

Digital Payments and the Shadow Economy in India (2019–2025): Evidence from Post-Pandemic Adoption Curves

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Abstract - This paper analyzes how India's rapid expansion of digital payments between 2019 and 2025—accelerated by COVID-19—has interacted with and reshaped the country's shadow economy. Drawing on adoption metrics for UPI and other rails, policy milestones, and sectoral narratives, it explains the mechanisms by which digital transactions create auditable trails, broaden the tax base, and enable MSME and gig-economy formalization. The paper reviews demographic diffusion into rural and low-income segments, the role of interoperable QR infrastructures and soundboxes, and the complementary influence of GST and DBT programs. It also documents persistent frictions—digital divide, literacy and trust gaps, security, and dispute redress—while highlighting impacts on inclusion, compliance, and gender outcomes. Finally, it sketches plausible post-2025 trajectories and policy levers for sustaining formalization and reducing the shadow economy's share of GDP.

Index Terms - Digital payments; UPI; shadow economy; GST; RBI; NPCI; financial inclusion; QR codes; COVID-19; MSMEs; AePS; BBPS; FASTag; tax compliance

Introduction

The past decade has witnessed a dramatic transformation in India's payments landscape, with the trajectory from cash-intensive to digital-led transactions reaching an inflection point following the COVID-19 pandemic. Between 2019 and 2025, digital payments not only skyrocketed in scale and scope but also penetrated deeply into new demographic and sectoral strata—including the historically persistent shadow economy. The “shadow economy,” comprising informal and unreported economic activities, has long challenged policymakers through its evasion of taxes and regulatory oversight. This report rigorously explores how the digital payments surge—particularly post-pandemic—has shaped the structure, size, and formalization of India's shadow economy.

Drawing on up-to-date statistics, empirical research, case studies, policy analysis, and sectoral narratives from 2019 to 2025, this report assesses the digital payments adoption curve, the pandemic's catalytic effects, and the resulting impact on the informal sector. It further analyzes the mechanisms by which digital transactions drive formalization, reviews the ecosystem's key stakeholders and policy levers, and critically examines ongoing barriers, challenges, and future prospects in this rapidly evolving arena.

The Evolution of Digital Payment Adoption in India, 2019–2025

Structural Shifts and Key Data Trends

India's digital payment system has undergone a profound transition since 2019, moving from a rapidly growing but still uneven ecosystem to a virtually ubiquitous infrastructure by 2025. Data released by the Reserve Bank of India (RBI) and the National Payments Corporation of India (NPCI) demonstrate the magnitude of this shift:

- By the first half of 2025, digital payments accounted for 99.8% of all payment transaction volumes and 97.7% of value—up from approximately 96.7% and 95.5% respectively in 2019.
- Total payment transaction volume rose from 3,248 crore in 2019 to 20,849 crore by 2024, while transaction value leaped from ₹1,775 lakh crore to ₹2,830 lakh crore in the same period.

A breakdown of instruments reveals UPI's dominance in retail payments and RTGS's hold over high-value transactions:

Table 1: Share of major digital payment instruments (H1 2025).

The Unified Payments Interface (UPI), launched in 2016, stands as the standout catalyst. Its transaction volume soared nearly 24-fold, from 441.6 crore in H1 2019 to 10,637 crore in H1 2025. The transaction value similarly jumped from ₹7.91 lakh crore to ₹143.35 lakh crore.

This exponential growth was supported by:

- Rapid expansion of QR code acceptance (over 657 million UPI QR codes by mid-2025)
- Deployment of 11 million+ POS terminals, 665 million QR codes, and low-cost soundboxes across urban and rural India
- Integration and usage of multiple payment modes: cards, IMPS, BBPS, NETC tags, PPIs, and emerging UPI features (biometric authentication, wearables, AI-driven enhancements)

These trends signal not only a quantitative expansion but a clear qualitative shift: digital retail rails (notably UPI and interoperable QR codes) have replaced cash as the primary mode for small and high-frequency transactions.

Post-Pandemic Inflection in Adoption Patterns

The COVID-19 pandemic served as a historic accelerant for India's digital payments journey:

- UPI volumes in FY 2019–20 were 12.5 billion; by FY 2021–22, they had ballooned to 45.6 billion—a 3.6x increase across just two years.
- Digital transactions volume overall saw a doubling in FY 2020–21 and another doubling in FY 2021–22: an unprecedented compression of adoption that would traditionally span a decade.
- Contactless and QR-based payments saw a particularly strong surge, responding to hygiene, safety, and distancing imperatives.

This “pandemic push” did not simply create temporary behavioral change: even as cash usage ticked back up post-restriction, the digital baseline remained vastly higher, indicating a permanent migration to digital rails.

Demographic broadening was notable: Rural and lower-income segment adoption increased dramatically—digital payment user share in rural populations rose from 27% before COVID to 35% by 2022; urban share slipped from 73% to 65%, reflecting deep rural and mass-market penetration.

Technological Innovations and Ecosystem Expansion

The Payments Stack: UPI and Complementary Systems

UPI remains the backbone—supporting both person-to-person (P2P) and person-to-merchant (P2M) interactions, and integrating seamlessly with e-commerce, government services, offline merchants, and peer platforms.

Recent enhancements (2023–2025) include:

- Aadhaar-based biometric and face authentication for transactions and PIN resets
- UPI Lite for low-value offline payments and wearable payments (enabling “look, speak, pay” features)
- UPI Multi-Signatory for corporate and MSME account aggregation
- UPI Cash Withdrawal via micro-ATMs and business correspondents
- AI-based UPI HELP for in-app transaction tracking, mandates, and dispute redressal

Interoperable QR codes and soundbox deployment help overcome infrastructure, literacy, and device barriers, providing an inclusive user journey even for low-literacy or first-time digital users.

Other digital rails expanding the ecosystem:

- AePS (Aadhaar Enabled Payment Systems)
- BBPS (Bharat BillPay)
- NETC (FASTag)
- Initial steps toward CBDC (Digital Rupee)

Sectoral Innovations and AI Integration

India is now piloting and globally exporting digital payment innovations:

- IoT-enabled and wearable payments (via smart glasses, soundboxes, and cars)
- AI-powered fraud detection, dispute handling, and contextual support (UPI HELP; agentic/AI-driven interfaces)
- Global UPI corridors for remittance, tourism, and diaspora payments (UPI now works in the UAE, Singapore, Mauritius, France, and other emerging corridors)

Banks, FinTechs, and non-bank players now provide digital-first account opening, lending, payment acceptance, and invoice management, blurring traditional sector lines and expanding financial inclusion.

COVID-19 and Policy Responses: Accelerating Digitalization

COVID-19's Catalytic Role

Lockdowns, social distancing, and the need for safe, remote commerce forced businesses and consumers alike to adopt digital payments:

- UPI monthly volumes shrank by 20% in April 2020 but rebounded to all-time highs within months; the so-called “V-shaped” recovery saw digital volumes surpassing pre-pandemic levels by late 2020.
- Government and RBI policy interventions were rapid and—inclusive: Zero MDR policy for UPI and RuPay; higher limits for contactless transactions; mass digital literacy campaigns; and special schemes like PMSVANidhi.

For rural and semi-urban India, the pandemic period functioned as a live demonstration of digital financial tools' utility and safety, fostering durable adoption even in previously resistant population segments.

Policy Milestones and Government Initiatives

Table 2: Key digital payment and regulatory milestones (2016–2025)

Digital Payments and the Shadow Economy: Definition, Measurement, and Evolution

Understanding the Shadow Economy in India

The shadow economy—also referenced as the informal, black, cash, or hidden economy—includes unreported, unregistered, and often untaxed economic activity. In India, it historically encompasses unregistered micro-enterprises, underreported cash transactions by otherwise-registered businesses, and legal but off-the-books employment, production, and commerce across sectors such as construction, traditional retail, agriculture, informal services, and informal real estate transactions.

Official estimates put the shadow economy at around 22–25% of India's GDP pre-2016. This figure decreased following demonetization (2016) and shrank further with digital payment adoption. For 2025, the ACCA projects the shadow economy will stand at 13.6% of GDP—down from 17.2% in 2016.

Table 3: Estimated size of shadow economy (selected years)

Methods to Measure the Shadow Economy

Researchers use several approaches, with each revealing different layers of informal activity:

- Direct Methods: Surveys and field studies, labor force gap analyses, tax audits
- Indirect Methods: Discrepancies between income and expenditure or labor statistics, currency demand modeling, electricity consumption methods

• Model-based (MIMIC) Approaches: Structural equation models linking macro-indicators (tax rates, unemployment, cash in circulation) to latent variables for the shadow economy. Recent MIMIC modeling—incorporating digital payments penetration (UPI/QR share), cash-in-circulation-to-GDP ratios, and compliance data—shows robust negative correlation between digital transactions and the shadow economy share.

The Impact of Digital Payments on the Shadow Economy

Mechanisms for Reducing Informality

1. Transaction Traceability: Digital payments create auditable trails for transactions, raising the risk of evasion detection.
2. Broadening the Tax Base: Adoption among small businesses and gig workers expands visibility for tax and regulation.
3. Reducing the Preference for Cash: As users grow accustomed to UPI, wallets, and cards, digital convenience outweighs cash loyalty.
4. Formalizing MSMEs and the Gig Economy: Digital rails incentivize account opening, platform registration, and GST integration.
5. Sectoral Digitalization: Post-pandemic shifts toward digital even in high-cash sectors broaden formal records.

Sectoral Case Studies and Illustrative Impacts

- A. Kirana Store Transformation: Example of a typical 'kirana' store digitizing payments, inventory, and ledger management—leading to higher sales and better credit recovery.
- B. Agriculture and Rural Sector: FPOs and farmers increasingly using digital payments; DBT schemes pushing rural actors into bank-linked rails.
- C. Urban Informal Services: PM SVANidhi's micro-credit and cashbacks tied to UPI volumes bring vendors into formal systems.
- D. Gender and Micro-Entrepreneurship: SEWA-led digital inclusion programs empower rural women through UPI usage and financial management.
- E. GST and Tax Compliance Effects: Digital trails strengthen GST compliance; positive long-run relationships between digital payments and GST revenues.

Persistent Barriers, Challenges, and Regional Disparities

1. Digital Divide and Infrastructure Gaps
2. Digital Literacy and Trust Deficit
3. Informal Economics and Cash Persistence
4. Regulatory and Transaction Costs
5. Security, Fraud, and Dispute Resolution

Behavioral Shifts: Consumers and Merchants

Consumer Trends

Key post-pandemic shifts include strong preferences for digital payments among urban users and rising adoption in rural areas, with digital systems driving higher discretionary spending due to reduced friction.

Merchant and Business Adaptation

Small merchants, micro-enterprises, and gig workers accept UPI/QR due to consumer demand and instant settlement. Visible infrastructure (QR/sound box) nudges cash-preferring consumers, while formal digital trails open access to credit and insurance.

Policy, Stakeholder, and Ecosystem Analysis

Government and Regulator Roles: RBI (regulation, sandboxes, PRAVAAH, PIDF), NPCI (UPI, AePS, NACH, NETC, BBPS), and central/state governments (GST, DBT, PMSVANidhi, PMGDISHA, sectoral DPI).

Financial & Private Sector: Banks (digital onboarding, PoS/QR enablement), FinTechs (low-cost hardware, AI security, B2B solutions), and global partnerships (UPI corridors).

Sectoral Impact and Case Narratives

Agriculture: Over 43% of farmers use digital payments for inputs and crop sales; FPO digitization improves income and costs.

MSMEs: UPI-linked histories and e-invoicing streamline operations and access to credit; women micro-entrepreneurs gain market access.

Urban Informal Sector: Vendor registration and digital incentives create transaction records and build credit profiles.

Overall Economic, Fiscal, and Social Impact

On Tax Compliance and Revenue: Studies show positive long-run relationships between digital payments and GST revenue/tax buoyancy.

On the Shadow Economy: The informal share of GDP has declined; pockets of cash-intensive activity persist.

On Financial and Gender Inclusion: Digital rails enable unprecedented inclusion, especially for women, youth, and rural populations.

Future Projections and Policy Recommendations

Future Projections: Digital Payments Post-2025

- Transactions projected to reach 617 billion by FY30; value to INR 907 trillion.
- UPI on track for 1 billion daily transactions by 2028; expanding global corridors.
- Shadow economy could fall below 12% of GDP by 2030 with continued digital expansion.

Key Policy Recommendations

1. Bridge Digital Divide
2. Expand Digital Literacy
3. Strengthen Security and Trust
4. Incentivize Small Merchant and MSME Adoption
5. Formalize Informal Sectors
6. Monitor Regional Disparities
7. Iterate Regulatory Framework
8. Promote Gender and Youth Inclusion

Conclusion

India's digital payments revolution, turbocharged by the COVID-19 pandemic and a harmonized public-private policy thrust, has achieved remarkable expansion. While the shadow economy remains a challenge, its measurable share of GDP has notably declined. Digital payment adoption functions as a structural enabler of economic formalization, tax compliance, and financial inclusion. Pushing further toward a fully formal economy will require coordinated action across infrastructure, literacy, regulatory evolution, and inclusive innovation.