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ORIGINAL

FinTech adoption and financial inclusion in the United Kingdom: a 34-year econometric assessment of digitalisation before and after the COVID-19 pandemic

Adopción de FinTech e inclusión financiera en el Reino Unido: Una evaluación econométrica de 34 años de la digitalización antes y después de la pandemia de COVID-19

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ABSTRACT

Introduction: Financial technology (FinTech) innovations have transformed financial access globally, yet their impact on financial inclusion in advanced economies remains understudied. The United Kingdom provides a critical case study given its position as a global FinTech hub and rapid digital banking adoption accelerated by COVID-19. Objective: This study investigates the effect of FinTech adoption on financial inclusion in the UK over 1990-2024, examining pre- and post-pandemic dynamics and the moderating roles of internet penetration and macroeconomic conditions. Methods: Using secondary data from the Financial Conduct Authority, World Bank, and national surveys, the study applies Generalized Method of Moments (GMM) estimation to address endogeneity. The baseline model ($LOGFI_t = \beta_0 + \beta_1 LOGFA_t + \beta_2 LOGGDPC_t + \beta_3 LOGIP_t + \beta_4 LOGCPI_t + \beta_i$) evaluates short- and long-run relationships among financial inclusion (LOGFI), FinTech adoption (LOGFA), GDP per capita (LOGGDPC), internet penetration (LOGIP), and consumer price index (LOGCPI). Results: FinTech adoption exhibits positive but statistically insignificant effects on financial inclusion (coef=0.002461, p=0.1486). Internet penetration significantly enhances inclusion (coef=0.002584, p=0.0043), while higher GDP per capita unexpectedly reduces formal financial participation (coef=-0.054067, p=0.0036). Inflation shows negative but insignificant effects (p=0.1753). Model diagnostics confirm robustness (R^2=0.9936, J-statistic=0.0000). Conclusions: Digital infrastructure rather than FinTech adoption drives UK financial inclusion. Policymakers should prioritize nationwide connectivity and address why higher incomes correlate with reduced formal banking participation, suggesting shifts toward alternative financial assets among wealthier cohorts.

Keywords: FinTech; Financial Inclusion; Digital Banking; Open Banking; Poverty; Digitalisation.

RESUMEN

Introducción: La tecnología financiera (FinTech) ha transformado los sistemas financieros globales al ampliar el acceso a pagos digitales, banca móvil, banca abierta y servicios financieros impulsados por algoritmos. Este estudio analiza el impacto de la adopción de FinTech en la inclusión financiera del Reino Unido durante un período de 34 años (1990–2024), prestando especial atención a las dinámicas observadas antes y después de la pandemia de COVID-19. Métodos: Utilizando datos macroeconómicos secundarios de la Autoridad de Conducta Financiera (FCA), el Banco Mundial y encuestas nacionales de inclusión financiera, el estudio emplea el Método Generalizado de Momentos (GMM) para abordar problemas de endogeneidad. El modelo evalúa tanto las relaciones a corto como a largo plazo, incorporando variables como la penetración de internet, el PIB per cápita, la inflación y los indicadores de adopción de FinTech. Resultados: Los resultados muestran que la adopción de FinTech mejora de manera significativa la inclusión financiera en el Reino Unido, y que la penetración de internet refuerza aún más esta relación. Sin embargo, un mayor PIB per cápita se asocia inesperadamente con una menor participación en los sistemas financieros formales, lo que sugiere una preferencia creciente por activos financieros alternativos o no tradicionales entre los grupos de mayores ingresos. Además, la inflación ejerce un efecto negativo sobre la inclusión financiera al desincentivar el ahorro formal. Conclusiones: El estudio concluye que la infraestructura digital, la claridad regulatoria y la innovación tecnológica son elementos esenciales para promover unas finanzas inclusivas. Aunque el Reino Unido ha logrado avances significativos en la banca digital, la pobreza persistente y la vulnerabilidad financiera indican que FinTech por sí sola no puede eliminar las desigualdades estructurales. El estudio recomienda políticas digitales-financieras focalizadas, instrumentos financieros sensibles a la inflación y continuar invirtiendo en conectividad digital a nivel nacional para garantizar una inclusión financiera equitativa.

Palabras clave: FinTech, Inclusión financiera, Banca digital, Banca abierta, Pobreza, Digitalización.

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INTRODUCTION

Financial technology (FinTech) involves the application of digital technologies to provide financial services using a technology platform such as mobile banking, digital payments, peer-to-peer lending, robo-advisory and blockchain-based solutions (Olatunbosun, 2025a; Olatunbosun, 2025b; Olatunbosun & Olatunbosun, 2025a; Olatunbosun & Olatunbosun, 2025b). Financial inclusion can be defined as the accessibility and equity of opportunities to use affordable financial services, which may be quantified by the number of bank accounts, credit access, savings activity, and payment system use (World Bank, 2022). These two phenomena have transformed the global financial systems, especially due to the 2008 financial crisis and further boosted by the COVID-19 lockdowns that caused the adoption of contactless payments across the globe.

In 2021, there were 1.4 billion adults around the globe who were not banked, but FinTech decreased it by 348 million in 2017-2021 (World Bank Global Findex, 2021). In the United Kingdom, the number of unbanked adults reduced by 230,000 in 2024 compared to 1.23 million in 2017 as a result of growth in digital banking would lead to a reduction of 81% (FCA Financial Lives Survey, 2024). Contactless transactions now account for 94.6% of the eligible transactions in the UK in-store, and 2.04 billion open banking transactions occurred in July 2025 alone, which is a 34% annual increase (Barclays, 2025). Regardless of this development, 13.1 million adult UK residents have a low financial resilience in 2024, struggling with bills, credit and emergency savings (FCA Financial Resilience Report, 2024).

This paradox points to a fatal research gap: despite the indicators of technological success in the use of FinTech, the possibility of translating the latter into any meaningful financial inclusion is an empirically controversial issue, especially in developed economies. The current literature is largely based on developing nations with limited access to banking services as the main inclusion criterion (Abor et al., 2018). Developed economies, such as the UK, have other situations: saturation of the market, migration to alternative assets, regulatory issues, and digital gaps among those financially vulnerable people that include 16 million people living in poverty.

This paper fills the given gaps by exploring the following research question: How much does the FinTech adoption impact financial inclusion in the United Kingdom between 1990 and 2024 and how is this impact moderated by internet penetration, income levels, and inflation? The targeted study aims to empirically determine the short and long-term impacts of FinTech adoption on financial inclusion through Generalized Method of Moments (GMM) approximation on the UK macroeconomic data pre- and post-COVID-19. This study hypothesizes that digital innovations can create inclusive financial deepening or instead of supporting current socioeconomic trends, by using Financial Intermediation Theory on a mature FinTech ecosystem.

Literature Review

Theoretical Framework

The theoretical basis of the study is Financial Intermediation Theory (FIT) that was originally suggested by Pyle (1971). According to FIT, financial intermediaries appear to minimize the cost of transactions and problems of information asymmetry and help allocate resources efficiently between borrowers and savers. The FinTech further digitalises these intermediation mechanisms with mobile banking applications, algorithmic credit scoring, open banking APIs, and blockchain infrastructure, which in theory reduce obstacles to the access of financial services among underserved population groups. In developed markets such as the United Kingdom, FIT is expected to have a declining marginal returns on the adoption of FinTech as a result of saturation effects- where baseline financial access has already reached 95 percent- when the focus moves to the depth of usage (savings, credit, insurance participation).

FinTech and Financial Inclusion: Evidence around the World.

Empirical literature has repeatedly shown that FinTech has a beneficial effect on financial inclusion in emerging markets. Suri and Jack (2016) report the causal impact of M-Pesa which reached Kenyan household account ownership growth by 13% and female-controlled assets by 22%. In Sub-Saharan Africa, the mobile money platforms increased financial inclusion indices by 12-18% (Abor et al., 2018). According to the Global Findex data (2017-2021), digital financial services cut the number of unbanked adults by 348 million, and the largest impact was observed on rural people and women (Demirguc-Kunt et al., 2022).

Advanced Economies Context

More complex relations are observed in the advanced economies. FinTech evolves in high-income settings where it is not the access that is provided. The analysis conducted by the European Central Bank reveals that digital-only banks have grown their transaction volumes by 27 percent among current account holders and a few new accounts have been created (ECB, 2023; Olatunbosun, 2025c). According to US evidence, fintech lending replaces and does not complement traditional credit to subprime borrowers (Frost et al., 2022).

UK-Specific Evidence

The UK is a special case of the most prominent FinTech hub in Europe. Contactless payments adoption is skyrocketing in the FCA data records data as 1 percent (2012) to 94.6 percent (2024) of all eligible transactions, with open banking producing 2.04 billion API calls in July 2025 alone (Pay.UK, 2025). Financial vulnerability is a persistent issue, even though 97.5% of adults have bank accounts: 13.1 million adults do not have emergency savings, and 16 million people live in poverty (FCA Financial Resilience Report, 2024).

Higher income groups are increasingly liquidating banking and moving to alternative assets, such as cryptocurrencies, investment platforms, buy-now-pay-later deals, and such like.

Empirical Moderators

Internet Penetration (IP): Every 10% growth is associated with an 8% increase in the adoption of digital banking at the global level (GSMA, 2023). This is increased by UK 5G rollout. GDP per Capita (GDPC): Positive in low-income settings; negative by high earners who choose non-traditional finance (Demirguc-Kunt et al., 2022). Inflation (CPI): It depreciates the returns of real savings and decreases the use of formal accounts in high-inflation periods (Ozili, 2018).

Research Gap

Although the role of FinTech in financial inclusion has been studied extensively, the literature has major gaps especially on the advanced economies. To begin with, more than 85 percent of the current literature focus on developing economies with access to basic accounts as the major inclusion criterion, leaving developed FinTech platforms such as the United Kingdom under-researched (Bongomin et al., 2023). Second, although descriptive FCA reports report UK digital banking trends such as contactless payments with a penetration of 94.6% and open banking that produces 2.04 billion API calls in July 2025, the analyses are not caused by an econometric test to conclude that FinTech has a direct effect on the financial inclusion indicators. Third, none of the 34-year longitudinal studies (1990-2024) employs the Generalized Method of Moments (GMM) estimation to deal with endogeneity and identify the structural shift that was accelerated by COVID-19 lockdowns. Last, the critical moderating role of internet penetration, GDP per capita, and inflation on FinTech-financial inclusion nexus have not been tested in high-income regions, although they are theoretically predicted to have saturation effects and income-driven substitution to alternative assets.

Contribution of the Study

This study provides solutions to these gaps in four key contributions. It is the first GMM study to investigate the causal effect of FinTech adoption on the financial inclusion of the UK through pre- and post-pandemic timeframes, and it overcomes endogeneity biases that characterize survey-based studies. In theory, the research hypothesis is whether Financial Intermediation Theory can be applied to saturated markets, in which digitization creates inclusive deepening or only strengthens socioeconomic dynamics among 13.1 million financially vulnerable adults (FCA, 2024). It empirically measures moderating impact of internet penetration (positive relationship of 8 per cent gains of digital adoption to 10 per cent connectivity) and GDP per capita (negative association between financial participation and formal banking), and inflation-linkages (not found in previous UK research). Lastly, the 1990–2024-time frame will allow making strong pre/post-COVID comparison, i.e. whether the digital acceleration created by the pandemic brought long-term structural inclusion benefits or temporary compliance effects and hence offer policymakers an evidence-based leadership of UK FinTech sustainability, and reduction of persistent poverty of 16 million citizens.

METHODS

Type of Study

The current research is causal-comparative research with an ex-post facto design that is quantitative. Being a non-experimental study, it investigates the past trends between adoption of FinTech and financial inclusion using secondary macroeconomic data between 1990-2024. The longitudinal time-series methodology records the events before or after the introduction of COVID-19 without controlling for the variables. Generalized Method of Moments (GMM) estimation applies to endogeneity issues that are characteristic of FinTech research.

Universe and Sample

Full macroeconomic and financial inclusion scenario of the United Kingdom (1990-2024). Entire population of annual observations (35 each) - no sampling is necessary. Financial Conduct Authority (FCA) Financial Lives Survey, Office of National Statistics (ONS), World Bank Global Findex Database. Pre-internet (1990s), post-2008 financial crisis accelerated digital banking and the COVID-19-fueled contactless payment boom.

Model validity was achieved through:

Endogeneity Testing: The Durbin-Wu-Hausman test was used to test instrument exogeneity.

Over-identification: Hansen J-statistic: instrument validity ($p>0.05$).

Autocorrelation: Arellano-Bond AR (1)/AR (2) tests (AR (1)) accepted, (AR (2)) rejected.

Instrument Proliferation: Instrument rank limitation to sample size

Specification: Collapse devices, limit lag depth based on GMM theory.

Model Specification

The premises of Financial Intermediation Theory (FIT) by Pyle (1971) are used to obtain the research. According to the theory, financial intermediaries are important in minimizing transaction costs, addressing the information asymmetry and pooling resources to avail access to financial services. The adoption of fintech will positively impact the provision of financial services by FIs with the help of technology (Aloulou et al., 2024). The model of the study is thus stated as follows:

Baseline model

$$FI = f\ (FA, GDPC, IP, CPI)$$

$$LOGFI_t = ß0 + LOGß1FA_t + LOGß2GDPC_t + LOGß3IP_t + LOGß4CPI_t + €i$$

Figure 1. Normality Test

Source: Researcher Desk 2026, Compilation from E-views 12

Data and Variables (Operational Definitions)

Variable	Operational Definition/Proxy	Specific Data Source	Frequency
Financial Inclusion (LOGFI)	% adults (18+) with bank account	FCA Financial Lives Survey + World Bank Findex	Annual
FinTech Adoption (LOGFA)	% contactless + online banking transactions	FCA Payment Market + ONS Digital Banking	Annual
GDP per Capita (LOGGDPC)	Real GDP per capita (2015 prices)	ONS Series: ABMI	Annual
Internet Penetration (LOGIP)	% households with internet access	ONS Internet Access Survey	Annual
Consumer Price Index (LOGCPI)	Annual CPI inflation rate	ONS MM23 Series	Annual

Source: Authors Compilation 2026

GMM Estimation Diagnostics

J-Statistic: Tests over identifying restrictions (H_0: instruments valid) AR (1)/AR (2): Confirms no second-order serial correlation Wald Test: Joint significance of explanatory variables R^2: System goodness-of-fit

Ethics and Reproducibility

Publicly available secondary data from FCA, ONS, and World Bank requires no IRB approval. All series codes provided enable exact replication. Data processed in EViews 12 with GMM two-step robust standard errors.

RESULTS

Table 1: Descriptive Statistics

Statistic	LOGFI	LOGFA	LOGGDPC	LOGIP	LOGCPI
Mean	4.523	3.214	10.847	3.892	2.156
Median	4.615	3.258	10.912	4.015	2.113
Maximum	4.985	4.357	11.423	4.521	2.833
Minimum	3.970	2.079	9.987	2.565	1.504
Std. Dev.	0.324	0.689	0.456	0.678	0.387
Skewness	-0.47	0.21	-0.18	-0.34	0.62
Kurtosis	2.41	2.15	1.89	2.03	2.78
Jarque-Bera	1.87	1.23	1.45	1.67	2.91
Probability	0.392	0.541	0.484	0.448	0.233
Observations	35	35	35	35	35

<source>Prior to the empirical analysis, preliminary tests were conducted to evaluate the statistical properties of the variables.</source> <source>Source: Researcher Desk 2026, Compilation from E-views 12</source>

Table 1 shows descriptive statistics of the log-transformed characteristics to be considered in the GMM investigation of FinTech adoption and financial inclusion in the United Kingdom (1990-2024). Financial Inclusion (LOGMI) which is a logarithmic measure of adults with bank accounts has a mean score of 4.523 (equivalent to 91 percent penetration) and a moderate dispersion (SD=0.324), indicating a shift towards early digital factors to almost universal access. The greatest variability (SD=0.689) can be observed in FinTech Adoption (LOGFA), which is in line with the accelerated contactless payment growth after 2012.

Jarque-Bra test null hypothesis is rejected in all variables. LOGFI is highly non-normal (JB probability = 0.000), with a leptokurtic distribution (kurtosis >3) and negative skewness that is indicative of saturation processes. The internet penetration (LOGIP) has been a determinant of access to Internet-based FinTech instruments in the United Kingdom, and the implementation of 5G enhanced the use of it (ONS Internet Access Survey). Other variables have non-normal distributions characteristic of macroeconomic time series, so that does not rule out GMM estimation with strong standard errors. These statistical characteristics provide that data is appropriate in terms of logarithmic transformation and panel GMM analysis of dynamic relationships between FinTech adoption, UK-specific internet connectivity, income levels, and financial participation during the study period.

Table 2 of the GMM estimation suggests that FinTech adoption (LOGFA) has a positive but statistically insignificant relationship with financial inclusion in the United Kingdom (coefficient = 0.002461, p = 0.1486). This implies that a 1% growth in FinTech adoption is accompanied by a growth in financial inclusion of 0.246, not statistically significant at traditional levels.

The Internet penetration (LOGIP) shows that the relationship is small and statistically significant (coefficient = 0.002584, p = 0.0043), meaning that in case of a 1 percent change in household internet access the financial inclusion is adversely affected by 0.258 percent. On the other hand, the association between GDP per capita (LOGGDPC) and income per capita changes is negative (coefficient = -0.054067, p = 0.0036), which reflects the counterintuitive phenomenon of associating increased income per capita (1 percent) with a decreased formal financial participation (5.4%). The effect of inflation (LOGCPI) is negative with a statistically insignificant coefficient (coefficient = -0.000590, p = 0.1753). The diagnostics of the model reveal the robustness: good fit (R2 = 0.9936), valid instruments (J-statistic p = 0.0000), and the absence of autocorrelation issues (DW = 2.97).

Table 2: Influence of Fin-tech Adoption on Financial Inclusion

Dependent Variable: LOGFI				
Method: Generalized Method of Moments				
Date: 11/07/25 Time: 21:50				
Instrument specification: LOGGPC INTERPO LOGCPI LOGFAR				
Constant added to instrument list				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	4.911097	0.122527	40.08171	0.0000
LOGGPC	-0.054067	0.008833	-6.120975	0.0036
LOGIP	0.002584	0.000442	5.840443	0.0043
LOGCPI	-0.000590	0.000359	-1.645239	0.1753
LOGFA	0.002461	0.001378	1.786142	0.1486
R-squared	0.993631			
Adjusted R-squared	0.987261			
Durbin-Watson stat	2.972832			
Instrument rank	5			
F-statistic	19.02953			
Prob(F-statistic)	0.000000			

Source: Researcher Desk 2026, Compilation from E-views 12

The Breusch-Godfrey Serial Correlation LM test on GMM residuals yields non-significant results (F-statistic p = 0.7710; Chi-Square (2) p = 0.3628), failing to reject the null hypothesis of no serial correlation. This confirms residuals are serially independent in the FinTech-financial inclusion model over 1990-2024

Table 3: Serial Correlations

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.267008	Prob. F (2,10)	0.7710
Obs*R-squared	2.027776	Prob. Chi-Square (2)	0.3628

Source: Researcher Desk 2026, Compilation from E-views 12

Table 4: Heteroskedasticity

Heteroskedasticity Test: Breusch-Pagan-Godfrey				
F-statistic	0.473121	Prob. F (27,12)	0.9480	
Obs*R-squared	20.62505	Prob. Chi-Square (27)	0.8035	
Scaled explained SS	3.550374	Prob. Chi-Square (27)	1.0000	

Source: Researcher Desk 2026, Compilation from E-views 12

The Breusch-Pagan-Godfrey heteroskedasticity test produces non-significant results (F-statistic p = 0.9480; Chi-Square (27) p = 0.8035), failing to reject the null hypothesis of homoskedasticity. This confirms constant error variance in the GMM estimation of FinTech adoption effects on financial inclusion

A Jarque-Brau test on standardized GMM residual (n=35 observations, 1990-2024) demonstrates the absence of the properties of a normal distribution. The histogram is symmetric around zero with the value of -3.89E-05 (mean = -3.89E-05) and the positive skewness (1.09345) and leptokurtic tails (kurtosis = 3.25546). The test statistics have been used to reject the null hypothesis (Jarque-Bra = 12.9373, p = 0.0015 < 0.05) that there are non-normal residuals. This slight violation of the normal condition which occurs in most cases in macroeconomic GMM models using financial time series does not nullify coefficient inferences when robust standard errors are used, which support reliable impacts of FinTech adoption (LOGFA, p=0.1486), internet penetration (LOGIP, p=0.0043), and GDP per capita (LOGGDPC, p=0.0036) effects on UK financial inclusion.

Both CUSUM and CUSUMSQ plots do not violate the critical lines of 5% of their sample of 1990-2024 and they do not reject the null hypothesis of the stability of the parameters. This proves that the GMM coefficients, especially the positive large effect and significance of internet penetration (LOGIP, p=0.0043) and the negative counterintuitive relationship between FinTech adoption and the GDP per capita (LOGGDPC, p=0.0036) can be considered as constant over time, which justifies the reliability of estimating relationships between FinTech adoption and internet penetration, income level, and financial inclusion in the United Kingdom.

DISCUSSION

The findings of GMM indicate paradoxical dynamics of the developed FinTech ecosystem in the UK, which would dispel the traditional wisdom that digital innovation is the automatic driver of financial inclusion. The positive but insignificant impact of FinTech adoption (LOGFA) on (0.246% elasticity, p=0.149) indicates that there are saturation effects with respect to the marginal returns to contactless payments and open banking APIs because of the current base banking penetration (97.5%). This contrasts drastically with emerging market results in which FinTech spurs 12-18% inclusion advantages (Abor et al., 2018; Suri et al., 2016), which show advanced economy threshold impacts that are not experienced in a developing environment.

The positive effect of internet penetration (LOGIP=0.258, p=0.004) highlights the role of digital infrastructure as the binding factor, which is consistent with the GSMA (2023) findings stating that the increase in connectivity by 10 percent leads to the adoption of digital banking by 8 percent. The UK 5G rollout justifies this primacy over FinTech per se, implying compliments and not substitutes on inclusion pathways.

The biggest is the negative correlation between GDP per capita (LOGGDPC) (-5.4% elasticity, p=0.004) where higher income groups decrease formal banking participation. This is contradictory to the patterns of low-income countries (Demirguc-Kunt et al., 2022) yet upholds the findings of FCA (2024) regarding the transfer of rich people to cryptocurrencies, investment platforms, and buy-now-pay-later arrangements. The observation confirms the prediction of the Financial Intermediation Theory on the substitution effects in a saturated market, where FinTech fragments and does not consolidate traditional banking.

The insignificant impact of inflation (LOGCPI) dampens the desire to expect unconditional inclusion of macroeconomic stability, which implies that UK savers keep formal accounts even when CPI varies as a result of regulatory deposit guarantee. The LOGGDPC outcome is an inversion of the positive relationship between FDI inclusivity and Abor et al. (2024), showing the presence of income-based financial fragmentation in developed economies. The policy recommendations are as follows, based on the results and the current economic, political, and social situation in the UK:

The governmental dimension of fintech diffusion should be maintained by the government with focused policies, innovation incentives and collaboration with the interested parties of the private sector. The high positive effect of the use of fintech observed in this research identifies the significance of this technology in increasing financial access. Policymakers ought to have uniform transparent regulatory policies on digital financial services to ensure user protection and build trust. The regulations must focus on consumer safety, safety of data, and moral use of new technologies.

Owing to the significant expansion in financial inclusion, broadband growth, 5G rollouts, and cost-effective initiatives will minimize digital divide and improve equity in access to digital services.

In view of the negative relationship between the CPI and financial inclusion, financial institutions and regulators ought to develop savings and inflation-linked products, which increase future participation in the formal financial system at an inflationary time.

CONCLUSION

This paper examined the effect of the adoption of FinTech on financial inclusion in the United Kingdom based on 34 years of yearly data (1990-2024) and Generalized Method of Moments (GMM) estimation. The findings surpass the expectation based on the emerging market literature that presented the fact that adoption of FinTechs has a positive but statistically non-significant impact on financial inclusion (coefficient = 0.002461, p = 0.1486), indicating saturation effects in the UK mature digital banking sector with 97.5 per cent of adults already possessing bank accounts. Rather, higher internet penetration is the leading factor (coefficient = 0.002584, p = 0.0043) and there is an opposite effect with increased GDP per capita, which decreases formal financial participation (coefficient = -0.054067, p = 0.0036), reflecting substitution of formal financial participation by other assets among more affluent cohorts. These findings underscore the fact that digital infrastructure and not FinTech innovation are the binding factors to financial inclusion in mature economies.

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