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THE ROLE OF DIGITAL PAYMENTS IN FINANCIAL DEVELOPMENT: COMPARATIVE ANALYSIS BETWEEN BRICS AND G7 COUNTRIES, WITH IMPLICATIONS FOR CENTRAL BANK DIGITAL CURRENCIES (CBDCS)

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ABSTRACT

This study examines the impact of digital payments on financial development by comparing emerging and developed economies, specifically BRICS and G7 countries, over the period from 2012 to 2023. This study assesses how digital payment deepening, measured by the volume of electronic money payments, influences financial development and what this may imply for future CBDC readiness. The analysis considers macroeconomic variables, including interest rate, inflation, unemployment, and gross domestic product growth. Financial development is measured by domestic credit to the private sector as a percentage of gross domestic product. Panel data econometric techniques are employed, with model selection guided by statistical tests and robustness checks. The findings reveal that digital payment expansion significantly enhances financial development in BRICS economies, likely due to improved access to digital financial services and inclusion. In contrast, the effect is statistically insignificant in G7 countries, where mature financial systems may reduce the marginal impact of additional payment digitalization. This divergence highlights the varying developmental roles of digital currencies across economic structures. The results also offer implications for CBDCs, suggesting that economies with stronger digital payment ecosystems may be better positioned to support CBDC implementation and diffusion. Recommendations include integrating digital currency initiatives with broader financial inclusion and employment strategies in emerging markets and enhancing regulatory and cybersecurity frameworks in developed nations.

Keywords: Digital payments, electronic money, central bank digital currency, financial development, emerging economies, developed economies, BRICS and G7.

INTRODUCTION

Financial technology (FinTech) has expanded rapidly, transforming the global financial system and encouraging the use of digital payments and services (Barroso & Laborda, 2022). This shift toward digital platforms is driven by demand for faster, safer, and cheaper financial solutions than traditional banks provide (Gomber et al., 2018). In response, many governments and central banks are developing digital payment systems to improve efficiency and financial inclusion (Tombini, 2023). One major innovation in this area is the Central Bank Digital Currency (CBDC), a government-backed digital form of money that is different from cryptocurrencies like Bitcoin. While no group controls cryptocurrencies, CBDCs are supported by governments and operate within official financial systems (Dionysopoulos et al., 2024). CBDCs offer benefits such as improved payment systems and greater financial inclusion while also reducing illegal activities (Son et al., 2023). However, they also pose risks like cybersecurity threats and disruption to commercial banks (Fanti & Moehr, 2022; Luu et al., 2023). Despite these risks, more than 130 countries are now exploring CBDCs as part of their digital transformation plans (Auer et al., 2023; Chhangani, 2023).

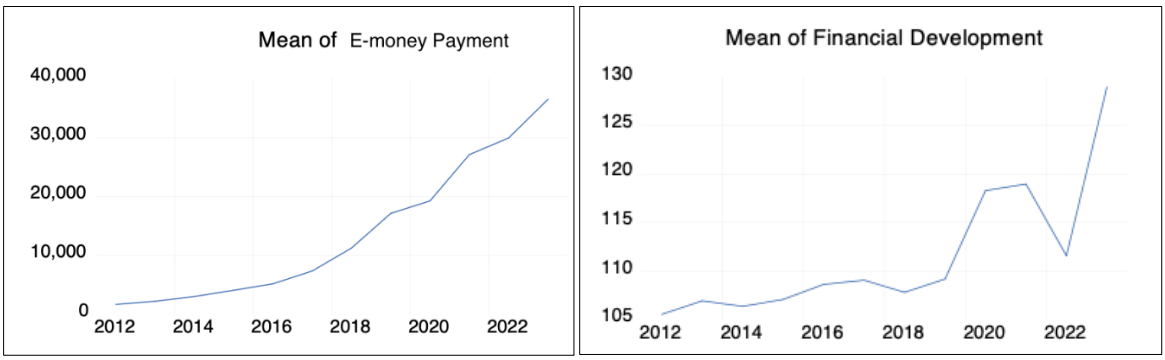
Countries like Brazil, Russia, India, China and South Africa (BRICS) have made strong progress in developing their financial systems to boost economic growth and make financial services more accessible (Guru & Yadav, 2019; Bhavish et al., 2018). These countries have improved credit access, grown their banking sectors, and expanded the use of mobile banking to reach people in underserved areas (Khatun & Bist, 2019). These efforts have made it easier to direct financial resources into key sectors of the economy (Bhavish et al., 2018). In contrast, developed countries in the G7, which are Canada, France, Germany, Italy, Japan, the UK, and the US, already have well-established financial systems with strong institutions and wide access to banking and capital markets (Timer & Raza, 2023). They also lead the way in digital finance and financial innovation, especially with advanced payment technologies and strong regulations and thus, G7 countries are often seen as global benchmarks in financial system development (Son et al., 2023).

Although CBDCs remain an important policy topic, the empirical reality is that comprehensive cross-country CBDC adoption data are still limited for the study period. Accordingly, this paper focuses directly on digital payments, specifically electronic money (e-money) transactions, as the core explanatory variable of interest. This is conceptually stronger because e-money transactions are an observable measure of payment digitalization rather than a stand-in for a monetary instrument that has not yet been widely implemented across countries. Existing literature shows that digital money development, including e-money and mobile payment systems, reflects the degree of payment system modernization, technological integration, and user adoption within an economy (Patel et al., 2024). In this sense, e-money transaction intensity captures the maturity of the digital payment ecosystem, which may shape financial development directly and may also carry implications for how CBDCs could later function within that ecosystem. Likewise, CBDCs are typically introduced within existing digital payment environments and often rely on infrastructure previously established for e-money and mobile financial services (Alliance for Financial Inclusion, 2022). Empirical evidence further shows that the increasing digitalization of payment systems reduces reliance on physical cash and strengthens conditions associated with digital monetary innovation (Zeng et al., 2025). Studies on consumer demand also highlight that familiarity with existing digital payment instruments significantly affects willingness to adopt CBDCs as a means of payment (Nocciola & Zamora-Pérez, 2024). Behavioral evidence from China's digital currency electronic payment system similarly demonstrates that prior experience with digital payment platforms shapes the adoption context of CBDCs (Xia et al., 2023). Recent evidence also suggests that digital transactions are positively associated with financial development, especially where structural barriers remain more binding, and that e-money development can support stronger monetary transmission, deposit growth, and credit expansion (Ullah et al., 2025).

In Figure 1, the mean volume of e-money payments (number in millions) reflects the extent of digital payment adoption in each economy. The consistent and significant rise in e-money transactions from 2012 to 2023 indicates rapid digital financial transformation. Likewise, financial development, which was measured by domestic credit to the private sector (% of GDP), has also increased during this period. By visualizing the mean values of both variables over time, Figure 1 illustrates how the growing diffusion of digital payment systems may correspond with an upward trend in financial development, offering preliminary insight into their potential relationship. These dynamics may also be relevant for future CBDC implementation, because stronger digital payment usage can signal payment-system readiness, consumer familiarity, and institutional capacity for digital currency deployment.

Figure 1

Average Yearly Trends of E-money Payment and Financial Development from 2012 to 2023



Although BRICS and G7 countries are at different stages of economic development, they both face challenges in financial development. BRICS countries struggle with limited access to formal financial services and high levels of unbanked populations, especially in rural and low-income areas (Khandare, 2019; Demirguc-Kunt et al., 2022). Additionally, they are heavily reliant on the US dollar for global trade, which exposes them to currency risk, trade imbalances, and limited monetary sovereignty (Nach & Ncwadi, 2024; Arnold, 2024). On the other hand, while G7 countries are more financially developed, they still face financial exclusion among the aging population (OECD, 2020). At the same time, outdated banking systems hinder the adoption of new technologies and contribute to growing inefficiency (Beck, 2025; Sharma, 2025). G7 financial systems also face growing cybersecurity risks, raising concerns about system resilience (Department of Finance Canada, 2025).

CBDCs, if effectively designed, could help to solve these issues. BRICS countries are actively exploring CBDCs to improve financial inclusion, modernize financial systems, and reduce their reliance on the US dollar through local currency-based cross-border transactions (Alora et al., 2024). In contrast, G7 countries are approaching CBDCs more cautiously due to concerns about cybersecurity, data privacy, financial stability and the potential disruption to the current banking system (Hall, 2021). Interest in CBDCs is increasing globally, yet most current research emphasizes their legal or technical dimensions. Against this background, digital payments are already playing a direct developmental role, regardless of whether a country has launched a CBDC. In BRICS countries, stronger digital payment usage may improve inclusion, lower transaction costs, and strengthen intermediation. In G7 countries, digital payments may contribute more to efficiency, convenience, and resilience than to major expansions in credit access. Therefore, the present study focuses on digital payment development as the primary empirical phenomenon, while drawing cautious implications for CBDCs rather than making direct claims about CBDC effects.

This study seeks to examine the impact of digital payment development, quantified through e-money transaction volumes, on financial development in both BRICS and G7 nations. This study provides valuable insights for policymakers and ministries in both emerging and advanced economies. Institutions such as Ministries of Finance, Ministries of Economy, and central banks across BRICS and G7 countries can leverage the findings to evaluate how the expansion of digital payments influences credit intermediation, financial inclusion, and financial system modernization. In addition, because CBDCs are likely to be introduced into already-digitized payment environments, the results may help policymakers assess which institutional and market conditions are most supportive of future CBDC adoption. The study also offers practical implications for investors by offering insights into evolving credit markets, interest rate dynamics, and competitive pressures in the banking sector, thereby supporting informed investment decisions within the finance and technology sectors.

Although past studies have made significant contributions to understanding CBDC design and implementation, most are theoretical or single-country focused. Adrian and Mancini-Griffoli (2019) proposed a framework of direct, hybrid, and synthetic models, Bindseil (2019) suggested a two-tier interest rate system to mitigate disintermediation, while Xia et al. (2023) provided empirical insights from China's digital yuan pilot, highlighting convenience, trust, and usefulness as key adoption factors. However, there is limited cross-country evidence on whether broader digital payment deepening contributes to financial development differently across emerging and advanced economies. This study fills the gap by comparing BRICS and G7 countries, showing that digital payments may play a stronger developmental role in countries with greater inclusion and modernization needs. At the same time, in advanced systems the effects may be more incremental. In doing so, the study provides a more defensible empirical foundation for discussing CBDC implications indirectly through payment-system development.

The remaining sections of this paper are structured as follows: Section II reviews the literature, while Section III outlines the data and methodology. Section IV reports and discusses empirical results. Lastly, Section V presents the conclusion and implications.

LITERATURE REVIEW

This section reviews the existing literature on the relationship between financial development and digital payments, identifying both opportunities and challenges. It also highlights research gaps and sets the foundation for the empirical analysis in later sections.

Digital payments and electronic money have the potential to reshape financial development by enabling financial systems to reduce information, enforcement, and transaction costs, thereby shaping the structure and efficiency of financial contracts, markets, and intermediaries across different institutional environments (Levine, 2005). One widely used indicator of financial development is domestic credit to the private sector as a percentage of GDP, reflecting the capacity of financial institutions to allocate resources productively (Beck et al., 2000). Electronic money and digital payment systems can potentially enhance financial development by improving payment systems can enhance financial infrastructure, enhancing financial inclusion, and enabling more effective monetary policy transmission (Auer et al., 2023; Ozili, 2022). By offering accessible digital financial services at a low cost, digital payment systems can provide unbanked and underbanked populations with new avenues to access credit, savings, and financial tools, an outcome strongly associated with improved financial development (Allen et al., 2022; Chen et al., 2022). Recent cross-country evidence also suggests that digital financial transactions positively influence financial development and that digital financial inclusion supports broader economic performance, particularly in developing settings (Basnayake et al., 2024; Ullah et al., 2025).

CBDCs share many functional similarities with e-money, particularly in delivering cashless, real-time, and user-friendly payment options that do not depend on traditional banking infrastructure. Both instruments operate outside the realm of commercial bank deposits and are designed to enhance financial access and payment efficiency. In fact, in Sweden's existing financial regulatory framework, a value-based CBDC is classified as e-money, reinforcing the conceptual and regulatory similarities between the two (Vollmar & Wening, 2024). According to the Bank for International Settlements (2015), e-money is usually denominated in the same currency as central or commercial bank money. It can be redeemed at par indicating its close link to the traditional money system. Moreover, digital currencies, including CBDCs, are viewed as digital-format assets with monetary features, and when issued by a sovereign authority for cash-like purposes, they effectively represent electronic money (Hong et al., 2018). Nonetheless, CBDCs and e-money are not identical. CBDCs are central bank liabilities, whereas e-money is generally privately issued. Therefore, rather than equating the two, this study treats e-money as a direct measure of payment digitalisation and discusses the relevance of CBDC only in terms of future institutional readiness and consumer familiarity. Nocciola and Zamora-Pérez (2024) show that familiarity with payment technologies shapes CBDC demand, while Dionysopoulos et al. (2024) show that increased e-money usage correlates with improved monetary policy transmission and financial inclusion. Likewise, Aguilar et al. (2024) find that a rise in digital payment adoption, analogous to widespread CBDC use, is positively linked to GDP growth and a reduction in informality, particularly in developing countries. Therefore, in the absence of comprehensive CBDC datasets, e-money serves as a practical and theoretically grounded proxy, especially in countries with high mobile payment penetration but no full-scale CBDC implementation.

However, despite the potential benefits, CBDCs may also pose risks to financial development, particularly through their impact on commercial bank deposits. Traditional financial intermediation relies heavily on deposit mobilisation to fund private-sector lending. G7 nations emphasise financial stability and monetary policy transmission which reflects Financial Intermediation Theory. According to Financial Intermediation Theory by Gurley & Shaw, banks play a critical role in collecting savings and allocating them to productive investments (Morrison, 1967). Since CBDCs are direct liabilities of central banks, their widespread adoption could lead to deposit outflows from commercial banks as the bank funding weakens, reducing their lending capacity and credit supply (Vollmar & Wening, 2024; Andolfatto, 2021). This disintermediate impact may be further increased if CBDCs offer interest-bearing characteristics that make them more attractive than bank deposits. Empirical data gives support for both the possible potential benefits and hazards of CBDC adoption. Kumhof and Noone (2021) demonstrate that interest-bearing CBDCs can dramatically cut commercial bank deposits, escalate funding costs, and restrain credit supply.

In contrast, Endogenous Money Theory indicates that banks can continue produce credit as long as there is adequate loan demand, independent of deposit levels (Sieroń, 2019). In such cases circumstances, banks may have to seek alternate, more costly sources of funds, such as interbank markets or central bank refinancing facilities (Bindseil, 2019; Bibi & Canelli, 2025), potentially reducing the efficiency of credit intermediation. Chiu et al. (2023) note that CBDCs can promote financial intermediation when interest rates are moderate, but excessive rates may lead to disintermediation. Furthermore, Werner (2014) indicate that credit creation is driven more by demand than by reserve availability, suggesting that lending remains available even if deposits drop decline but at greater costs.

Thus, while digital payments and e-money can support financial development by advancing digital financial inclusion, they can also disrupt traditional banking models and reduce domestic credit to the private sector. The overall impact of digital payments on financial development will depend on the

regulatory environment, the design of payment instruments, the extent of interoperability with banks, and the level of adoption among households and firms. Based on the literature, this study proposes three key assumptions: first, that digital payment development has a significant effect on financial development; and second, that this impact may differ between BRICS and G7 countries due to institutional, technological, and policy variations. A third, more cautious implication is that stronger digital payment ecosystems may create more favourable conditions for future CBDC implementation, even if they do not directly measure CBDC adoption.

Despite growing literature on Central Bank Digital Currencies (CBDCs) and digital finance, there remains a limited understanding of how digital payments interact with key macroeconomic determinants such as interest rates, inflation, unemployment, and domestic credit to influence financial development and economic growth, particularly in the context of BRICS and G7 countries. Most existing studies focus on technical design, policy implications, or individual case studies of CBDC implementation, with little emphasis on broad comparative panel evidence linking e-money and digital payment digitalization systems to financial development across diverse economic structures. Furthermore, cross-country comparative research that quantitatively assesses the role of digital payments within macroeconomic frameworks remains scarce.

This study aims to bridge these gaps by empirically analysing the impact of digital payment adoption, proxied by e-money transactions, on financial development across BRICS and G7 nations, using macroeconomic indicators as explanatory variables. By integrating digital payments into a macroeconomic panel data framework, this research offers a novel contribution by assessing how digital payments influence traditional credit dynamics and financial development outcomes in both emerging and advanced economies, and by drawing policy-relevant implications for future CBDC readiness.

METHODOLOGY

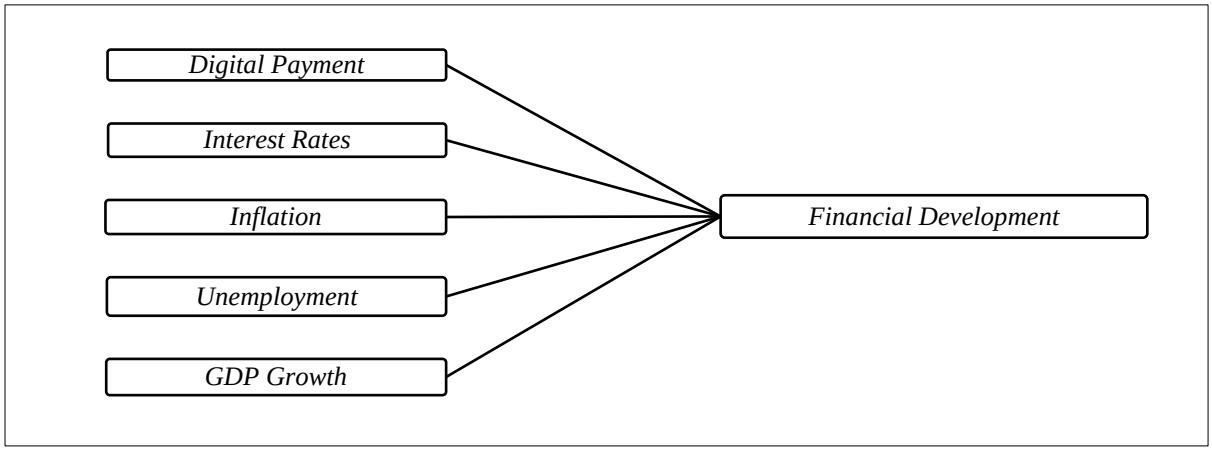
This study draws on four foundational economic theories to explore how digital payments and macroeconomic variables affect financial development in BRICS and G7 countries. The Financial Intermediation Theory highlights the role of banks in mobilising savings and allocating capital efficiently by accepting deposits and providing credit (Morrison, 1967). The expansion of payments, especially when stored outside conventional bank deposit channels, can divert household savings away from commercial banks, thereby diminishing their loanable funds and disrupting the intermediation process (Bindseil, 2019). On the other hand, Endogenous Money Theory offers a more flexible perspective, suggesting that banks create money through lending in response to credit demand rather than merely redistributing pre-existing deposits. Even if digital payment growth reduces deposit levels, banks can still lend, albeit at a higher cost due to alternative funding mechanisms (Badarudin et al., 2013).

The Financial Repression Theory underscores how government-imposed controls, such as interest rate ceilings and inflationary pressures, can discourage formal savings and restrict credit expansion, thus impeding financial development (Yülek, 2017). This is particularly pertinent in BRICS nations, where regulatory inefficiencies and a reliance on informal financial institutions are more prominent. In such situations, the expansion of low-yield or transaction-oriented digital payment instruments may promote formalisation and financial inclusion; yet, if these instruments are inadequately connected with the banking system, they may decrease the role of formal intermediaries in mobilising savings (Aguilar et al., 2024). In contrast, the Endogenous Financial Development Theory posits that financial systems evolve alongside economic growth. As employment and income rise, so does demand for more sophisticated financial products and services (Greenwood & Jovanovic, 1990). Digital payments, by facilitating digital transactions

and expanding financial access, especially in underserved areas, can catalyse this process, fostering deeper financial markets and greater inclusion (Auer et al., 2023). Collectively, these theoretical perspectives provide a robust foundation for understanding how digital payments, interest rates, inflation, unemployment, and GDP growth influence the evolution of the financial system across both emerging and developed economies, as shown in Figure 2.

Figure 2

Conceptual Framework



Building upon these theories and related empirical studies such as those by Kumhof and Noone (2021) and Chiu et al. (2023), this study employs a panel data econometric model to quantify the impact of digital payments and macroeconomic variables on financial development. The dependent variable is financial development, proxied by domestic credit to the private sector as a percentage of GDP. The key explanatory variable, digital payment (*DP*), is proxied by the number of e-money payments. Other independent variables include interest rate (*IR*), inflation (*INF*), unemployment (*UE*), and GDP growth (*GDPG*). The panel regression equation is specified as follows:

$$FD_{it} = \beta_0 + \beta_1 DP_{it} + \beta_2 IR_{it} + \beta_3 INF_{it} + \beta_4 UE_{it} + \beta_5 GDPG_{it} + \mu_i + \epsilon_{it} \quad (1)$$

Here, FD_{it} denotes financial development in country *i* at year *t*, and μ_i captures country-specific unobserved heterogeneity. This model structure allows for an evaluation of both temporal and cross-sectional variation in the determinants of financial development over the period 2012–2023.

The ratio of domestic credit to the private sector (% of GDP) is recognised and widely used in empirical research as a proxy of financial intermediation for financial development, reflecting the effectiveness of financial institutions in supplying funds to the private sector, which indicates the depth, efficiency, and resource allocation capacity in the banking system. This measure reflects the portion of financial intermediation, indicating to private investment and economic growth. Past studies such as De Haan et al. (2022); Jammeh (2022); Keho (2024) and Struthmann (2025), used domestic credit to the private sector as a proxy for financial development in cross-country analyses. Numerous researchers in reputable academic journals have adopted this indicator, consistent with established conventions in financial development research.

This study applies panel-data econometric techniques in EViews and Stata to examine the relationship between digital payments and financial development across BRICS and G7 countries over the 12 years from 2012 to 2023. A panel data approach is selected over pure cross-sectional or time-series analysis because it

offers several advantages: it allows for controlling for unobserved heterogeneity, increases degrees of freedom, reduces collinearity among regressors, and improves the efficiency of econometric estimates (Baltagi, 2021). This makes panel analysis particularly suitable for capturing both the temporal and cross-country variations present in macro-financial data (Baltagi, 2021; Hsiao, 2014).

Initial data diagnostics are conducted using EViews, where descriptive statistics and a correlation matrix are generated. The descriptive statistics summarise the central tendency and dispersion of each variable, while the correlation matrix measures the strength of association among variables and helps in identifying potential multicollinearity (Gujarati & Porter, 2009).

The main regression analysis is conducted using the Stata software. To ensure an appropriate model specification, this study employs traditional panel data techniques, namely Pooled Ordinary Least Squares (OLS), Fixed Effects Model (FEM) and Random Effects Model (REM). First, the F-test is used to compare the Pooled OLS model with the FEM. A significant result supports FEM, which is favoured for its ability to control for country-specific time-invariant characteristics that would otherwise bias estimates in Pooled OLS (Wooldridge, 2010). Second, the Breusch-Pagan Lagrange Multiplier (LM) test is conducted to determine whether the REM is preferable to Pooled OLS. A significant result favours REM, which assumes that unobserved effects are randomly distributed and uncorrelated with explanatory variables (Baltagi, 2021). Lastly, the Hausman test is performed to choose between FEM and REM. If the test is significant, FEM is preferred because it avoids the inconsistency that arises when explanatory variables are correlated with random individual effects (Hausman, 1978). This tiered approach ensures that the model selected is both statistically sound and theoretically appropriate.

To validate regression assumptions and avoid misleading inferences, the study conducts a series of diagnostic tests. Multicollinearity is checked using the Variance Inflation Factor (VIF), which ensures that explanatory variables are not excessively correlated (Singh & Kumar, 2021). Heteroskedasticity is tested using the Breusch-Pagan test, while autocorrelation is diagnosed using the Durbin-Watson statistic (Gujarati & Porter, 2009). Because this study involves multiple countries that may be simultaneously affected by global shocks, the Pesaran CD test is also applied to detect cross-sectional dependence, which is an issue that, if ignored, can result in biased standard errors and invalid hypothesis testing (Pesaran, 2020).

When heteroskedasticity, serial correlation, or cross-sectional dependence is identified, the study re-estimates the Fixed Effects Model employing Driscoll-Kraay standard errors. This estimator is preferred over other alternative methods such as cluster-robust or White standard errors because it concurrently addresses for heteroscedasticity, autocorrelation, and cross-sectional dependence, rendering it suitable for panels with a moderate number of time periods and cross-sections (Hoechle, 2007). Alternative methods may handle only one or two of these concerns, however Driscoll-Kraay offers a thorough correction, hence ensuring more dependable and efficient parameter estimates (Hoechle, 2007). The overall methodological strategy reflects a careful balance between theoretical rationale and empirical robustness, specifically designed for multi-country macroeconomic panel data.

However, it is acknowledged that the study does not explicitly test for endogeneity or reverse causality between digital payment adoption and financial development. Similar approaches are common in cross-country macroeconomic studies employing FEM and Driscoll–Kraay estimators, such as those by Iqbal et al. (2015) and Shah et al. (2021), which focus on association rather than causation. Following these precedents, this paper interprets the results as indicative relationships rather than strict causal effects. To further strengthen causal inference, future research could employ instrumental variable estimation or panel causality tests.

To capture heterogeneity between emerging and developed economies, separate models are estimated for BRICS and G7 countries. This approach allows clearer comparison of how digital payments influence financial development across different economic contexts. While no formal structural difference test is conducted, this methodological choice aligns with recent comparative studies such as Hussain et al. (2024), who examined the financial inclusion-growth nexus across Asian countries using subgroup regressions without formally testing for structural differences. Therefore, this study adopts a similar comparative framework to maintain methodological consistency with the existing literature on cross-country financial development.

The data utilized in this study spans a 12-year period from 2012 to 2023, covering two significant groups of countries: the BRICS nations and the G7 countries. Table 1 outlines the data sources and measurement details for the key variables examined in this analysis. Financial development is measured by domestic credit to the private sector (% of GDP), sourced from the World Bank's World Development Indicators (WDI). Digital payment activity is proxied by the number of e-money payments, obtained from the Bank for International Settlements (BIS). Interest rate data, representing central bank policy rates, are also sourced from BIS. Inflation and GDP growth rates, along with unemployment rates based on ILO estimates, are retrieved from the WDI. These internationally recognized data sources ensure consistency, credibility, and comparability of the macro-financial indicators used in the analysis.

Table 1

Data Sources

Variable	Proxy/Indicator	Measurement Unit	Source
Financial Development	Domestic Credit to Private Sector	Percentage of GDP	World Bank - WDI
Digital Payment	E-money Payment	Number in Millions	Bank for International Settlements - BIS
Interest Rate	Policy Interest Rate	Percentage (%)	Bank for International Settlements - BIS
Inflation	Inflation, consumer prices	Percentage (%)	World Bank - WDI
Unemployment	Total Unemployment Rate (ILO Estimate)	Percentage (%)	World Bank - WDI
GDP Growth	GDP Growth	Percentage (%)	World Bank - WDI

The integration of well-established theories, a carefully specified econometric model, rigorous diagnostic testing, and high-quality panel data ensures that this study provides robust empirical insights into the relationship between CBDC adoption and financial development across advanced and emerging economies.

RESULTS AND DISCUSSION

Descriptive Statistics

Table 2 presents the descriptive statistics for all variables across BRICS and G7 countries. On average, G7 economies exhibit higher financial development (FD = 129.12) compared to BRICS (FD = 90.26), consistent with their more mature financial systems. Interestingly, the average value of digital payment

is significantly higher in BRICS (26,941.90) than in G7 (2,908.02), though accompanied by substantial variability, suggesting uneven adoption across emerging markets. BRICS countries also show higher mean interest rates (6.85%), inflation (5.01%), and unemployment (11.46%) than G7 counterparts (0.69%, 1.94%, and 6.22%, respectively), reflecting their more volatile macroeconomic environments. Meanwhile, GDP growth in BRICS (3.29%) exceeds that of G7 (1.25%), indicating stronger economic momentum in emerging economies during the observed period.

Table 2

Descriptive Statistics

Country	Variable	Mean	Std. Dev.	Maximum	Minimum
BRICS & G7	*FD*	111.99	48.61	220.32	41.70
	DP	13,505.64	45,694.08	307,441.20	1.98
	IR	3.41	3.81	17.00	-0.10
	INF	3.29	2.80	15.53	-0.23
	UE	8.53	6.96	34.01	2.35
	GDPG	2.15	3.48	9.69	-10.30
BRICS	*FD*	90.26	43.75	186.21	41.7
	DP	26,941.90	66,631.60	307,441.20	1.98
	IR	6.85	3.07	17.00	2.00
	INF	5.01	2.71	15.53	0.23
	UE	11.46	9.11	34.01	4.31
	GDPG	3.29	3.68	9.69	-6.17
G7	*FD*	129.12	45.55	220.32	63.45
	DP	2,908.02	3,042.53	15,516.60	16.30
	IR	0.69	1.35	5.38	-0.10
	INF	1.94	2.23	8.20	-0.23
	UE	6.22	2.95	12.68	2.35
	GDPG	1.25	3.06	8.93	-10.30

Notes. FD refers to Financial Development, measured by domestic credit to the private sector as a percentage of GDP. DP is proxied by the value of e-money transactions. IR denotes the interest rate, INF represents inflation, UE stands for the unemployment, and GDPG indicates the GDP growth.

Correlation Matrix

Table 3 presents the correlation matrix for all variables across BRICS & G7, BRICS only, and G7 only. The matrix reflects the strength of association among variables without indicating causality. Preliminarily, digital payment shows the strongest positive correlation with FD across all panels, with coefficients of 0.49 (overall), 0.64 (BRICS), and 0.76 (G7). This suggests a substantial co-movement between digital payment and financial development, especially in developed economies, possibly due to greater digital financial integration. However, other macroeconomic indicators such as GDP growth exhibit weak correlations with financial development, implying that short-term economic growth alone does not necessarily lead to deeper credit markets. These associations provide early insights but must be interpreted with caution, particularly given the potential for multicollinearity (e.g., IR and INF correlation at 0.79).

Table 3

Correlation Matrix

Country	Variables	*lnFD*	*lnDP*	*lnIR*	*lnINF*	*lnUE*	*lnGDPG*
BRICS	*lnFD*	1					
& G7	*lnDP*	0.49	1				
	lnIR	-0.45	0.16	1			
	lnINF	-0.43	-0.01	0.79	1		
	lnUE	-0.24	-0.16	0.31	0.28	1	
	lnGDPG	-0.04	0.18	0.23	0.22	-0.09	1
BRICS	*lnFD*	1					
	lnDP	0.64	1				
	lnIR	-0.45	-0.59	1			
	lnINF	-0.59	-0.65	0.67	1		
	lnUE	0.17	-0.22	0.00	0.32	1	
	lnGDPG	0.13	0.31	-0.12	-0.26	-0.41	1
G7	*lnFD*	1					
	lnDP	0.76	1				
	lnIR	0.04	0.16	1			
	lnNF	0.03	0.11	0.73	1		
	lnUE	-0.46	-0.37	-0.06	-0.12	1	
	lnGDPG	0.03	0.04	0.15	0.27	-0.05	1

Notes. FD refers to Financial Development, measured by domestic credit to the private sector as a percentage of GDP. DP is proxied by the value of e-money transactions. IR denotes the interest rate, INF represents inflation, UE stands for the unemployment, and GDPG indicates the GDP growth.

Result of Panel Data Analysis Dependent Variable: lnFD (BRICS and G7)

Table 4 presents the regression outcomes for financial development across BRICS and G7 countries, using Pooled OLS, REM, FEM, and FEM with Driscoll–Kraay standard errors. The Breusch-Pagan LM test ($\chi^2 = 149.54$, $p < 0.01$) rejects the Pooled OLS specification in favor of a panel estimator. Although the Hausman test result ($\chi^2 = 10.71$, $p = 0.06$) falls just above the 5% threshold, it remains statistically significant at the 10% level, supporting the adoption of the Fixed Effects Model (FEM) to account for country-specific heterogeneity. Further diagnostic tests detect the presence of heteroskedasticity ($\chi^2 = 895.34$, $p < 0.01$), serial correlation ($F = 77.58$, $p < 0.01$), and cross-sectional dependence ($\chi^2 = 196.81$, $p < 0.01$), thus violating the standard FEM assumptions. To address these econometric issues and ensure robust inference, the analysis proceeds with FEM using Driscoll-Kraay standard errors, which are suitable for correcting all three problems simultaneously.

Using the Driscoll-Kraay corrected FEM, the coefficient of digital payment is positive and statistically significant at the 5% level ($\beta = 0.01$, $t = 2.37$). This result suggests that a 1% increase in digital payment adoption is associated with a 0.01% increase in financial development, ceteris paribus. The finding supports theoretical arguments that digital currencies can enhance financial intermediation and inclusion by improving transaction efficiency and reducing access frictions (Kumhof & Noone, 2021; Chiu et al., 2023).

Among the macroeconomic variables, GDP growth is negatively associated with financial development and statistically significant at the 1% level (β = -0.08, t = -2.81). At the same time, inflation displays a positive and statistically significant effect on financial development (β = 0.03, t = 2.00). These findings are consistent with Beck et al. (2007), who emphasize that financial development often lags GDP growth in the presence of institutional or access constraints, and that moderate inflation, when managed well, can promote financial intermediation by improving asset returns and expanding credit channels.

In contrast, interest rate and unemployment rate exhibit negative coefficients (β = -0.06 and β = -0.03, respectively), but both are statistically insignificant. These results imply that traditional macroeconomic variables do not exhibit strong or consistent direct effects on financial development in the combined BRICS and G7 sample.

Overall, the findings underscore the increasing importance of digital payment in enhancing financial systems. While digital payment demonstrates a modest but statistically robust positive effect on financial development, conventional macroeconomic indicators reveal mixed impacts. These insights offer useful implications for policymakers seeking to promote financial sector development through digital innovation, particularly in contexts where traditional levers yield limited results.

Table 4

Result of Panel Data Analysis Dependent Variable: lnFD (BRICS and G7)

	Pooled OLS	Random Effect	Fixed Effect	Driscoll-Kraay SE
Constant	4.43***	4.83***	4.82***	4.82***
	(16.76)	(26.54)	(32.42)	(34.90)
lnDP	0.11***	0.01*	0.01*	0.01**
	(8.67)	(1.91)	(1.71)	(2.37)
lnIR	-0.36***	-0.07*	-0.06	-0.06
	(-5.07)	(-1.92)	(-1.63)	(-1.51)
lnINF	0.02	0.04	0.04	0.04*
	(0.17)	(1.11)	(1.14)	(2.00)
lnUE	0.011	-0.04	-0.03	-0.03
	(0.22)	(-0.88)	(-0.58)	(-0.58)
lnGDPG	-0.04	-0.08***	-0.08***	-0.08**
	(-0.47)	(-2.85)	(-2.96)	(-2.81)
Breusch-Pagan LM test	149.54***		-	
(χ^2–stat)	(0.00)			
Hausman test	-	10.71*		
(χ^2–stat)		(0.06)		
Observations	127	127	127	
Multicollinearity (VIF)	-	-	1.92	-
Heteroskedasticity	-	-	895.34***	-
(χ^2–stat)			(0.00)	
Serial Correlation	-	-	77.58***	-
(F–stat)			(0.00)	
Cross-sectional dependence			196.81***	-
(χ^2–stat)			(0.00)	

Notes. Figures in parentheses are t-statistics, except for Breusch-Pagan, LM test, Hausman test, Heteroskedasticity, Serial Correlation tests and Cross-sectional dependence, which are p-values. * and ** and *** indicate the respective 10% and 5% and 1% significance levels.

Result of Panel Data Analysis Dependent Variable: lnFD (BRICS)

Table 5 reports the panel regression results for financial development in BRICS countries using four model specifications: Pooled OLS, REM, FEM, and FEM with Driscoll–Kraay standard errors. The Breusch-Pagan LM test ($\chi^2 = 0.00$, $p = 1.00$) provides no statistical support for panel estimation over the Pooled OLS model.

However, the Hausman test (χ^2 = 45.64, p < 0.01) strongly favors the Fixed Effects Model over REM, indicating that country-specific heterogeneity is significant. Diagnostic tests reveal violations of classical regression assumptions: heteroskedasticity (χ^2 = 37.82, p < 0.01), serial correlation (F = 77.58, p < 0.01), and cross-sectional dependence (χ^2 = 26.22, p < 0.01). Given these issues, the FEM with Driscoll-Kraay standard errors is adopted to ensure consistent and reliable inference.

Under the robust FEM specification, digital payment has a positive and statistically significant relationship with financial development at the 1% level (β = 0.02, t = 3.22). This implies that a 1% increase in digital payment is associated with a 0.02% increase in financial development, ceteris paribus. This finding is in line with Demirgüç-Kunt et al., (2022**)**, who highlighted the critical role of digital financial services in improving access and inclusion in developing regions.

Among the macroeconomic variables, unemployment exhibits a negative and statistically significant effect on financial development (β = -0.16, t = -2.99). This aligns with Epstein and Finkelstein Shapiro (2019), who found that stronger financial development lowers unemployment volatility, suggesting that a well-developed financial system supports labor market stability and overall economic growth.

GDP growth displays a negative coefficient (β = -0.07, t = -1.63), although the relationship is statistically insignificant. Similarly, interest rate and inflation exhibit positive but statistically insignificant effects (β = 0.01 and β = 0.04, respectively), indicating that these macroeconomic variables do not have a meaningful or direct impact on financial development in the BRICS context.

Overall, the results highlight the growing significance of digital payment as a financial development tool in emerging economies. While unemployment and GDP growth remain important but complex drivers, conventional indicators like interest rates and inflation have limited direct explanatory power. These findings reinforce the potential of digital financial innovations to complement traditional development strategies in the BRICS region.

Table 5

Result of Panel Data Analysis Dependent Variable: lnFD (BRICS)

	Pooled OLS	**Random Effect**	**Fixed Effect**	**Driscoll-Kraay SE**
Constant	3.40***	3.41***	4.76***	4.76***
	(7.22)	(7.22)	(17.69)	(18.72)
lnDP	0.09***	0.09***	0.02**	0.02***
	(4.03)	(4.03)	(2.20)	(3.22)
lnIR	0.23	0.23	0.01	0.01
	(1.60)	(1.60)	(0.30)	(0.61)
lnINF	-0.55***	-0.55***	-0.01	-0.01
	(-4.01)	(-4.01)	(-0.24)	(-0.24)
lnUE	0.32***	0.32***	-0.16*	-0.16**
	(4.62)	(4.62)	(-1.76)	(-2.99)
lnGDPG	0.04	0.04	-0.07**	-0.07
	(0.40)	(0.40)	(-2.13)	(-1.63)
Breusch-Pagan LM test (χ^2–stat)		0.00 (1.00)	-	
Hausman test (χ^2–stat)	-	45.64*** (0.00)		
Observations	56	56	56	
Multicollinearity (VIF)	-	-	1.84	-

(continued)

	Pooled OLS	Random Effect	Fixed Effect	Driscoll-Kraay SE
Heteroskedasticity (χ^2–stat)	-	-	37.82*** (0.00)	-
Serial Correlation (F–stat)	-	-	77.58*** (0.00)	-
Cross-sectional dependence (χ^2–stat)			26.22*** (0.00)	-

Notes. Figures in parentheses are t-statistics, except for Breusch-Pagan, LM test, Hausman test, Heteroskedasticity, Serial Correlation tests and Cross-sectional dependence, which are p-values. * and ** and *** indicate the respective 10% and 5% and 1% significance levels.

Result of Panel Data Analysis Dependent Variable: lnFD (G7)

Table 6 displays the regression estimates for financial development in G7 countries, applying four specifications: Pooled OLS, REM, FEM, and FEM with Driscoll–Kraay standard errors. The Breusch-Pagan LM test ($\chi^2 = 0.00$, $p = 1.00$) indicates that a panel model is not statistically preferable to Pooled OLS. However, the Hausman test ($\chi^2 = 57.37$, $p < 0.01$) decisively supports the Fixed Effects Model over REM, suggesting that country-level heterogeneity is significant. Furthermore, diagnostic tests reveal the presence of heteroskedasticity ($\chi^2 = 224.25$, $p < 0.01$), serial correlation ($F = 30.14$, $p < 0.01$), and cross-sectional dependence ($\chi^2 = 56.80$, $p < 0.01$), prompting the use of the FEM with Driscoll-Kraay standard errors for robust and consistent estimation.

Under the preferred model, the coefficient of digital payment is negative and statistically insignificant ($\beta = -0.03$, $t = -1.45$), implying that digital payment has not had a measurable impact on financial development in G7 countries. This finding supports the observations of Chen et al. (2022) and Koparan (2025), who found that the marginal gains of digital payment are minimal in advanced economies, as financial services are already broadly accessible and efficient.

Among the control variables, the interest rate exhibits a negative and statistically significant effect ($\beta = -0.06$, $t = -2.32$), and GDP growth also shows a statistically significant negative relationship ($\beta = -0.05$, $t = -5.40$). The significant negative effects of interest rates and GDP growth are consistent with Boyd et al. (2001), who argue that high interest rates may discourage financial activity, and misallocated or unequal growth may fail to expand credit access in developed financial systems. Inflation is positively and significantly associated with financial development ($\beta = 0.05$, $t = 2.92$). The positive effect of inflation supports the argument by Huybens and Smith (1999), who suggest that moderate inflation can encourage financial intermediation by increasing returns on financial assets.

In contrast, unemployment is statistically insignificant ($\beta = -0.01$, $t = -0.35$), implying that labor market conditions may have a limited direct role in shaping financial development in these advanced economies.

Taken together, the results highlight a divergence between emerging and developed economies. While digital payment plays a positive role in financial development in BRICS, its effect in the G7 context appears limited. Instead, traditional macroeconomic indicators remain significant determinants of financial development in developed countries. These findings emphasize the need for differentiated digital currency strategies that reflect each country's stage of financial maturity and institutional structure.

Table 6

Result of Panel Data Analysis Dependent Variable: lnFD (G7)

	Pooled OLS	Random Effect	Fixed Effect	Driscoll-Kraay SE
Constant	4.31***	4.31***	5.09***	5.09***
	(19.28)	(19.28)	(21.12)	(37.72)
lnDP	0.12***	0.12***	-0.03	-0.03
	(8.39)	(8.39)	(-0.92)	(-1.45)
lnIR	-0.05	-0.05	-0.06**	-0.06**
	(-0.61)	(-0.61)	(-2.04)	(-2.32)
lnINF	-0.01	-0.01	0.05*	0.05**
	(-0.17)	(-0.17)	(1.87)	(2.92)
lnUE	-0.16**	-0.16**	-0.01	-0.01
	(-2.50)	(-2.50)	(-0.21)	(-0.35)
lnGDPG	0.01	0.01	-0.05**	-0.05***
	(0.15)	(0.15)	(-2.23)	(-5.40)
Breusch-Pagan LM test (χ^2–stat)	0.00 (1.00)		-	
Hausman test (χ^2–stat)	-	57.37*** (0.00)		
Observations	71	71	71	
Multicollinearity (VIF)	-	-	1.58	-
Heteroskedasticity (χ^2–stat)	-	-	224.25*** (0.00)	-
Serial Correlation (F–stat)	-	-	30.14*** (0.00)	-
Cross-sectional dependence (χ^2–stat)			56.80*** (0.00)	-

Notes. Figures in parentheses are t-statistics, except for Breusch-Pagan, LM test, Hausman test, Heteroskedasticity, Serial Correlation tests and Cross-sectional dependence, which are p-values. * and ** and *** indicate the respective 10% and 5% and 1% significance levels.

CONCLUSION

The study aims to provide insights for central banks, Ministries of Finance, investors, and policymakers by comparing how digital payments impact monetary policy and financial stability in BRICS and G7 economies on related economic factors. In BRICS, digital payment adoption appears to stimulate financial inclusion and enhance monetary transmission. In contrast, in G7 countries, the developmental effect is statistically insignificant, suggesting that mature financial systems may already have captured many of the gains associated with payment digitalization. These findings indicate that the expansion of digital payment ecosystems plays a meaningful role in shaping financial system outcomes, particularly in economies where financial access and payment infrastructure are still evolving.

The study highlights that the impacts differ significantly by region, requiring tailored policy strategies aligned with each economy's institutional maturity and financial infrastructure. In emerging economies, digital payments appear to complement financial development by broadening access, reducing frictions, and potentially supporting deeper credit intermediation. In advanced economies, digital payments appear to serve a more efficiency-oriented role, improving convenience and resilience rather than

materially transforming financial depth. Importantly, these differences also suggest that the economic environment in which digital payments develop may influence the potential effectiveness and policy objectives of future Central Bank Digital Currency (CBDC) implementation.

Based on these findings, several policy recommendations emerge. For BRICS economies, digital payment development should be strategically aligned with broader financial inclusion, de-dollarization, and credit accessibility agendas, reinforcing domestic payment ecosystems and supporting national currencies' internationalization. A well-developed digital payment infrastructure can also provide the technological and behavioral foundation necessary for potential CBDC deployment, as users and institutions become familiar with digital financial platforms. Governments should also integrate future CBDC initiatives alongside existing digital payment systems with employment creation, digital literacy programs, and small business financing mechanisms to ensure that financial inclusion gains translate into sustained development. Regulators must ensure that innovation remains consistent with the stability of existing banking systems and that any future CBDC issuance complements rather than replaces commercial bank credit intermediation.

For G7 countries, policy emphasis should shift toward refining regulatory sandboxes, interoperability standards, and cybersecurity frameworks, which enable the private sector to innovate safely within digital payment ecosystems. In these advanced financial systems, CBDCs are more likely to function as an extension of existing digital payment infrastructures rather than as a primary driver of financial development. Moreover, lessons from early CBDC pilot programs (such as the digital euro or digital pound) should be consolidated into global best practices, ensuring flexibility, transparency, and public trust. Central banks should adopt robust monitoring systems that periodically assess the macro-financial impacts of CBDC deployment, particularly on liquidity, interest margins, and capital markets.

Importantly, this study's results should be interpreted with caution, as e-money transactions were used as a proxy for digital payment development rather than direct CBDC adoption due to data constraints. While this approach provides valuable early insights into the relationship between payment digitalization and financial development, it does not fully capture the unique policy design, technological architecture, and operational implications of actual CBDCs. Thus, the conclusions do not claim that CBDCs have been empirically proven to enhance financial development. Instead, the results suggest that the growth of digital payments creates institutional and behavioral conditions that may support future CBDC implementation and effectiveness.

The findings also reveal that in BRICS economies, rising unemployment negatively influences financial development, suggesting that digital payment and future CBDC policies should be integrated with broader macroeconomic and employment strategies. The positive association between digital payment readiness and financial development in BRICS supports the Endogenous Money Theory, where demand-driven credit creation plays a critical role. In contrast, G7 economies exhibit limited developmental effects, where digital financial infrastructures—including potential CBDCs—are more likely to strengthen payment efficiency, security, and system resilience rather than significantly expand credit intermediation.

Based on the research, several suggestions are offered for future researchers. Given that this study focuses solely on BRICS and G7 nations over the 12-year period (2012–2023), future research should expand the scope to include other regions such as ASEAN or Eastern Europe. These areas may offer valuable insights due to their diverse institutional settings, varying levels of technological readiness, and different stages of financial development, which can influence how Central Bank Digital Currencies

(CBDCs) impact financial systems. As more countries pilot or launch CBDCs, future work should leverage direct data on CBDC transactions, participation rates, and policy design features, enabling more precise estimation of their developmental effects. Researchers are also encouraged to employ advanced econometric techniques, such as dynamic panel models or instrumental variable approaches, to address potential endogeneity and identify causal relationships.

Theoretical extensions ought to investigate how structural characteristics such as banking depth, capital market development, and monetary transmission efficiency mediate the link between digital payments, CBDCs, and financial intermediation, potentially via interaction terms. Furthermore, mixed-method research that integrates cross-country econometric analysis with case studies (such as China's e-CNY) or behavioural surveys can elucidate the socio-economic and psychological determinants influencing CBDC adoption, including public trust, legal frameworks, and digital literacy.

In conclusion, this study enhances the existing literature on digital payments and digital currencies by offering empirical evidence regarding the impact of payment digitalisation on financial development in both developed and emerging economies. By highlighting regional differences, institutional dynamics, and macroeconomic considerations, the findings provide a crucial basis for future policy formulation and academic inquiry. The findings indicate that digital payments not only directly influence financial development but also establish the technological infrastructure, institutional capacity, and user familiarity essential for the effective deployment of CBDCs in the future. As the worldwide transition to digital currencies progresses, comprehending the intricate relationship between digital payment systems and CBDC development is becoming increasingly vital. The study thus urges policymakers, regulators, and researchers to embrace a proactive, inclusive, and contextually aware strategy for digital currency deployment that harmonises innovation with stability and development with regulation.

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