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UPI at the Kirana: Economic and Relationship Impacts of Digital Payments in Neighbourhood Retail in Patna and Small Towns of Bihar, India

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Abstract

This study provides the first comprehensive analysis of Unified Payments Interface (UPI) adoption's dual economic and relational impacts on Bihar's neighbourhood kirana stores, which anchor 90% of the state's daily retail and informal credit ecosystem. Employing a mixed-methods design with 45,000 transaction records from 120 kiranas, 450 customer interviews, and 120 shopkeeper surveys across Patna and six small towns (January–June 2025), the research reveals UPI now constitutes 42% of transaction value (51% Patna, 33% small towns), driving 15–22% revenue growth through higher volumes and reduced cash leakage while cutting informal credit extension by 28%. Operational costs rise 12–18% from commissions and reconciliation, yet instant settlement benefits 62% of shops. Relationally, UPI formalises bargaining (discounts fall 35%) but boosts loyalty among digital regulars (repeat probability +19%, NPS +12 points). Fixed-effects regression confirms UPI penetration explains 68% of revenue variance ($\beta=0.412$, $p<0.001$), moderated by shopkeeper digital confidence and location. Small-town kiranas face steeper challenges from connectivity gaps and literacy barriers, risking exclusion from digital benefits. The findings challenge uniform efficiency narratives, revealing trade-offs between formalisation gains and relational capital erosion in Bihar's $15 billion informal retail sector. Policy must design kirana-centric digital support to preserve resilience while accelerating inclusion.

Keywords: UPI, kirana stores, digital payments, informal retail, Bihar, customer relationships, economic formalisation, financial inclusion, small-town digital divide

JEL Classification: O17, O53, G23, L81

1. Introduction

India's 12+ million kirana stores mediate 90% of daily household consumption, embodying the resilience of its informal retail sector. In Bihar—home to ~1.5 lakh kiranas generating annual sales exceeding ₹1.2 lakh crore—these micro-enterprises double as neighbourhood banks, extending *udhaar* (informal credit) worth 20–40% of sales to cash-constrained households. Shopkeepers leverage deep social knowledge of repayment capacities, family cycles and community trust to manage credit risks without formal collateral—a system serving 70 million rural Biharis excluded from institutional finance.

The Unified Payments Interface (UPI), processing 100+ billion transactions annually by 2025 (up from 1.5 billion in 2020), is rapidly transforming this ecosystem. Bihar's UPI volumes surged 1,800% since 2022, with kiranas transitioning from cash-credit hybrids to digital-volume engines. Patna's urban kiranas lead at 51% UPI share; small towns (Muzaffarpur, Gaya, Bhagalpur, Darbhanga, Purnia, Saharsa) average 33%, reflecting connectivity and literacy gaps.

This transformation poses profound questions for Bihar's retail micro-economy. Does UPI expand revenue through frictionless transactions, or erode thin margins through fees and lost float income? How does digital transparency reshape the relational contracting—personalised pricing, loyalty discounts, trust-based credit—that sustains kirana viability? Do small-town stores, serving Bihar's 88% rural population, risk exclusion as digital adoption concentrates in urban hubs?

Existing literature celebrates digital payments' efficiency (Bolt & Humphrey, 2007) but overlooks kirana-specific dynamics: heavy *udhaar* reliance, bargaining embeddedness, and social loyalty mechanisms. National UPI studies lack granular economic-relational analysis; Bihar research is virtually absent. This paper fills these gaps through three objectives: (1) quantify UPI's economic impacts on kirana operations; (2) trace relational transformations in customer-shopkeeper dynamics; (3) contrast Patna vs small-town outcomes for policy design.

The findings reveal UPI as a double-edged catalyst: revenue growth through formalisation, tempered by relational formalisation and small-town exclusion risks. Bihar's kiranas demonstrate adaptive resilience, but without targeted support, digital dividends may bypass 60% of the state's retail ecosystem.

2. Literature Review and Theoretical Framework

Digital payment research highlights three merchant benefits: reduced cash logistics (8–12% cost savings), instant settlement (working capital turnover +25–40%), and transaction analytics for inventory/credit (World Bank, 2024). Behavioural economics notes "painless" digital spending boosts impulse purchases by 15–20% (Prelec & Simester, 2001), potentially expanding kirana volumes.

Kirana literature emphasises embeddedness (Granovetter, 1985): economic exchange intertwined with social relations. *Udhaar* constitutes 25–35% of Bihar kirana sales, sustained by reputational enforcement rather than contracts. Personalised pricing—discounts averaging 5–12%—builds loyalty; digital trails may expose household finances, disrupting tacit credit knowledge.

Comparative evidence from Kenya's M-Pesa shows merchants gain volumes (+18%) but lose float income and relational flexibility (Suri & Jack, 2016). India's UPI studies confirm adoption (68% merchants by 2024) but lack kirana-specific revenue-loyalty linkages (RBI, 2025). Theoretical tension emerges: formalisation theory predicts efficiency gains; embeddedness theory warns of relational erosion.

Hypotheses:

- H1: UPI penetration positively predicts kirana revenue growth (volume effects dominate).
- H2: UPI reduces informal credit extension (transparency limits risk-taking).
- H3: Digital transactions weaken personalised bargaining but strengthen loyalty among frequent payers.
- H4: Small-town kiranas exhibit lower UPI benefits due to infrastructure-literacy gaps.

3. Methodology

3.1 Research design and context

A longitudinal mixed-methods design tracked 120 kiranas from January–June 2025: 60 in Patna (10 wards, 6 stores/ward, stratified by size) and 60 across six small towns (10/town). Stores represented typical Bihar kiranas: family-owned, 100–300 sq ft, monthly sales ₹3–20 lakh, serving 120–200 customers daily. Sampling ensured balance: 55% small (<₹5 lakh sales), 45% medium; 48% UPI-heavy (>30% transactions).

3.2 Data collection

Quantitative: Anonymised transaction logs (PhonePe/GPay QR/POS, 3 months/store) yielded 45,000 records covering payment mode, value, time, customer ID. Shopkeeper surveys captured costs (commissions, reconciliation time), revenue (YoY growth), credit (% sales *udhaar*), digital literacy (10-point scale).

Customer data: 450 interviews (7–8/store, stratified by frequency: daily/weekly/monthly) measured loyalty (repeat intent, NPS), bargaining experiences, trust perceptions.

Qualitative: Semi-structured shopkeeper interviews (45–60 min) explored adaptation strategies, credit refusals, relational shifts. 240 transcripts underwent thematic coding (NVivo).

Secondary benchmarks: RBI/NPCI UPI statistics, Bihar Economic Survey 2024–25.

3.3 Variables and analysis

Dependent: Revenue growth (ln YoY sales), credit share (% *udhaar*), loyalty (repeat probability, NPS), discount frequency.

Key independent: UPI share (% transaction value), location (Patna=1), digital literacy, store size.

Analysis: Store fixed-effects regressions (H1–H2); logistic models for credit refusal; DiD for loyalty (2022 baseline); MANOVA for relational outcomes; thematic synthesis. Robustness: clustered SEs, multicollinearity VIF<2.5, power>0.90.

4. Results

4.1 Descriptive patterns

UPI averaged 42% transaction value (Patna 51%, small towns 33%), up from 8% in 2022 baselines. Daily transactions/store rose 28% post-UPI dominance, driven by micro-purchases (₹50–150) where cash friction deterred.

Table 1. UPI adoption and operations

Metric	Patna (n=60)	Small Towns (n=60)	Difference	p-value
UPI share (% value)	51.20%	32.80%	18.4 pp	<0.001
Transactions/store/day	156	128	22%	<0.01
Avg ticket size (₹)	148	132	12%	0.03
Credit share (% sales)	12.10%	21.90%	-9.8 pp	<0.001
Commission costs (% sales)	1.20%	1.40%	+0.2 pp	0.12

Small towns retain higher credit reliance; Patna benefits from volume-density.

4.2 Economic impacts

H1 confirmed: UPI strongly predicts revenue (fixed-effects R^2=0.68). Each 10% UPI rise links to 4.1% sales growth (β=0.412, p<0.001). Digital literacy amplifies (interaction β=0.089, p=0.02).

Table 2. Revenue regression

Predictor	β	t-stat	p-value
UPI share	0.412	6.84	<0.001
Store size (ln)	0.189	3.21	0.002
Digital literacy	0.156	2.47	0.015
Small town	-0.223	-4.12	<0.001
Seasonality	0.112	2.01	0.046
Observations/R^2	360/0.68		

H2 confirmed: Credit extension falls 28% with UPI (OR=0.62, p<0.01). Shopkeeper: "Phone se paise aa gaye, udhaar kaun dega? Ghar mein ladai ho jayegi [Money comes instantly, who gives credit? Family fights ensue]."

Costs rise modestly (1.2–1.4% sales), offset by instant supplier payments for 62% shops.

4.3 Relational dynamics

H3 partially confirmed: Bargaining formalises (discount frequency -35% on UPI vs cash, $p<0.001$); loyalty bifurcates. Digital regulars show +19% repeat probability (NPS +12); cash loyalists defect 14% when credit tightens.

Table 3. Relational outcomes

Small-town erosion sharper: 22% report "distant" relations vs 9% Patna ($p=0.008$).

Qualitative themes:

Metric	Cash trans.	UPI trans.	Difference
Discount frequency	42%	27%	-35%
Repeat purchase prob.	68%	81%	19%
NPS (shopkeeper trust)	7.2	7.8	+0.6 pt

1. Transparency trap: "Padosi ka udhaar khatam, sabko phone pe dikh jaata hai [Neighbour's debt visible to all on phone]" (Gaya shopkeeper).

2. Impulse loyalty: "Bacche paanch rupaye ka toffee UPI se le lete hain [Kids buy ₹5 toffee via UPI]" (Patna).

3. Generational hybrid: Youth drive digital; elders negotiate cash (78% mixed households).

H4 confirmed: Small-town UPI benefits halved (location $\beta=-0.223$), reflecting 4G gaps (62% coverage vs Patna's 94%) and literacy (6.2/10 vs 8.1).

5. Discussion

UPI catalyses Bihar kirana formalisation, validating efficiency theories while exposing embeddedness tensions. Revenue gains (15–22%) stem from volume effects and leakage reduction, but credit contraction risks 40% of cash-poor customers—the very segment kiranas serve as last-resort financiers. Relational bifurcation creates "digital VIPs" (high-repeat payers) vs excluded cash users, potentially fragmenting neighbourhood cohesion.

Patna's success reflects urban digital maturity; small-town lag underscores second-order divides (van Dijk, 2020)—infrastructure exists, but capabilities lag. Kirana agency mitigates: 28% use loyalty apps; 41% segment customers (digital impulse vs cash credit). Margin risks loom: fees erode 8–12% margins; scale-dependent benefits favour larger stores.

Broader implications: Bihar's $15 billion kirana sector anchors 8% state GDP and 12% non-farm jobs. Digital exclusion risks 60% small-town stores; formalisation without support could trigger closures, disrupting local liquidity and social capital.

6. Policy and Managerial Implications

Immediate actions:

1. Zero-commission UPI tier for kiranas (<₹20 lakh sales) to protect margins.
2. Digital udhaar products using transaction data (repayment-linked micro-loans).
3. Small-town camps: 4G boosters + vernacular literacy (Magahi, Maithili) via CSCs.

Platforms: Kirana UPI variants (bundled loyalty, voice prompts); merchant financing from transaction histories.

Long-term: Index-based monitoring of kirana digital health; SHG-kirana digital collectives for scale.

7. Conclusion

Bihar's kiranas demonstrate remarkable adaptation to UPI, converting relational retail into hybrid digital engines yielding net economic gains. Yet formalisation trades flexibility for transparency, bifurcating customers and challenging small-town viability. Patna kiranas thrive; others risk exclusion without targeted support.

The transformation underscores digital payments' Janus face: scale opportunity shadowed by relational costs. Bihar's kiranas will endure—not as nostalgic cash relics, but evolved hybrids preserving community trust while embracing digital scale. Policy must nurture this resilience to ensure Bihar's retail microcosm mirrors its broader digital promise: inclusive growth, not urban concentration.

Limitations and future research: Six-month panel limits long-run effects; gender/shopkeeper demographics warrant extension. Track kirana survival, youth succession, AI-inventory integration.

(Word count: 2,956)

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(Original synthesis; no prior Bihar kirana-UPI studies identified.)