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# Digital Financial Services, Transaction Velocity, and Macroeconomic Growth: A Systematic PRISMA Review and Research Agenda for Emerging Economies

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**Abstract**

Digital Financial Services (DFS) and Digital Public Infrastructure (DPI) have made so many changes in retail financial intermediation, allocation of capital, and macroeconomic circulation in developing market economies. By reducing the physical overhead and operational frictions linked with paper currency exchange, interoperable payment platforms change monetary circulation velocity, micro-enterprise formalization, and household liquidity management. Instead of the extensive usage of technology, scholarly research on the elasticity of digital transactional capacity output is still scattered.

Following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) methodology in a precise manner, this paper examines 110 peer-reviewed journal articles, central banks' working papers, and doctoral dissertations published from 2011 until 2026 in Scopus, Web of Science (SSCI), and institutional repositories. The findings have been categorized into four main thematic areas which include (i) transmission mechanism theory that links digital rails to endogenous growth, (ii) growth elasticity empirically examined in developing country panels, (iii) retail payment systems and the case of India Stack, and (iv) subnational spatial inequalities and demographics.

The review establishes that while digital payment systems reduce marginal transaction processing costs to near-zero levels and accelerate the velocity of money, their macroeconomic growth dividends are mediated by physical capital accumulation, institutional quality, and regional telecommunications infrastructure. Crucially, existing literature remains heavily skewed toward micro-level behavioral adoption surveys, creating a methodological gap in macro-econometric modeling—specifically time-series ARDL bounds testing and dynamic panel Two-Step System GMM estimations—that directly quantify real GDP and sub-national output elasticities. A structured future research agenda is formulated to bridge these empirical gaps.

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## 1. Introduction

Finance-Growth Relationship is a core area of study in contemporary development economics. The early theories developed by Schumpeter (1911), followed by the generalization provided by King and Levine (1993) have established the fact that effective financial intermediation facilitates innovation, enhances capital allocation efficiency and increases TFP. However, in case of

conventional banking systems, physical intermediation faces a number of operational challenges. Physical intermediation requires costly infrastructure, clerical verification, and physical currency transfer, thereby leading to credit rationing and exclusion of low-income groups.

In the last decade, developments in telecommunications and DPI have brought about a fundamental change to the mechanics of finance. Interoperable retail payments channels, such as UPI in India, Pix in Brazil, and mobile money systems in Sub-Saharan Africa, have de-linked financial transactions from the physical banking hall and physical points of sale. DFS function as a GPT that provides high-frequency transaction data, reduces transaction costs, speeds up the velocity of money, and facilitates algorithmic credit scoring.

As the digital transformation in advanced economies largely portrays an incremental migration from credit cards to mobile wallets, the encounters of emerging market and developing economies (EMDEs) shows a structural bounce over traditional physical branch infrastructure. Over the Global South, public and private payment innovations have fundamentally reviewed monetary velocity and retail liquidity. In East Africa, platform-based mobile money systems such as Kenya's M-Pesa demonstrated how telecommunications networks could absorb underbanked populations into formal transaction circuits. Similarly, Brazil's central-bank-operated instant payment network, Pix, rapidly displaced cash transactions by offering open, real-time settlement without commercial interchange fees. Within this global structural transition, India presents a compelling macroeconomic case study: the deployment of Digital Public Infrastructure (DPI) specifically the Unified Payments Interface (UPI) operates at a continental scale across a complex federal landscape, providing critical empirical insights for emerging economies seeking to mobilize domestic commerce and formalize informal production networks.

Despite widespread technological uptake, the economic literature displays an analytical disconnect. A substantial volume of published research focuses on micro-level user adoption using behavioral paradigms (such as the Unified Theory of Acceptance and Use of Technology, UTAUT) or localized household surveys. As such, there is very little research that examines quantitatively via econometrics the influence of digital payments on real GDP per capita and regional output (e.g., Gross State Domestic Product [GSDP]). This systematic review draws on the existing empirical literature from around the world and India spanning 110 studies to provide the mechanisms, methodology, and a focused research agenda.

## 2. Review Methodology: The PRISMA Protocol

The present review adheres to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses 2020) protocol in order to guarantee structural reproducibility, avoid selection bias, and have an auditable selection process.

### 2.1. Information Sources and Search Architecture

A systematic search strategy was employed in five primary electronic indexing sources, which include Scopus, Web of Science (Clarivate / SSCI), ScienceDirect (Elsevier), Emerald Insight, and SpringerLink. In order to cover technical information in institutions, working papers from central banks, and doctorial level studies, this dataset was augmented by the Reserve Bank of India (RBI Database on Indian Economy – DBIE), BIS, IMF, World Bank (Global Findex), and Shodhganga (INFLIBNET).

The database queries used were based on the following nested Boolean expressions within three distinct concepts: payment system (Construct A), economic growth indicators (Construct B), and econometric models within emerging economies (Construct C). The query string was developed in the following manner:

#### 2.1.1. Scopus Advanced Search Query String

TITLE-ABS-KEY (("digital financial services" OR "fintech" OR "digital payments" OR "UPI" OR "mobile money")
AND ("economic growth" OR "GDP" OR "GSDP" OR "per capita income" OR "financial deepening")
AND ("ARDL" OR "GMM" OR "dynamic panel" OR "cointegration")
AND ("India" OR "emerging economies")) AND PUBYEAR > 2010

To preserve relevance to sovereign retail payments and monetary clearing, an explicit exclusion parameter was incorporated: NOT ("cryptocurrency" OR "bitcoin" OR "Ethereum" OR "blockchain mining").

### 2.2. Study Screening, Eligibility, and Flow Metrics

The literature selection process followed the four PRISMA stages, moving from identification to the final analytical corpus:

**1. Identification**

Records identified via database searching: N = 384

- Scopus / Web of Science: n = 226
- Central Bank & Multilateral Archives (RBI, BIS, IMF, WB): n = 94
- Doctoral Dissertations & Theses: n = 64

↓

[Duplicates removed: n = 72]

↓

**2. Screening**

Records screened on Title & Abstract: N = 312 ⟶ [Records excluded: n = 168]

- Crypto-assets / Non-sovereign token volatility: n = 64
- Non-empirical essays / Opinion commentaries: n = 58
- Computing hardware / Network engineering: n = 46

↓

**3. Eligibility**

Full-text articles assessed for methodological quality: N = 144 ⟶ [Full-text records excluded: n = 34]

- Inadequate econometric controls / Missing diagnostics: n = 18
- Broken sample spans / Unverifiable empirical data: n = 16

↓

**4. Inclusion**

Final synthesized corpus for systematic review: N = 110

- Empirical Cross-Country Panels & Macro Time-Series: n = 52
- Digital Public Infrastructure (DPI), UPI & Regional Panels: n = 40
- Methodological Treatises & Growth Foundations: n = 18

### 2.3. PRISMA Selection Audit Matrix

**Table 1**

| PRISMA Stage | Total Pool (N) | Screening Criteria & Sub-Categories | Attrition & Specific Exclusions (n) |
|---|---|---|---|
| 1. Identification | $N = 384$ | • Scopus / Web of Science (Clarivate): $n = 226$<br>• Central Bank & Policy Portals (RBI DBIE, BIS, IMF, World Bank): $n = 94$<br>• Theses & Doctoral Dissertations: $n = 64$ | $n = 72$ duplicate records identified and removed prior to initial screening. |
| 2. Screening | $N = 312$ | Records evaluated via title and abstract against empirical economics criteria, sovereign payment systems, and macroeconomic output relevance. | $n = 168$ **excluded:**<br>• Speculative crypto-assets & non-sovereign token trading: $n = 64$<br>• Non-empirical essays, editorials, and opinion pieces: $n = 58$<br>• Pure engineering, computing hardware, and network protocols: $n = 46$ |
| 3. Eligibility | $N = 144$ | Full-text articles critically evaluated for econometric model specification, adequate control variables, and verifiable empirical data. | $n = 34$ **excluded:**<br>• Inadequate econometric controls / missing post-estimation diagnostic tests: $n = 18$<br>• Broken time-series spans / unverifiable empirical datasets: $n = 16$ |
| 4. Inclusion | $N = 110$ | **Final Synthesized Corpus:**<br>• Empirical Cross-Country & National Time-Series (ARDL / PVAR): $n = 52$<br>• Digital Public Infrastructure (DPI), UPI & Sub-National Panels: $n = 40$<br>• Methodological Treatises & Foundational Growth Theories: $n = 18$ | 100% **Met Eligibility Criteria**<br>Systematically indexed and analyzed within a dedicated Zotero research database. |

## 3. Empirical Literature on Thematic Synthesis

### 3.1. Transmission Channels and Macro-Growth Elasticity

The empirical literature links up on three distinct micro-to-macro transmission mechanisms relating with digital financial platforms to real output:

- **Minimization of Transaction Cost and Consumption Smoothing:** In many developing economies, buying and paying often takes real travel time and money. Clerks also handle paperwork by hand, and that adds fees. People may also wait around because transactions do not clear right away. When digital platforms come in, the cost to process each payment drops close to nothing. That lets users send many small transfers throughout the day. Studies that test mobile money in the field, including work on Kenya's M-Pesa by Jack and Suri (2014), show that when it is easier to move money, poorer households can smooth spending when they face bad personal shocks. The result is a rise of about 2% in consumption for households living in extreme poverty. More broadly, this kind of steady smoothing can help keep overall demand and personal consumption from swinging as much.
- **The Systemic Liquidity and the Velocity of Money:** Money fluctuates quicker when payments clear quickly. The Fisher identity ($M \cdot V = P \cdot Y$), relates money, speed, and real activity. If payments get settled quick, there is less waiting and less time consumed for holding currency idle. For payment systems that move funds through instant account transfers, the speed of money rises. With a great velocity, the same monetary base can support more retail transactions and it happens without creating the kind of inflation pressure that a slower system can bring.
- **Credit Mobilization with the help of Digital Footprints:** In the emerging economies, banks usually restrict loans, which happens when lenders cannot trust borrower information. Sometimes it also happens when borrowers do not hold land or other physical assets that banks accept, and digital payment systems can change this. Everyday purchases get turned and transferred into clear records, and those records can be checked. Digital payments can also be used to estimate cash inflows in a more regular way. Kemala and other colleges in 2026 explain the ways the underwriting methods take help of transaction data. Here the objective is to help MSMEs acquire funds for working capital. Many MSMEs have been left out of normal bank lending.

Research done with panel data in multiple countries points to a link as well. Bekele and others in 2026 look at Sub Saharan Africa. JEAS in 2026 studies Asian economies. Both lines of work report a positive long term co integrating relationship. In simple terms, when digital inclusion rises, GDP per capita tends to rise too. This pattern shows up across several digital inclusion measures. Nevertheless, country-level time series analysis (e.g., Yahaya, 2026) emphasizes the fact that geographical ruralness and telecommunications shortcomings pose significant challenges.

### 3.2. Benchmark Literature Review: Methodology and Empirics

The table below presents an analysis of important empirical works in terms of sample period, methodology, specifications, elasticities, and limitations:

**Table 1:** Econometric and Methodological Synthesis of Benchmark Empirical Literature

| Study & Year | Geographic Scope & Period | Econometric Model | Core Dependent & Explanatory Variables | Key Findings & Quantitative Elasticity | Methodological Limitations & Empirical Gaps |
|---|---|---|---|---|---|
| Jack & Suri (2014) | Kenya (2008–2010 panel) | Difference-in-Differences (DiD) with household fixed effects | **Dep:** Real per capita household consumption **Core:** M-Pesa mobile money adoption, health/weather shock dummy | The use of mobile money lowered costs of transactions and allowed households to smooth their consumption completely; consumption of extremely poor increased by 2%. | Microeconomic household survey; does not give an output elasticity ($\beta$) for GDP. |
| Pradhan *et al*. (2021) | India (1990–2019 time-series) | Vector Error Correction Model (VECM) & Johansen Cointegration | **Dep:** Real Gross Domestic Product per capita **Core:** Telecommunications infrastructure, financial inclusion index | Established a long-run cointegrating vector; digital telecommunications and financial deepening Granger-cause real economic output. | Utilized traditional financial indicators (branches, ATMs); does not integrate post-2016 high-frequency instant retail payment data (UPI). |
| Yahaya (2026) | Nigeria (2001–2022 time-series) | ARDL Bounds Testing & Unrestricted ECM | **Dep:** Financial Inclusion Index **Core:** DFS adoption, telecom access, regulatory quality, rurality | The adoption of DFS is positively correlated to the level of inclusion ($\beta = 4.862, p < 0.001$); however, rurality negatively pulls on this variable ($\beta = -0.542, p < 0.05$). | National aggregate time series; unable to account for spatial variations at the state level. |
| Bekele *et al*. (2026) | 36 Sub-Saharan African economies (2004–2021) | Panel Vector Autoregression (PVAR) | **Dep:** Real GDP per capita **Core:** Multidimensional inclusion index (Benefit of the Doubt approach) | Positive financial inclusion shocks generate persistent, positive impulse responses on per capita GDP output. | Emphasizes physical banking indicators (ATMs, deposit accounts); lacks modern instant payment data. |
| JEAS Panel Study (2026) | 30 Asian Developing Economies (2014–2021) | Fixed Effects Dummy Variable Panel Model | **Dep:** ln(GDP per capita) **Core:** Digital Financial Inclusion Index (DFII), Inflation | Statistically significant positive elasticity between DFII and per capita GDP; inflation exerts negative drag. | Relies on triennial Global Findex surveys; lacks high-frequency continuous annual time-series. |
| Chaurasiya & Singh (2026) | BRICS economies (2012–2020) | Fixed Effects Driscoll-Kraay & 2SLS-IV | **Dep:** Financial Risk ($FR$) **Core:** Inclusion index, Institutional Quality ($IQ$), $IQ \times FI$ interaction | Inclusion and governance interact to reduce systemic fragility; $IQ \times FI$ interaction shows strongest dampening. | Cross-country focus; does not evaluate domestic federal or inter-state spatial divergences. |
| Haldankar & Sajilal (2024) | India (July 2016 – December 2023) | Log-linear regression, paired $t$-tests, ANOVA | **Dep:** Monthly UPI volume of transaction **Core:** COVID-19 shock, POS/ATM throughput | Pandemic prompted behavioral shifts; UPI transaction volume replaced ATM and POS terminal growth. | Assesses platform throughput; does not model direct growth elasticity over aggregate real GDP or GSDP. |
| Pandey & Kushwaha (2026) | India (Rural UP & MP districts) | Structural Equation Modeling (SmartPLS 4) | **Dep:** Behavioral intention to have digital payments **Core:** Facilitating conditions, perceived security | Enabling telecom conditions and recognized security dictate adoption between rural women cohorts. | Cross-sectional behavioral survey ($N = 468$); do not capture aggregate macroeconomic output results. |
| Le Quoc (2024) | Global Panel (2015–2021) | Panel Vector Autoregression (PVAR) | **Dep:** Economic Growth ($EG$) **Core:** Digital inclusion index, gender inequality | Digital financial inclusion brings growth globally, but widens gender gaps in systems with dull baseline infrastructure. | Short time-horizon; omits granular central bank payment system indicators. |

### 3.3. Retail Payment Systems and the Indian Context

India's digital transition represents a departure from traditional financial inclusion strategies. After d years for physical branches considering social banking regulations, the "India Stack" launch, involving the biometric verification, universal bank accounts considering Pradhan Mantri Jan Dhan Yojana (PMJDY) scheme, and the Unified Payment Interface (UPI), reorganised retail transactions.

- **UPI considering contact less:** The coronavirus-induced swiftness of the movement from cash withdrawals with the help of physical ATMs and POS card payments for the QR code-based payments on mobile devices is here to stay.
- **The Macroeconomic Results:** An ongoing study shows up in Indian research on macroeconomic output, where some of the authors consider that rising digital transaction volume comes from people with the help of digital payments in spite of cash or money. In this view, total output does not rise, even if transactions grow (see, for example, Nahata, 2018; Sujlana & Kiran, 2018). Other studies point in a different direction, making a point that digital transactions work as an infrastructure and also debated this can spike GDP rather than leave it same (see, for example, Pradhan *et al*., 2021; Jain, 2026).
- **Comparative Perspective of an Institutional Architecture:** Whereas the MNO closed-loop framework is there in Kenya or a duopoly private-platform infrastructure is there in China (Alipay & WeChat Pay), India considered an open-access framework for its public-good platform which is run by the NPCI. By separating the consumer application interface from the underlying payment switch and linking settlements directly to bank accounts, the UPI rail achieved volume scalability with near-zero marginal processing fees. However, as observed in comparable emerging federations such as Brazil and South Africa,

the macroeconomic benefits of such digital payment switches remain conditioned by regional telecommunications bandwidth, electrical grid stability, and uneven commercial density, creating distinct spatial patterns of financial deepening between industrialized urban centers and agrarian rural states.

### 3.4. Spatial Disparities, Demographic Divides, and Governance by Institutions

The gains from digital money tools are not shared in the same way across places or groups.

- In many regions, the activity is more intense, as the Digital payment use and point of sale terminals are mostly seen in cities and more developed states. Rural-heavy states lag due to basic weaker networks. When district outputs get reviewed, digital access scores supposed to group near big business centers rather than spread evenly.
- Women and people having low literacy bears extra hurdles. Many women cannot have proper access to a smartphone, and there exists worry about safety as well. In rural surveys, what people do for the digital payments usually depends on whether support is available, or if instructions are clear in local language, and if the people feel fraud risks are real.
- For institutions and rules, the story is also conditional. Research from emerging markets shows that digital finance can lower risks in the wider system only when governance is solid. If rules are not there and cybersecurity steps are not aligned, rapid id growth of payment apps can create harm, and in that case, people who are less protected have higher chances to face scams and predatory schemes.

## 4. Methodological Synthesis: Time-Series Cointegration and Dynamic Panel Estimators

A careful synthesis of the literature suggests that for measuring the influence of DFS on economic growth, it is important to consider econometric problems such as non-stationarity, structural breaks, unobservable spatial heterogeneity, and dynamic endogeneity. In the literature reviewed (110 papers), scholars make use of two main econometric approaches, depending on the level of data aggregation.

### 4.1. Econometric Time Series Analysis: ARDL Bound Testing Approach

The approach to bound testing that was designed by Pesaran, Shin, and Smith (2001) serves as the standard specification when analyzing countries using a time series approach.

**Theoretical Underpinnings and Comparative Strengths**

- **Mixed Integration Characteristics:** Conventional cointegration methods (like the Engle-Granger approach or the Johansen-Juselius methodology) necessitate all the variables to be unit root processes, or to be $I(1)$. processes. Digital transaction data, telecommunications substitutes, and economic growth rates often show mixed order integrations $I(0)$ and $I(1)$). The ARDL methodology does not depend on whether the regressors are all $I(0)$, $I(1)$, or cointegrated with each other as long as none of them is $I(2)$.
- **Robustness in Finite Samples:** For post-demonetization or post-UPI single-country analysis when time intervals such as years or quarters are relatively restricted, ARDL delivers consistent estimates of long-term coefficients and valid t-statistics where asymptotic distributions fail.
- **Short- and Long-Run Dynamics Simultaneously:** ARDL employs the UECM approach to specify the model that simultaneously models long-run equilibrium and short-run speed of adjustment.

**Formal Econometric Specification**

The basic unrestricted error-correction equation of growth is specified as follows:

$$\Delta \ln(\text{GDP\_PC}_t) = \alpha_0 + \sum_{i=1}^{p} \gamma_i \Delta \ln(\text{GDP\_PC}_{t-i}) + \sum_{j=0}^{q_1} \delta_j \Delta \ln(\text{DFSI}_{t-j}) + \sum_{k=0}^{q_2} \theta_k {}'\Delta \text{X}_{t-k} + \phi_1 \ln(\text{GDP\_PC}_{t-1}) + \phi_2 \ln(\text{DFSI}_{t-1}) + \phi_3 {}'\text{X}_{t-1} + \varepsilon_t$$

Where $\llbracket \text{GDP\_PC}_t$ represents the real Gross Domestic Product per capita, $\text{DFSI}_t$ stands for the Digital Financial Services Index, $\mathbf{X}_t$ is the macroeconomic variables (Gross Fixed Capital Formation, Inflation, and Trade Openness) and $\varepsilon_t$ is the white noise error term.

**Cointegration Hypothesis and Diagnostic Rules**

The null Hypothesis of zero cointegrating levels is tested using the non-standard F-statistics:

$$H_0: \phi_1 = \phi_2 = \boldsymbol{\phi}_3 = 0 \quad \text{versus} \quad H_1: \phi_1 \neq 0 \cup \phi_2 \neq 0 \cup \boldsymbol{\phi}_3 \neq \mathbf{0}$$

- If $F_{\text{calc}} > I(1)_{\text{upper critical bound}}$, the null hypothesis is rejected, establishing a long-run cointegrating vector.
- If $F_{\text{calc}} < I(0)_{\text{lower critical bound}}$, the null hypothesis cannot be rejected, indicating the absence of a stable level relationship.
- Once cointegration is confirmed, the speed of adjustment back to long-run equilibrium is captured by the lagged Error Correction Term ($\lambda \cdot \text{ECT}_{t-1}$), where $\lambda$ must be negative and statistically significant ($-1 < \lambda < 0$).

### 4.2. Dynamic Panel Econometrics as Two-Step System GMM

Characterized by cross-state divergences (such as Indian states), static panel estimators (Pooled OLS, Fixed Effects, Random Effects) produce biased and inconsistent estimates, when evaluating federal economies

**STATIC PANEL ESTIMATOR LIMITATIONS**

**Pooled OLS:** Ignores unobserved cross-sectional state effects ($\mu_i$), biasing the lagged dependent coefficient upward.

**Fixed Effects (Within):** Subtracting group means creates Nickell (1981) bias; the transformed lagged variable ($\tilde{y}_{i,t-1}$) correlates with the transformed disturbance ($\tilde{\varepsilon}_{it}$) in small-$T$ panels.

**Difference GMM:** First-differencing removes $\mu_i$ but introduces severe finite-sample bias when explanatory variables are highly persistent.

#### 4.2.1. Settling Endogeneity and Dynamic Feedback

In sub-national environment, digital payment expansion reveals bidirectional causality with output:

$$\text{Digital Financial Throughput (DFSI)}_{it} \rightleftharpoons \text{Economic Output (GSDP per capita)}_{it}$$

Whereas the high digital payment velocity revives commercial formalization and state output, economically advanced states holds more fiscal capacity to place fiber-optic networks, subsidized smartphone schemes, and merchant QR soundboxes.

#### 4.2.2. Econometric Specification

In order to address the problem of endogeneity, omitted variables, and dynamic behavior, the Two-Step System Generalized Method of Moments (System GMM) technique is utilized (Arellano & Bover, 1995; Blundell & Bond, 1998). System GMM constructs a system combining equations in first differences with equations in levels:

$$\ln(y_{it}) = \alpha_0 + \rho \ln(y_{i,t-1}) + \beta_1 \ln(\text{DFSI}_{it}) + \mathbf{X'}_{it}\boldsymbol{\gamma} + \mu_i + \tau_t + \varepsilon_{it}$$

Taking first differences eliminates the unobserved state fixed effect ($\mu_i$):

$$\Delta \ln(y_{it}) = \rho \Delta \ln(y_{i,t-1}) + \beta_1 \Delta \ln(\text{DFSI}_{it}) + \Delta\mathbf{X'}_{it}\boldsymbol{\gamma} + \Delta\tau_t + \Delta\varepsilon_{it}$$

#### 4.2.3. Moment Restrictions and Diagnostic Validation

System GMM uses lagged levels of the explanatory variables as instruments for the differenced equation, and lagged first differences as instruments for the level equation:

- **For the differenced equation:** $E\left[\ln(y_{i,t-s}) \cdot \Delta\varepsilon_{it}\right] = 0 \quad \text{for } s \geq 2$
- **For the level equation:** $E\left[\Delta \ln(y_{i,t-s}) \cdot (\mu_i + \varepsilon_{it})\right] = 0 \quad \text{for } s = 1$

For empirical validity to hold, there are three criteria to be met:

**Arellano-Bond Serial Correlation Test:** The residuals in first difference should show negative first-order serial correlation ($\text{AR}(1), p < 0.05$), while the hypothesis of lack of second-order serial correlation ($\text{AR}(2), p > 0.05$) should not be rejected.

**J-Hansen Overidentifying Restrictions Test:** It tests the general validity of instruments with respect to the null hypothesis of exogeneity of instruments. Acceptable range for $p$ -value is $0.10 \leq p \leq 0.25$.

**Safety Checks:** The number of instruments ($j$) must not be surpassing the number of cross-sectional units ($N$). To prevent overfitting endogenous regressors and weakening the Hansen test, researchers must enforce lag limits (e.g., laglimits(2 3)) and instrument matrix collapsing (collapse).

## 5. Identified Research Gaps and Future Research Agenda

After reviewing the 110 studies, three clear weak points show up in the current evidence.

### 5.1. Identified Empirical Research Gaps

**Table 3**

| Gap 1: Macro-GDP Output Elasticities | Gap 2: Granular Central Bank Indicators | Gap 3: Sub-National Dynamic Panel GMM |
|---|---|---|
| Move past micro surveys based on UTAUT and TAM. Build macro econometric models that can estimate how real GDP per capita responds. In other words, focus on the elasticity parameter, beta, linking GDP per capita to the volume and value of retail digital payments. | Replace low frequency proxy variables like branch counts and ATM numbers. Use faster payment system records from the central bank. Take help of RBI DBIE logs for UPI, IMPS, and RTGS. Combine these signals with Principal Component Analysis, so the main trends are captured without handling each series in isolation. | Deal with unobserved differences across states. Also handle endogeneity and the risk that causality can run both ways. Use Two Step System GMM to assess regional divergence while accounting for dynamic effects. |

**Gap 1: Absence of Direct Macroeconomic Output Elasticity Estimations for Payment Rails**

Most papers on digital platforms lean on micro level behavioral setups, like UTAUT and TAM, or they depend on localized household survey data. Consequently, the literature lacks formal macroeconomic models that estimate the empirical parameter elasticity ($\beta$) of real GDP per capita with respect to digital transaction throughput. Furthermore, existing growth models fail to isolate whether digital payment rails generate an independent impulse to real aggregate production or merely substitute electronic transfers for physical cash.

**GAP 2: Gaps in Use of Detailed Payment System Metrics from The Central Bank**

After changes like demonetization and the rollout of the India Stack, central banks have started sharing frequent data on payments. In India, the RBI has done this through its DBIE portal. The material covers monthly transaction counts and total value for separate payment routes, such as UPI, IMPS, RTGS, NEFT, and POS.

Most published work has not used these records much. Instead, researchers often depend on older stand-ins. Examples include the number of commercial bank branches or overall ATM figures. Future work should apply Principal Component Analysis (PCA) to central bank transactional data to build composite, high-frequency digital payment indices.

**Gap 3: Methodological Omission of Sub-National Dynamic Panel Divergence**

Prior scholarship is divided between cross-country aggregate regressions and localized single-district surveys. Few studies combine national time-series dynamics with sub-national panel estimations. In federal economies like India where telecom readiness, digital literacy, and industrial output vary substantially by state applying Two-Step System GMM to state-level panels is essential to determine whether digital financial expansion reduces or widens regional economic disparities over time.

## 6. Conclusion

In this systematic review, 110 research articles were reviewed to assess the implications of Digital Financial Services (DFS) and Digital Public Infrastructure (DPI) on macroeconomics in developing countries. The synthesis establishes that digital payment rails operate as essential general-purpose infrastructure that lowers marginal transaction costs, accelerates the velocity of money, and mitigates credit rationing via verifiable digital footprints. However, the benefits of DFS do not flow equally and are offset by physical capital investment, telecom infrastructure readiness, and regulations. Addressing the identified methodological gaps through rigorous time-series ARDL bounds testing and dynamic panel Two-Step System GMM will provide crucial empirical evidence for central banks and economic policymakers.

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