent district-time fixed effects and pincode fixed effects.
- Standard errors are clustered at the pincode level.

Dynamic Effects of UPI on Stock Market Participation

$$Y_{p,t} = \alpha_{d(p),t} + \gamma_p + \sum_{k=-6}^{k=14} \beta_k \times \mathbb{1}[\text{Quarter} = k] \times \text{UPI Exposure}_p + \epsilon_{p,t}$$



(a) Number of Transactions



(b) Number of Investors

UPI and Stock Market Participation

DV	Number of Transactions (1)	Number of Investors (2)
UPI Exposure X Post	197.961*** (11.717)	20.310*** (1.059)
Pincode FE	Y	Y
District-Month FE	Y	Y
N	1,121,378	1,121,385
Adj. R^2	0.964	0.964
Pre-UPI mean	954.857	66.875

A 1 s.d. ↗ UPI exposure $\Rightarrow$ 7.2% ↗ in monthly transactions; 10.5% ↗ in active investors relative to pre-UPI mean.

Placebo

Bartik

Establishing UPI as the main driver

(I) Interoperability of UPI: UPI vs. non-“Open” payment system

- YONO from State Bank of India (SBI) is a closed system, while UPI operates as an open banking framework.
- Allows a direct test of digital banking vs. open payments on trading behavior.
- Controls for general digitization effects, ensuring UPI's impact isn't just based broad fintech adoption (or unobservables).

Identification Using UPI vs. YONO

Empirical Methodology

$$Y_{p,d,t} = \alpha_{d,t} + \beta_1 \times \text{UPI Exposure}_p + \beta_2 \times \text{YONO Exposure}_p + \epsilon_{p,d,t}$$

in pincode p at month t :

- $Y_{p,d,t}$ represents the stock market participation outcome (number of transactions, number of investors).
- $\alpha_{d,t}$ represents district-time fixed effects, controlling for regional economic conditions.
- UPI Exposure_p measures the intensity of UPI adoption in a pincode.
- YONO Exposure_p measures the intensity of YONO adoption in a pincode.
- Standard errors are clustered at the pincode level.
- For the sample post-November 2017, once YONO was launched.

UPI Exposure vs. YONO

Yono Measure	Value		Volume	
	Number of Transactions (1)	Number of Investors (2)	Number of Transactions (3)	Number of Investors (4)
UPI Exposure	619.036*** (74.880)	49.239*** (5.669)	655.435*** (41.494)	51.939*** (3.177)
Yono	0.000 (0.000)	0.000 (0.000)	1.485*** (0.547)	0.113*** (0.041)
District-Month FE	Y	Y	Y	Y
N	495,562	494,719	495,562	494,719
Adj. R^2	0.341	0.348	0.323	0.329
Pre-UPI mean	954.857	66.875	954.857	66.875

No effect of YONO in terms of value, and a smaller relative effect in terms of volume.

(II) Exploiting within-investor variation

Empirical Methodology

$$Y_{i,b,t} = \alpha_{i,t} + \gamma_b + \beta \times \text{Post}_t \times \text{Early Adopter}_b + \epsilon_{i,b,t}$$

for investor i through brokerage account b in month t

- $Y_{i,b,t}$ is the number of transactions.
- Post is a dummy that equals 1 post Q3 2016 and 0 otherwise.
- Early Adopter_b equals 1 if the brokerage account b is associated with early UPI-adopting banks, and 0 otherwise.
- $\alpha_{i,t}$ and γ_b are individual-time and brokerage FE.
- Standard errors are clustered at the individual level.
- The coefficient of interest β captures the difference in transactions for a UPI-enabled brokerage versus others.

(II) Results using within-investor variation

Sample	Investor with two or more brokers during entire sample period	Investor with two or more brokers in each month	
DV	Number of Transactions		
Post X Early UPI Enabled Brokerage	1.337*** (0.159)	1.294*** (0.223)	0.412** (0.207)
Investor FE	Y	Y	
District-Month FE	Y	Y	Y
Broker FE	Y	Y	Y
Investor-Month FE			Y
N	55,767,926	15,616,204	15,616,200
Adj. R^2	0.387	0.314	0.155
Pre-UPI mean	16.792	20.012	20.012

For the same investor, 2.2% higher trading volume on the early adopter bank, relative to pre-UPI mean.

(III) Speed of UPI

- During sharp market movements, ability to instantly transfer money (or receive money) to the brokerage account is crucial
- September 11, 2019: stock market crashed 793 points erasing 3.3 trillion INR
- March 12, 2020: another sharp fall (8.18%) due to global fears of recession

$$Y_{i,h} = \delta_i + \gamma_h + \beta \times \text{UPI Exposure}_{p(i)} \times \text{Post Crash}_h + \epsilon_{i,h}$$

- $Y_{i,h}$ measures the number of transactions executed by investor i in hour h in pincode $p(i)$.
- Post Crash_h is a dummy variable for 12 trading hour window that takes the value 1 for after the crash and 0 before.
- δ_i, γ_h represent investor and hour fixed effects, respectively.
- Standard errors are clustered at the investor level.

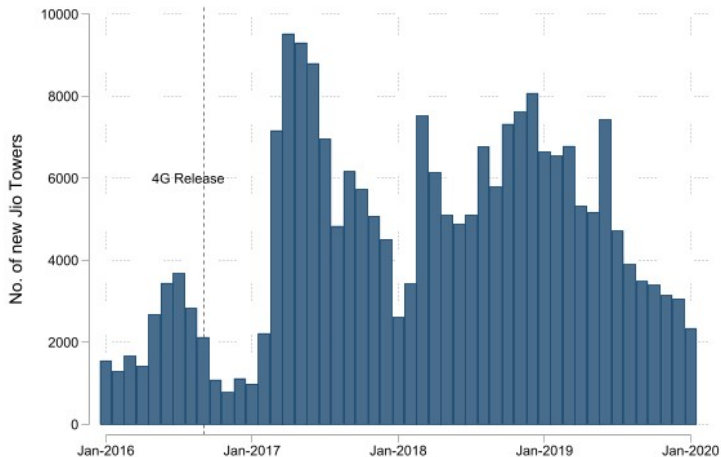
(III) Speed of UPI

BSE Test

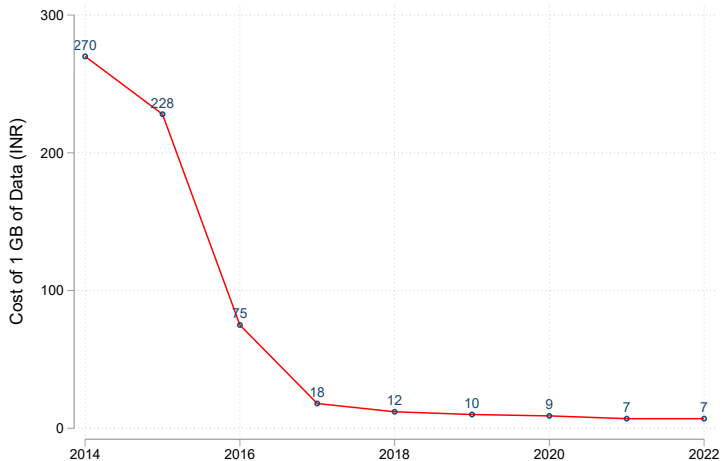
Event	2019 & 2020		2019		2020	
DV	Number of Transactions (1)	Number of Tickers Traded (2)	Number of Transactions (3)	Number of Tickers Traded (4)	Number of Transactions (5)	Number of Tickers Traded (6)
Post Crash X UPI Exposure	0.009*** (0.003)	0.007*** (0.001)	0.009* (0.005)	0.013*** (0.002)	0.009*** (0.003)	0.004*** (0.002)
Investor FE	Y	Y	Y	Y	Y	Y
Hour FE	Y	Y	Y	Y	Y	Y
N	14,389,045	14,449,978	5,436,143	5,460,537	9,034,245	9,071,293
Adj. R^2	0.117	0.132	0.163	0.182	0.116	0.132

(IV) Access to cheap and fast internet

- Rapid rollout of 4G Jio Towers starting September 2016



... that lowered data costs exponentially



Empirical Methodology

$$Y_{p,t} = \alpha_{d(p),t} + \gamma_p + \beta_1 \cdot \text{Post} \times \text{UPI Exposure}_p + \beta_2 \cdot \text{Post} \times \text{Early Jio}_p + \beta_3 \cdot \text{Post} \times \text{UPI Exposure}_p \times \text{Early JIO}_p + \varepsilon_{p,t}$$

- $Y_{p,t}$ represents the number of investors and transactions in pincode p in district $d(p)$.
- Post is a dummy that equals 1 post Q3 2016 and 0 otherwise.
- Early Jio_p identifies pincodes that had a Jio tower installed within 6 kilometers by Q1 2017
- $\alpha_{d,t}$ and γ_p represent district-time and pincode fixed effects, respectively.
- Standard errors are clustered at the pincode level.

Access to cheap and fast internet

DV	Number of Transactions (1)	Number of Investors (2)	Number of Transactions (3)	Number of Investors (4)
UPI Exposure X Post	105.615*** (12.094)	10.341*** (1.115)	50.024** (22.995)	4.165** (2.092)
Post X Early JIO	127.528*** (14.299)	12.784*** (1.242)	116.409*** (14.149)	11.710*** (1.238)
UPI Exposure X Post X Early JIO	154.857*** (20.464)	16.888*** (1.808)	149.211*** (20.197)	16.211*** (1.798)
Post X High Non-JIO			95.769*** (17.947)	9.435*** (1.681)
UPI Exposure X Post X High Non-JIO			63.664*** (23.746)	7.145*** (2.180)
Pincode FE	Y	Y	Y	Y
District-Month FE	Y	Y	Y	Y
N	1,121,378	1,121,385	1,120,951	1,120,958
Adj. R^2	0.964	0.964	0.964	0.965
Pre-UPI mean	954.857	66.875	954.857	66.875

Effect of access to Jio, 1.46x the baseline effect for #transactions and 1.63x for #investors. Jio effect is 2.3x of non-Jio for #transactions and 2.69x for #investors.

(V) Retail versus institutional investors

DV	Number of Transactions		Number of Investors	
	Retail (1)	Institutional (2)	Retail (3)	Institutional (4)
UPI Exposure X Post	197.961*** (11.717)	11.859 (7.625)	20.310*** (1.059)	0.466 (0.319)
Pincode FE	Y	Y	Y	Y
District-Quarter FE	Y	Y	Y	Y
N	1,121,378	193,597	1,121,385	193,602
Adj. R^2	0.964	0.913	0.964	0.943
Pre-UPI Mean	954.857	159.244	66.875	5.621

Despite the increase in retail investors, no impact on institutional investors.

(VI) Comparing physical vs. internet trading

DV	Number of Transactions	
	Physical (1)	Internet-based (2)
UPI Exposure X Post	-99.211*** (6.283)	134.152*** (5.789)
Pincode FE	Y	Y
District-Quarter FE	Y	Y
N	1121313	1121363
Adj. R^2	0.833	0.761
Pre-UPI Mean	407.974	106.426

1 SD ↗ UPI exposure $\Rightarrow$ 8.4% ↘ in monthly physical transactions and 43.7% ↗ in monthly internet-based transactions, relative to pre-UPI mean.

(VII) Complementarity of UPI and Digital Platforms

Fintech versus non-fintech

DV	Number of Transactions		Number of Investors	
	FinTech (1)	Non-FinTech (2)	FinTech (3)	Non-FinTech (4)
UPI Exposure $\times$ Post	184.076*** (10.049)	84.613*** (13.050)	8.320*** (0.342)	12.059*** (0.751)
Pincode FE	Y	Y	Y	Y
District-Quarter FE	Y	Y	Y	Y
N	1,132,770	1,132,770	1,121,388	1,121,389
Adj. R^2	0.778	0.953	0.763	0.975
Pre-UPI Mean	60.952	1230.607	3.701	62.612

1 SD $\nearrow$ UPI exposure $\Rightarrow$ 104.8% $\nearrow$ in monthly transactions along with 78% $\nearrow$ in no. of investors on FinTech platforms and 2.4% $\nearrow$ in monthly transactions along with 6.7% $\nearrow$ in no. of investors on Non-FinTech platforms, relative to pre-UPI mean.

Democratization of Retail Access: Heterogeneity tests

Heterogeneity by gender

Democratization of access

DV	Number of Transactions		Number of Investors	
	Female (1)	Male (2)	Female (3)	Male (4)
UPI Exposure $\times$ Post	21.786*** (1.324)	167.045*** (9.244)	2.109*** (0.116)	16.799*** (0.826)
Pincode FE	Y	Y	Y	Y
District-Quarter FE	Y	Y	Y	Y
N	1,121,405	1,121,369	1,121,400	1,121,377
Adj. R^2	0.846	0.962	0.904	0.961
Pre-UPI Mean	43.188	748.580	3.437	52.500

1 SD $\nearrow$ UPI exposure $\implies$ 21.3% $\nearrow$ in no. of female investors (17.5% $\nearrow$ in monthly transactions) and 11.1% $\nearrow$ in no. of male investors (7.7% $\nearrow$ in monthly transactions) relative to pre-UPI mean.

Heterogeneity by age

DV	Number of Transactions			Number of Investors		
	Young (1)	Middle Age (2)	Mature (3)	Young (4)	Middle Age (5)	Mature (6)
UPI Exposure × Post	66.864*** (2.960)	123.710*** (6.661)	-0.478 (3.026)	6.500*** (0.286)	11.150*** (0.577)	2.041*** (0.181)
Pincode FE	Y	Y	Y	Y	Y	Y
District-Quarter FE	Y	Y	Y	Y	Y	Y
N	1,121,353	1,121,376	1,121,368	1,121,361	1,121,403	1,121,379
Adj. R^2	0.813	0.955	0.963	0.835	0.965	0.981
Pre-UPI Mean	63.163	512.500	357.456	5.562	39.289	20.948

1 SD ↗ UPI exposure $\Rightarrow$ 40.6% ↗ in no. of young investors (36.7% ↗ in monthly transactions), 9.8% ↗ in no. of middle aged investors (8.4% ↗ in monthly transactions) and 3.4% ↗ in no. of mature investors (no effect on monthly transactions), relative to pre-UPI mean.

Heterogeneity by investor ticket size

- Reduced entry barriers to stock market participation by enabling easier and more flexible handling of small transactions
- Multiple frictions: minimum balance requirements, cumbersome fund transfer, psychological barriers around committing large sums.
- Examine trading for small-ticket investors.
- **Small Investors:** Bottom 30% of transactions in terms of trading value (Lee & Radhakrishna, 2000; Malmendier & Shanthikumar, 2007), which corresponds to ₹30,000 (\$320) per month.

Heterogeneity by investor ticket size

DV Cut-Off Small Investors	Number of Investors			
	Trading Value – ₹30,000		Trading Value – ₹50,000	
	Y (1)	N (2)	Y (3)	N (4)
UPI Exposure X Post	17.032*** (0.862)	9.450*** (0.518)	18.103*** (0.928)	7.742*** (0.421)
Pincode FE	Y	Y	Y	Y
N	1,121,381	1,121,370	1,121,388	1,121,391
Adj. R^2	0.963	0.960	0.964	0.956
Pre-UPI mean	57.322	30.012	60.906	22.830
T-test	(2)-(1) -7.582*** (1.006)		(4)-(3) -10.361*** (1.019)	

Larger effect on small ticket investors relative to large ticket investors.

Rural vs. Urban

What are the consequences of UPI-induced retail participation
on investors?

Investor-Level Measures: Risk-taking and Diversification

Risk-Taking

$$\text{RiskTaking}_{i,t} = \frac{\text{Trades in Risky Assets}_{i,t}}{\text{Total Trades}_{i,t}}$$

- $\text{Trades in Risky Assets}_{i,t}$: Number of trades in stocks with above-median price volatility.
- $\text{Total Trades}_{i,t}$: Total trades executed by investor i in month t .

Portfolio Diversification

$$\text{Portfolio Diversification}_{i,t} = 1 - \sum_T \left(\frac{\text{Turnover}_{i,S,t}}{\sum_T \text{Turnover}_{i,S,t}} \right)^2$$

- $\text{Turnover}_{i,S,t}$: Total buy and sell value of stock S by investor i in month t .

Consequences: Return and Trading Behaviors

DV	Risk Taking (1)	Diversification (2)
UPI Exposure $\times$ Post	-0.008*** (0.001)	0.004*** (0.001)
Small	0.073*** (0.001)	-0.243*** (0.001)
UPI Exposure $\times$ Small	0.007*** (0.002)	0.004*** (0.001)
Post $\times$ Small	-0.011*** (0.001)	0.009*** (0.001)
UPI Exposure $\times$ Post $\times$ Small	0.006*** (0.002)	-0.003*** (0.001)
Investor FE	Y	Y
District-Month FE	Y	Y
N	131,281,827	129,936,407
Adj. R^2	0.249	0.356

What are the consequences of UPI-induced retail participation
on stock markets?

Stock market consequences

- Securities' trading outcomes vary with UPI exposure
- Examine market performance at security-month level using a discrete exposure measure

$$Y_{s,t} = \alpha_s + \gamma_t + \beta \times \mathbb{1}[\text{UPI stock}_{s,t} > \text{Median}] \times \text{Post}_t + \varepsilon_{s,t}$$

for stock s at month t .

- $Y_{s,t}$ represents market outcomes.
- $\text{UPI stock}_{s,t}$ represents share of trades from high UPI exposure pincodes.
- α_s, γ_t represent security and month fixed effects, respectively.
- Standard errors are clustered at the security level.

Stock-Level Measures

Trading Volume, Liquidity and SD (Excess Return)

Trading Volume

- Trading Volume $_{s,t}$: The number of shares of stock s traded in month t .

Illiquidity

- Daily ratio of absolute stock return to the its trading volume (Amihud, 2002).

SD (Excess Returns)

- The measure represents the standard deviation of a stock's daily excess returns relative to market, within each month.

Stock market consequences

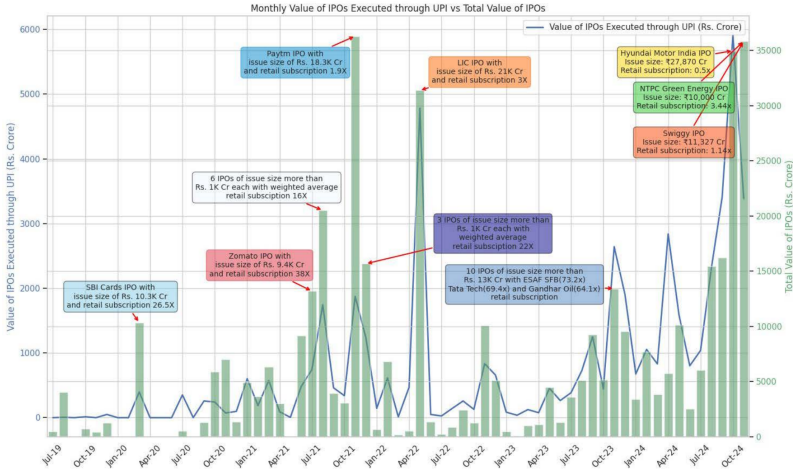
DV	Trading Volume	Illiquidity	SD (Excess Return)
	(1)	(2)	(3)
High UPI Intensity	-199.909* (105.360)	-0.000 (0.000)	-0.002*** (0.000)
Post $\times$ High UPI Intensity	875.613*** (148.350)	-0.000 (0.000)	0.001*** (0.000)
Security FE	Y	Y	Y
Year-Month FE	Y	Y	Y
N	80249	77909	79140
Adj. R^2	0.787	0.122	0.356

Next steps

- We document how UPI significantly increased market participation.
- There is democratization of retail stock market participation.
- What are the implications for investors? ... markets?
- Role for policy: Role for regulatory intervention? financial literacy?
- Outside the scope of this study: What are the implications for firms' capital structure? ... banking? ... savers? ... human capital?

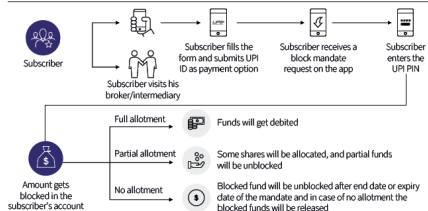
Thank You!

Trends in Increasing Usage of UPI IPO. Source: RBI Payment Systems Report

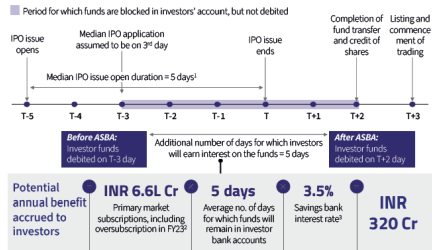


UPI-based ASBA for primary markets has led to ease in IPO applications for investors

Illustrative process for applying to IPOs using UPI-based ASBA



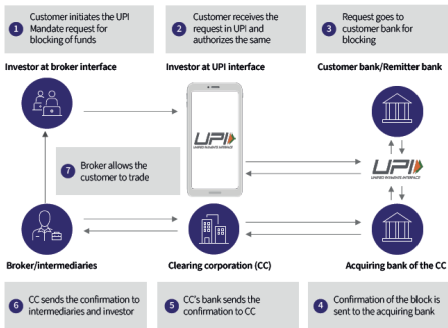
Introduction of ASBA for primary markets can potentially accrue INR 320 crore of annual benefit for investors



Source: NSE capital markets report-2024

The introduction of ASBA for secondary markets will enable investors to trade based on funds blocked in their own bank accounts

Transaction flow for ASBA based trading in secondary markets



Investors will continue to earn interest on the funds in bank accounts till settlement; earlier funds were transferred to broker wallets

Potential annual benefit expected to be accrued to investors

$$= \text{INR } 79\text{k}^1 \text{ Cr} \times 365 \text{ days} \times 3.5\% = \text{INR } 2,800 \text{ Cr}$$

¹ Average daily cash collateral collected from retail investors by TMs² (as reported to NCL), October-December 2023

² The funds will continue to remain in investor accounts throughout the year

³ Savings bank interest rate³

Source: NSE capital Markets report-2024

Effects of UPI on Stock Market Participation: Placebo Test

Number of Randomization DV	100		500	
	Number of Transactions (1)	Number of Investors (2)	Number of Transactions (3)	Number of Investors (4)
UPI Exposure X Post	0.589 (15.196)	0.129 (1.288)	0.414 (15.145)	0.123 (1.237)
Pincode FE	Y	Y	Y	Y
District-Month FE	Y	Y	Y	Y

UPI and Stock Market Participation

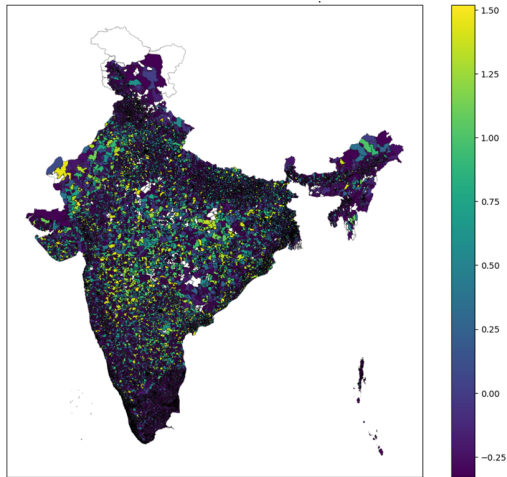
Robustness: Bartik Exposure

UPI Bartik

$$\text{UPI Bartik}_{p,t} = \text{National UPI}_t \times \frac{\text{UPI Usage}_p}{\text{GDP}_p}$$

- Combines local UPI exposure with national variation.
- UPI Usage_p is as of September 2017
- GDP_p is proxied by night light indexes
- Time variation is from the national trends in UPI
- National UPI_t is exogenous to local demand factors and ex-ante shares of UPI across different regions.

Geographic Variation in UPI Exposure



(d) UPI Bartik

Balance Test – UPI Bartik

Variable	(1) High UPI Bartik		(2) Low UPI Bartik		(3) Mean Difference
	N	Mean/(SE)	N	Mean/(SE)	(1)-(2)
Pincode: NSE Sample					
Economic Activity	9,306	14.875 (13.768)	9,307	21.007 (17.679)	-6.132
Number of Transactions	204,638	1628.943 (3668.848)	202,416	288.837 (1059.22)	1340.106
Number of Investors	204,638	114.776 (266.315)	202,416	19.525 (74.212)	95.251
Investor: NSE Sample					
Age	659,574	37.649 (12.849)	659,676	38.117 (13.253)	-0.468
Female	659,574	0.117 (0.321)	659,676	0.135 (0.343)	-0.018

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

UPI Exposure

UPI and Stock Market Participation

DV	Number of Transactions (1)	Number of Investors (2)
UPI Bartik	113.260*** (4.263)	13.399*** (0.365)
Pincode FE	Y	Y
District-Month FE	Y	Y
N	1,110,925	1,110,994
Adj. R^2	0.965	0.967
Pre-UPI mean	954.857	66.875

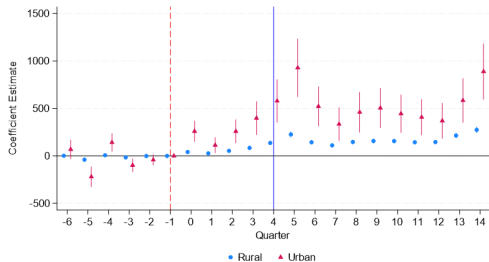
Areas more exposed to the UPI shock, saw an average monthly increase of 113 stock transactions and 13 investors relative to the pre-UPI mean of 955 and 67.

Placebo

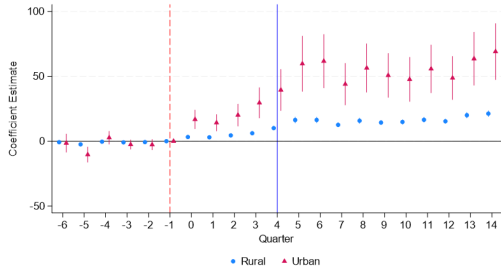
Bartik

Heterogeneity: Rural versus Urban

Dynamic Effects of UPI on Stock Market Participation – Rural vs Urban Pincodes



(a) Number of Transactions



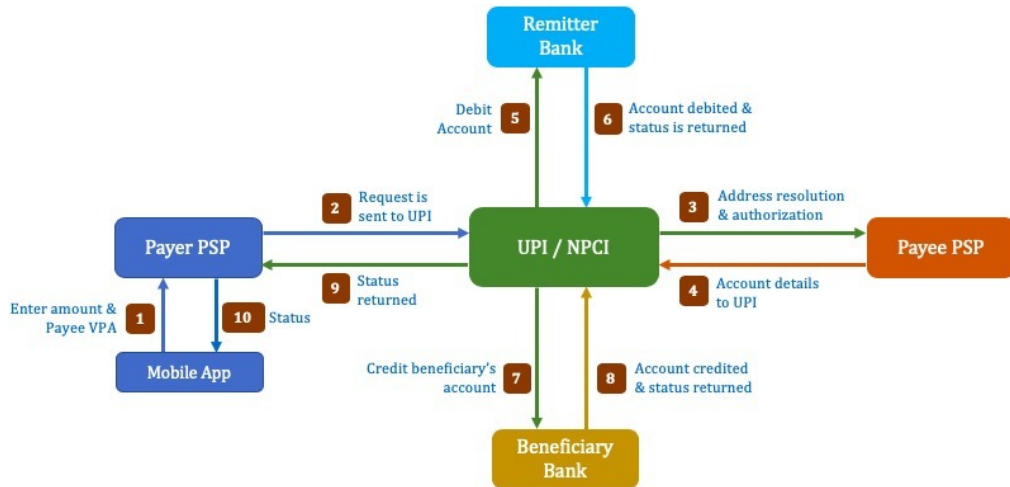
(b) Number of Investors

Rural versus urban

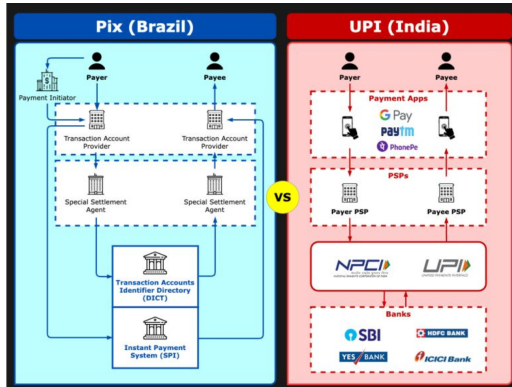
DV	Number of Transactions		Number of Investors	
	Rural (1)	Urban (2)	Rural (3)	Urban (4)
UPI Exposure X Post	141.005*** (9.596)	457.899*** (87.925)	13.323*** (0.859)	45.687*** (7.767)
Pincode FE	Y	Y	Y	Y
District-Month FE	Y	Y	Y	Y
N	950,783	161,162	950,714	161,249
Adj. R^2	0.934	0.969	0.929	0.975
Pre-UPI Mean	430.222	3855.075	29.502	271.655
T-test	(2)-(1) 316.893*** (88.447)		(4)-(3) 32.365*** (7.815)	

1 SD ↗ UPI exposure $\Rightarrow$ 15.7% ↗ in no. of rural investors (15.4% ↗ in monthly transactions) and 5.8% ↗ in no. of urban investors (4.1% ↗ in monthly transactions) relative to pre-UPI mean. Main

UPI-Payments Flow Chart



PIX versus UPI: UPI “more” interoperable



- : UPI: Features an open-source API allowing integration across apps from banks & third-party providers; Pix: Integrates primarily within banking and financial apps (only recently third parties allowed).
- UPI is decentralized and data hosted by banks; Pix is centralized

UPI Account Open

Verify your bank account

You can choose to verify using debit / ATM card or Aadhaar. [Learn more](#)

Debit / ATM card
Verify using debit / ATM card number and expiry date

Aadhaar
Verify using your Aadhaar number

By continuing, you agree to share your Aadhaar number with your bank and NPCI solely to verify your bank account for UPI-based services.

Continue

Powered by **L1P1**

Enter first six digits of Aadhaar

Make sure your Aadhaar is linked to your Axis Bank T240 account and your phone number linked to both is the same. [Learn more](#)

Enter six digits of your Aadhaar number

Powered by **L1P1** | **Axis Bank**

1 2 3
4 5 6
7 8 9
+ 0 **X**

Create a UPI PIN

You'll need to enter this PIN for all payments with this account. [Learn more](#)

Axis Bank 7346
Savings account
user@axisbank

Create PIN

Axis Bank
XXXXXXXXXX7346

ENTER 6-DIGIT AADHAAR OTP

RESEND AADHAAR OTP

AADHAAR-OTP has been sent to your registered mobile number via SMS. AADHAAR-OTP will be auto read.

1 2 3
4 5 6
7 8 9
+ 0 **X**

Axis Bank
XXXXXXXXXX7346

ENTER 6-DIGIT BANK OTP

OTP

BANK-OTP has been sent to your registered mobile number via SMS. BANK-OTP will be auto read.

1 2 3
4 5 6
7 8 9
+ 0 **X**

Axis Bank
XXXXXXXXXX7346

SET 6-DIGIT UPI PIN

UPI PIN will keep your account secure from unauthorized access. Do not share this PIN with anyone.

1 2 3
4 5 6
7 8 9
+ 0 **X**

Axis Bank
XXXXXXXXXX7346

CONFIRM 6-DIGIT UPI PIN

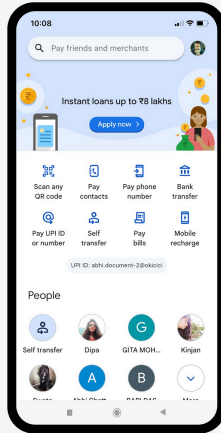
UPI PIN will keep your account secure from unauthorized access. Do not share this PIN with anyone.

1 2 3
4 5 6
7 8 9
+ 0 **X**

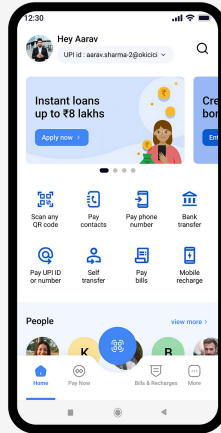
Axis Bank
XXXXXXXXXX7346

Bank account added
You're ready to make payments.

Landing Page-TPP

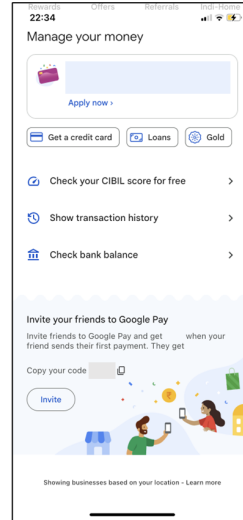
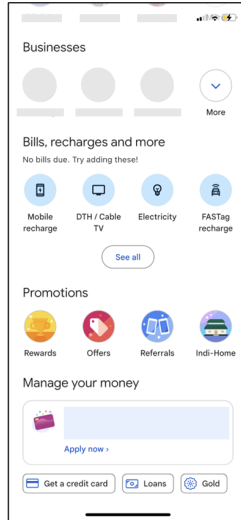
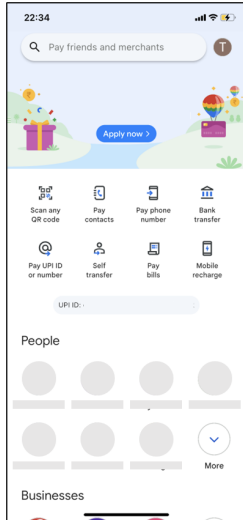


Old Design

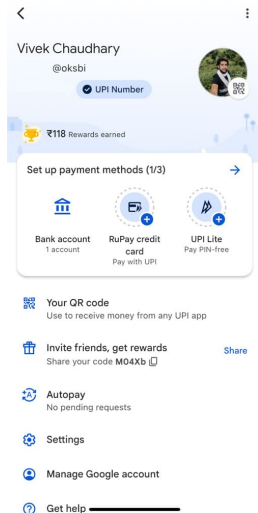


New Design

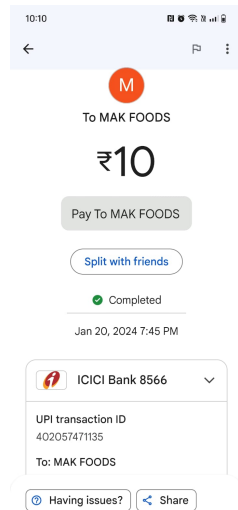
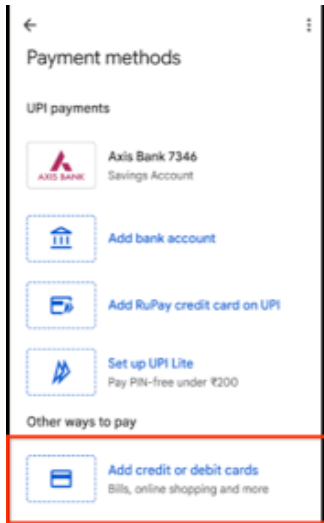
Google Pay Interface



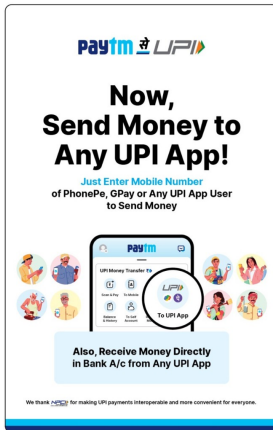
Payment Method



Main



Interoperability



paytm से UPI

**Now,
Send Money to
Any UPI App!**

Just Enter Mobile Number
of PhonePe, GPay or Any UPI App User
to Send Money

The central image shows a smartphone screen with the Paytm app interface. A magnifying glass highlights the 'To UPI App' option. Surrounding the phone are several circular icons depicting people using different mobile payment apps like PhonePe, GPay, and others.

**Also, Receive Money Directly
in Bank A/c from Any UPI App**

We thank **NPCI** for making UPI payments interoperable and more convenient for everyone.