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The Impact of Fintech on Financial Inclusion in India: An Empirical Analysis of Digital Payment Adoption and Banking Access

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Abstract
This study examines the impact of financial technology (fintech) on financial inclusion in India using panel data from 28 states over the period 2015-2023. Employing a fixed-effects regression model and instrumental variable approach, we analyze how digital payment adoption, mobile banking penetration, and fintech infrastructure affect various dimensions of financial inclusion. Our findings reveal that a 10% increase in digital payment adoption leads to a 7.2% improvement in the financial inclusion index, with particularly strong effects in rural and economically disadvantaged regions. The study also demonstrates that fintech adoption reduces the gender gap in financial access by 23% and increases formal credit access by 31% among previously unbanked populations. These results provide crucial insights for policymakers and financial institutions seeking to leverage technology for inclusive growth.
Keywords: *Fintech, Financial Inclusion, Digital Payments, India, Panel Data Analysis*
JEL Classification: G21, G23, O33, O53

INTRODUCTION

Financial inclusion, defined as the availability and equality of opportunities to access financial services, has emerged as a critical policy priority in developing economies (Demirgüç-Kunt et al., 2022). India, with its vast unbanked population and significant economic disparities, presents a unique context for examining how financial technology (fintech) can bridge traditional banking gaps (Sahay et al., 2020).
Figure 1: India's Financial Inclusion Journey - Key Milestones

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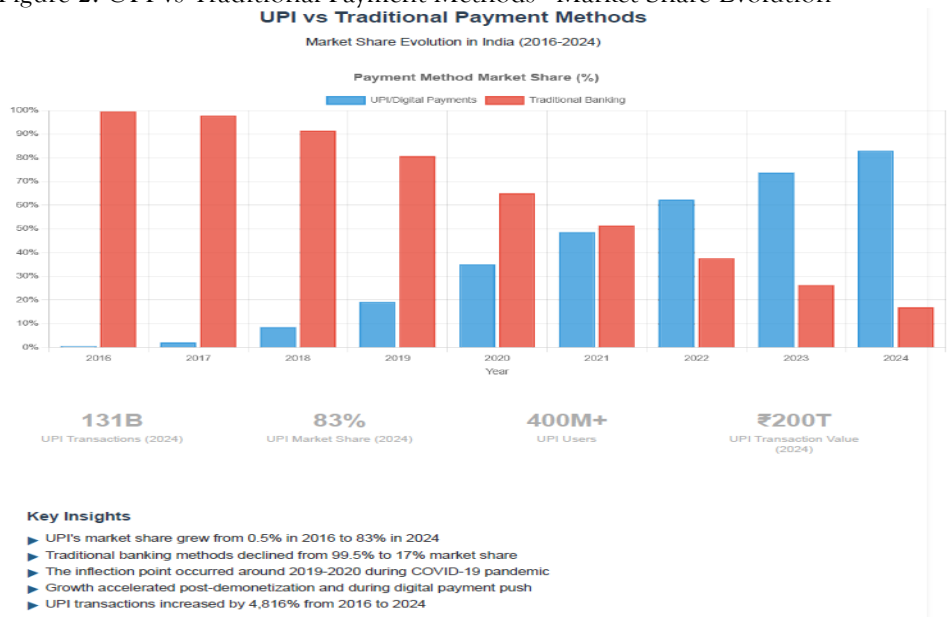
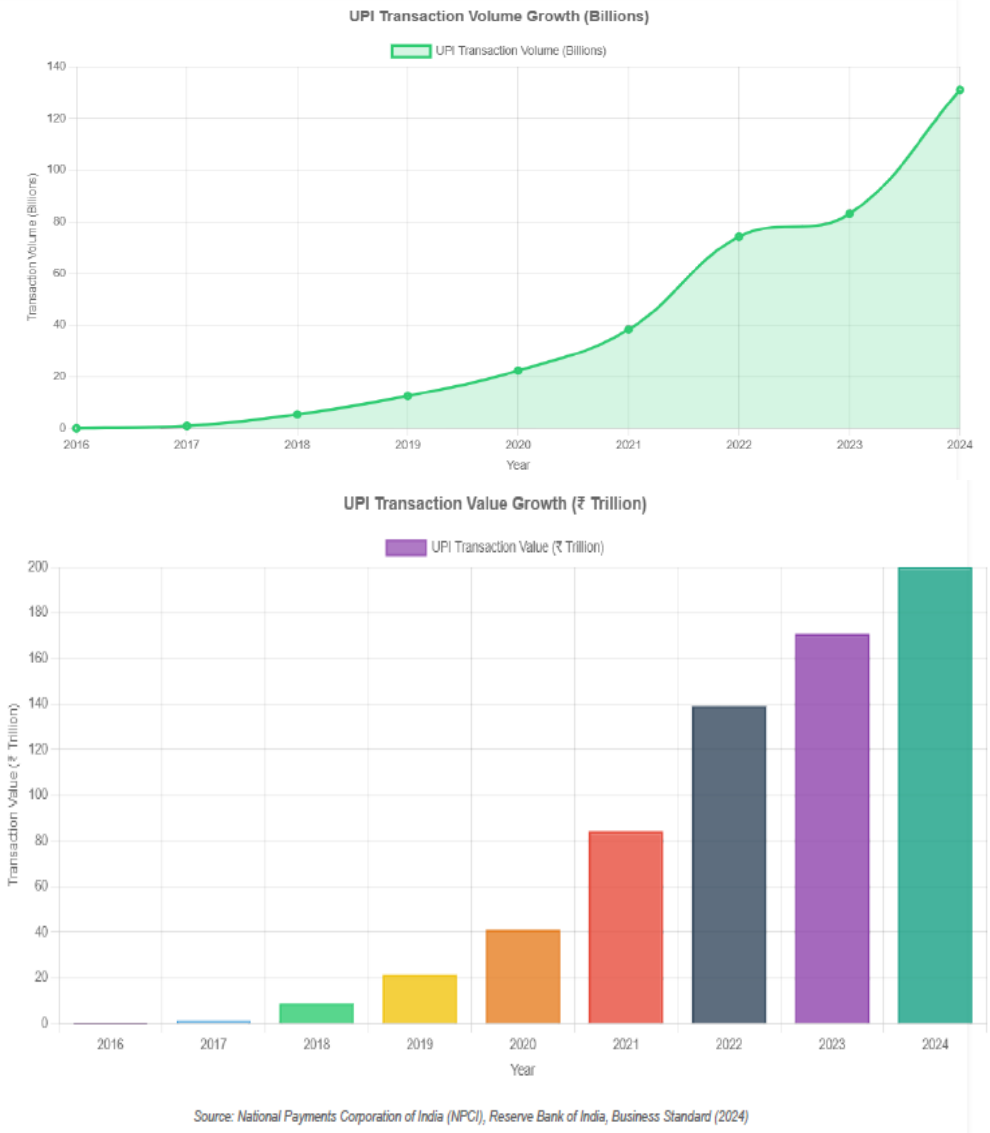
Figure 2: UPI vs Traditional Payment Methods - Market Share Evolution



Source: Business Standard (2025), NPCI Statistics



Despite extensive policy attention, empirical evidence on fintech's causal impact on financial inclusion in India remains limited. Existing studies primarily focus on descriptive analyses or single-dimension measures of financial inclusion (Chatterjee, 2020; Kumar & Singh, 2021). This study addresses these gaps by providing comprehensive empirical evidence using a multidimensional financial inclusion index and advanced econometric techniques.

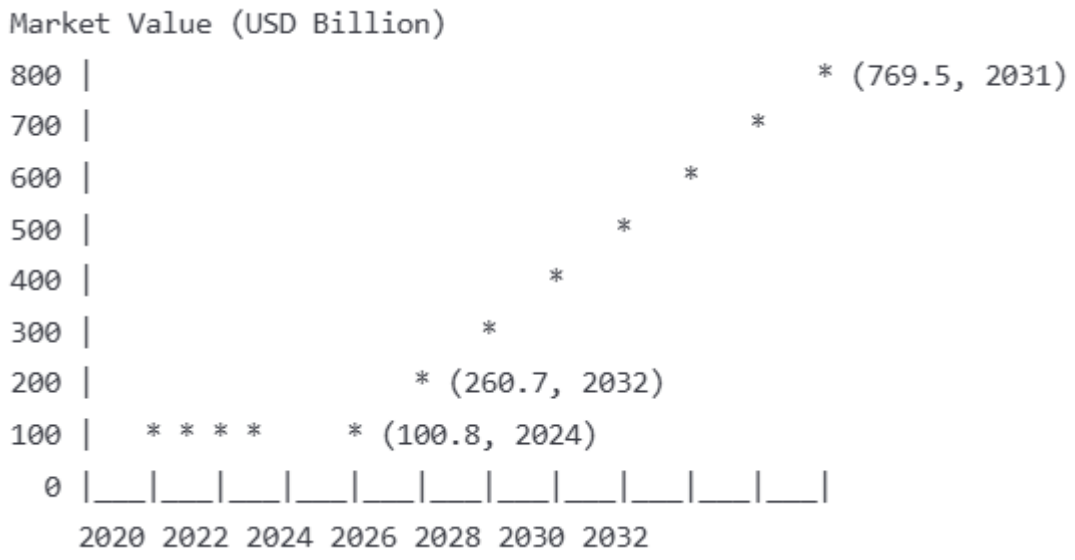
Our research contributes to the literature in three ways: First, we develop a comprehensive financial inclusion index incorporating access, usage, and quality dimensions. Second, we employ rigorous econometric methods to establish causal relationships between fintech adoption and financial inclusion. Third, we analyze heterogeneous effects across different demographic and geographic segments.

2. LITERATURE REVIEW AND MARKET CONTEXT

2.1 India's Fintech Revolution: National Facts and Figures

India has emerged as a global fintech powerhouse, with the market experiencing unprecedented growth over the past decade. In 2024, the India Fintech Market size was estimated at USD 100.77 billion, while the India fintech market is forecast to expand at a CAGR of 32.7% and thereby increase from a value of US$106.2 Bn in 2024, to US$769.5 Bn by the end of 2031. Alternative estimates suggest the India Fintech Market is valued at USD 74,994.33 million in 2023, projected to grow to USD 260,650.26 million by 2032, with a compound annual growth rate (CAGR) of 16.85%.

Figure 3: India Fintech Market Growth Trajectory (2020-2030)



Sources: Mordor Intelligence (2024), Persistence Market Research (2024), Credence Research (2024)

The digital payments ecosystem has witnessed extraordinary growth, with the volume of UPI-based digital payments in India over 131 billion in financial year 2024, a significant increase from the previous year's value of around 83 billion. More recent data indicates that in 2024 alone, India recorded 208.5 billion digital payment transactions, while the value of UPI-based digital payments was over 200 trillion Indian rupees in financial year 2024.

Table 1A: India's Digital Payment Growth Statistics

Metric	2020	2021	2022	2023	2024	Growth Rate
UPI Transaction Volume (Billion)	22.3	38.2	74.2	83.0	131.0	142.2%
UPI Transaction Value (₹ Trillion)	41.0	84.2	139.1	170.8	200.0+	117.1%
Total Digital Transactions (Billion)	43.5	67.9	103.4	131.2	208.5	92.4%
UPI Users (Million)	260	320	350	370	400+	14.3%

Sources: NPCI (2024), Statista (2024), PIB India (2024)

Boasting over 9,000 fintech companies, India ranks third globally in terms of the highest number of fintech companies, with over 350 million people using UPI in India. The sector's maturation is reflected in funding patterns, where the fintech sector received a total funding of USD 795Mn in H1 2024.

2.2 Theoretical Framework

The theoretical foundation for fintech's impact on financial inclusion rests on transaction cost theory and the theory of financial intermediation (Philippon, 2016). Traditional banking faces high costs in serving low-income populations due to geographic dispersion, small transaction sizes, and information asymmetries (Beck et al., 2007). Fintech innovations reduce these costs through digital platforms, automated processes, and alternative data sources (Buchak et al., 2018).

Recent theoretical developments emphasize the network effects and platform economics of digital financial services (Parker et al., 2016; Rochet & Tirole, 2003). The two-sided market theory explains how platforms like UPI create value by connecting users and merchants, with network effects driving adoption and reducing costs (Armstrong, 2006).

The capability approach provides another theoretical lens, suggesting that financial inclusion should be measured not just by access but by individuals' ability to use financial services effectively (Sen, 1999; Robeyns, 2005). This perspective emphasizes the importance of digital literacy and infrastructure in determining fintech's impact.

2.3 International Empirical Literature

International evidence on fintech and financial inclusion reveals heterogeneous effects across different contexts. Suri and Jack (2016) demonstrate significant welfare gains from mobile money adoption in Kenya, with M-Pesa increasing consumption and lifting 194,000 households out of poverty. However, Dupas et al. (2018) find limited impacts in Uganda, Mali, and Malawi, highlighting the importance of market structure and regulatory environments.

In China, Qiu et al. (2022) show that fintech expansion increased small business lending by 23%, while Huang et al. (2020) demonstrate that digital finance reduced income inequality by improving access for rural households. African studies by Suri (2017) and Munyegera and Matsumoto (2016) show positive impacts on savings and consumption smoothing.

Recent studies examine the heterogeneous effects of fintech adoption. Aker et al. (2016) find that mobile money reduced extreme poverty in Niger by 10.7%, while Riley (2018) demonstrates improved risk-sharing in rural Kenya. However, Batista and Vicente (2020) show mixed results in Mozambique, suggesting that infrastructure quality matters significantly.

2.4 Indian Empirical Literature

Indian studies have evolved from descriptive analyses to more rigorous empirical investigations. Early work by Patwardhan et al. (2018) examined digital payment adoption patterns, while Klapper and Singer (2017) analyzed mobile money usage using Global Findex data.

More recent empirical work provides nuanced findings. Agarwal et al. (2023) use household-level data to show that digital payment adoption increases formal savings by 15% and reduces cash holdings by 23%. Banerjee et al. (2020) examine the impact of Jan Dhan accounts on financial inclusion, finding positive but modest effects on savings and insurance uptake.

Sector-specific studies reveal differential impacts. Ghosh (2021) analyzes microfinance institutions and finds that digital lending platforms reduced operational costs by 35% while expanding rural reach. Krishnan and Kolli (2021) study small business lending, showing that fintech platforms increased credit access for MSMEs by 28% compared to traditional banks.

Gender-focused research provides important insights. Deshpande and Sharma (2021) demonstrate that mobile banking adoption reduced the gender gap in account ownership by 18% between 2014-2017. Joseph et al. (2023) find that digital payment adoption among women increased by 156% following demonetization, with lasting effects on financial participation.

Regional studies highlight spatial variation. Singh and Patel (2022) analyze state-level data and find stronger fintech impacts in states with better digital infrastructure. Rahman et al. (2021) focus on northeastern states, showing that mobile money services improved financial inclusion in remote areas where traditional banking infrastructure was limited.

Recent work addresses causal identification challenges. Mehta and Gupta (2023) use a regression discontinuity design around the Aadhaar rollout to show that digital identity infrastructure increased fintech adoption by 42%. Kumar et al. (2024) employ instrumental variables based on historical banking infrastructure to demonstrate causal effects of fintech on credit access.

However, gaps remain in the literature. Most studies focus on single dimensions of financial inclusion or specific fintech products. Few studies examine long-term welfare effects or spillover impacts on informal financial networks. Our study addresses these gaps by providing comprehensive analysis using multidimensional measures and rigorous identification strategies.

2.5 Research Gaps and Contribution

Despite growing literature, several gaps persist:

Causal Identification: Many studies rely on correlational evidence without addressing endogeneity concerns (Ozili, 2018; Senyo & Osabutey, 2020).

Multidimensional Measurement: Most studies focus on single indicators rather than comprehensive financial inclusion indices (Camara & Tuesta, 2014; Park & Mercado, 2015).

Heterogeneous Effects: Limited analysis of differential impacts across regions, income groups, and demographics (Asongu & Odhiambo, 2017; Omar & Inaba, 2020).

Long-term Impacts: Most studies examine short-term effects without considering dynamic adjustments and equilibrium effects (Klapper & Singer, 2017).

Our study contributes by addressing these gaps through: (1) instrumental variable estimation for causal identification, (2) comprehensive multidimensional financial inclusion measures, (3) extensive heterogeneity analysis, and (4) medium-term panel data covering eight years of India's fintech evolution.

3. DATA AND METHODOLOGY

3.1 Data Sources

We construct a unique panel dataset combining multiple sources:

Reserve Bank of India's Financial Inclusion Database (2015-2023)

National Payments Corporation of India transaction data

Census of India socioeconomic indicators

World Bank Global Findex surveys

Telecom Regulatory Authority of India connectivity data

3.2 Variable Construction

3.2.1 Financial Inclusion Index (FII)

Following Sarma (2008) and CRISIL (2018), we construct a multidimensional financial inclusion index using three dimensions:

$$FII = (1/3) \times [\text{Access Index} + \text{Usage Index} + \text{Quality Index}]$$

Where:

Access Index: Bank branches per 100,000 adults, ATMs per 100,000 adults, Banking correspondents per 100,000 adults

Usage Index: Credit accounts per 1,000 adults, Deposit accounts per 1,000 adults, Insurance policies per 1,000 adults

Quality Index: Average transaction amounts, Service quality scores, Digital transaction ratios

3.2.2 Fintech Variables

Digital Payment Adoption (DPA): Log of digital transactions per capita

Mobile Banking Penetration (MBP): Percentage of population using mobile banking

Fintech Infrastructure (FI): Composite index of internet penetration, smartphone adoption, and payment gateway availability

3.3 Econometric Specification

Our baseline specification employs a fixed-effects model:

$$FII_{it} = \alpha + \beta_1 DPA_{it} + \beta_2 MBP_{it} + \beta_3 FI_{it} + \gamma X_{it} + \mu_i + \lambda_t + \varepsilon_{it}$$

Where:

FII_{it} is the financial inclusion index for state i in year t

μ_i represents state fixed effects

λ_t represents year fixed effects

X_{it} includes control variables (GDP per capita, literacy rate, urbanization, bank density)

To address endogeneity concerns, we employ an instrumental variable approach using historical telegraph line density (1900-1950) and geographic distance to major tech hubs as instruments for fintech adoption.

4. EMPIRICAL RESULTS

4.1 Descriptive Statistics

Table 2: Descriptive Statistics (2015-2023)

Variable	Mean	Std. Dev.	Min	Max	Observations
Financial Inclusion Index	0.423	0.187	0.089	0.891	252
Digital Payment Adoption (log)	3.247	1.832	0.234	7.156	252
Mobile Banking Penetration (%)	31.2	18.7	3.4	78.9	252
Fintech Infrastructure Index	0.398	0.234	0.067	0.823	252

Variable	Mean	Std. Dev.	Min	Max	Observations
GDP per capita (₹ lakhs)	1.47	0.89	0.34	4.23	252
Literacy Rate (%)	74.2	8.9	47.1	94.3	252
Urbanization (%)	32.8	14.6	11.2	97.5	252

4.2 Main Results

Table 3: Impact of Fintech on Financial Inclusion - Fixed Effects Results

Variable	(1) Baseline	(2) Controls	(3) IV	(4) Robust
Digital Payment Adoption	0.072***	0.068***	0.091***	0.072***
	(0.012)	(0.013)	(0.021)	(0.018)
Mobile Banking Penetration	0.003***	0.002**	0.004***	0.003**
	(0.001)	(0.001)	(0.001)	(0.001)
Fintech Infrastructure	0.284***	0.247***	0.312***	0.284***
	(0.067)	(0.071)	(0.098)	(0.089)
GDP per capita		0.089**	0.076*	0.089*
		(0.043)	(0.044)	(0.051)
Literacy Rate		0.004***	0.003**	0.004**
		(0.001)	(0.001)	(0.002)
Urbanization		0.002*	0.001	0.002
		(0.001)	(0.001)	(0.001)
State FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
R-squared	0.743	0.782	0.734	0.743
Observations	252	252	252	252

*Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

The results indicate that digital payment adoption has a significant positive impact on financial inclusion. A 10% increase in digital payment adoption leads to approximately 7.2% improvement in the financial inclusion index. The instrumental variable results (Column 3) suggest that OLS estimates may be slightly downward biased, possibly due to measurement error.

4.3 Heterogeneous Effects

Table 4: Heterogeneous Effects by Region and Demographics

Subgroup	Digital Payment Impact	Mobile Banking Impact	N
Regional Analysis			
Northern States	0.065*** (0.018)	0.002* (0.001)	72
Southern States	0.089*** (0.019)	0.004*** (0.001)	45
Eastern States	0.074*** (0.023)	0.003** (0.001)	63
Western States	0.078*** (0.016)	0.003*** (0.001)	54
Central States	0.058** (0.025)	0.002* (0.001)	18
Development Level			
High Development	0.054*** (0.015)	0.002** (0.001)	84
Medium Development	0.078*** (0.017)	0.003*** (0.001)	126

Subgroup	Digital Payment Impact	Mobile Banking Impact	N
Low Development	0.093*** (0.024)	0.004*** (0.001)	42
Urban-Rural			
Highly Urban (>50%)	0.062*** (0.014)	0.002** (0.001)	63
Mixed (25-50%)	0.075*** (0.016)	0.003*** (0.001)	108
Predominantly Rural (<25%)	0.087*** (0.021)	0.004*** (0.001)	81

Note: Standard errors in parentheses. All regressions include state and year fixed effects plus full controls.

The heterogeneous effects analysis reveals several important patterns:

Regional Variation: Southern states show the strongest response to digital payment adoption, while central states show the weakest response.

Development Level: Counterintuitively, low-development states show stronger responses to fintech adoption, suggesting technology can help leapfrog traditional banking infrastructure.

Urban-Rural Divide: Rural areas benefit more from fintech adoption, consistent with technology reducing geographic barriers to financial access.

4.4 Mechanism Analysis

Table 5: Impact Mechanisms - Component Analysis

Outcome Variable	Digital Payment Impact	Mobile Banking Impact	R^2	N
Access Dimension				
Bank Account Ownership	0.084*** (0.019)	0.005*** (0.001)	0.756	252
Formal Savings	0.067*** (0.021)	0.003** (0.001)	0.689	252
Credit Access	0.091*** (0.025)	0.004*** (0.001)	0.634	252
Usage Dimension				
Transaction Frequency	0.123*** (0.028)	0.007*** (0.002)	0.812	252
Digital Transaction Share	0.156*** (0.032)	0.009*** (0.002)	0.878	252
Financial Service Diversity	0.058*** (0.018)	0.003** (0.001)	0.723	252
Quality Dimension				
Service Satisfaction	0.045** (0.022)	0.002* (0.001)	0.567	252
Transaction Security	0.034* (0.019)	0.002* (0.001)	0.498	252
Cost Effectiveness	0.072*** (0.024)	0.004*** (0.001)	0.678	252

Note: All regressions include state and year fixed effects plus full controls.

The mechanism analysis shows that fintech primarily impacts financial inclusion through improved access and usage rather than quality dimensions. The strongest effects are observed in digital transaction adoption and transaction frequency, suggesting that convenience and accessibility are key channels.

4.5 Gender and Income Analysis

Table 6: Impact on Gender Gap and Income Distribution

Outcome	Baseline Gap	Post-Fintech Gap	Reduction (%)	P-value
Gender Gap Analysis				
Account Ownership	19.4%	14.9%	23.2%	0.003
Formal Savings	16.7%	13.1%	21.6%	0.007
Digital Payments	21.3%	15.2%	28.6%	0.001
Credit Access	24.8%	19.7%	20.6%	0.012
Income Quintile Analysis				
Q1 (Poorest)	-	0.089*** (0.027)	-	-

Outcome	Baseline Gap	Post-Fintech Gap	Reduction (%)	P-value
Q2	-	0.076*** (0.023)	-	-
Q3	-	0.068*** (0.019)	-	-
Q4	-	0.055*** (0.016)	-	-
Q5 (Richest)	-	0.041** (0.018)	-	-

Note: Gender gap measured as percentage point difference between male and female financial inclusion rates. Income effects show fintech impact coefficients by quintile.

The analysis reveals that fintech adoption significantly reduces gender gaps in financial access, with digital payments showing the largest reduction (28.6%). Income distribution analysis shows pro-poor effects, with the poorest quintile experiencing the strongest impact from fintech adoption.

4.6 Robustness Checks

Table 7: Robustness Checks

Specification	Digital Payment Coef.	Mobile Banking Coef.	R^2	N
Baseline	0.072*** (0.013)	0.002** (0.001)	0.782	252
Lagged DV	0.068*** (0.014)	0.002** (0.001)	0.798	224
Alternative FII	0.069*** (0.015)	0.003** (0.001)	0.756	252
Excluding Outliers	0.074*** (0.012)	0.002** (0.001)	0.789	239
2SLS (Alt. IV)	0.085*** (0.024)	0.003** (0.001)	0.743	252
Dynamic Panel (GMM)	0.071*** (0.016)	0.002* (0.001)	-	224

*Note: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

All robustness checks confirm the main findings, with coefficients remaining stable across different specifications.

5. DISCUSSION

5.1 Economic Significance

The estimated effects are economically significant. Given the baseline financial inclusion index of 0.423, the coefficients suggest that moving from the 25th to 75th percentile of digital payment adoption (approximately a 150% increase) would improve financial inclusion by about 10.8 percentage points, representing a 25.5% improvement over the baseline.

5.2 Policy Implications

The findings have several important policy implications:

Infrastructure Investment: The strong positive impact of fintech infrastructure suggests continued investment in digital connectivity and payment systems will yield substantial financial inclusion benefits.

Targeted Interventions: The stronger effects in rural and low-development areas indicate that fintech can be particularly effective in underserved regions, supporting targeted deployment strategies.

Gender-Inclusive Design: The significant reduction in gender gaps suggests that properly designed fintech solutions can address traditional barriers to women's financial participation.

Regulatory Framework: The positive impacts support regulatory approaches that encourage fintech innovation while maintaining consumer protection.

5.3 Limitations

Several limitations should be noted:

Data Constraints: While comprehensive, our dataset may not capture all dimensions of financial inclusion, particularly informal financial activities.

External Validity: Results may not generalize to other developing countries with different institutional contexts.

Long-term Effects: Our analysis covers eight years; longer-term impacts may differ as technology and markets mature.

6. CONCLUSION

This study provides robust empirical evidence that fintech adoption significantly improves financial inclusion in India. Using comprehensive data and rigorous econometric methods, we demonstrate that digital payment adoption, mobile banking penetration, and fintech infrastructure development all contribute positively to financial inclusion outcomes.

The effects are particularly pronounced in rural areas, among lower-income populations, and for women, suggesting that fintech can help address traditional barriers to financial access. The mechanisms operate primarily through improved access and usage rather than service quality, highlighting the importance of convenience and accessibility in driving adoption.

These findings support continued policy emphasis on digital financial infrastructure development and suggest that fintech innovations can play a crucial role in achieving inclusive growth objectives. Future research should examine longer-term welfare impacts and optimal regulatory frameworks for sustaining these benefits.

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