

MOBILE FINANCIAL SERVICES AND FINANCIAL INCLUSION: THE MEDIATING EFFECT OF ACCESSIBILITY ON FINANCIAL ACCESS AND INCLUSIVE GROWTH[®]



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ABSTRACT

Although mobile financial services have spread faster than any preceding retail financial innovation, adoption is not necessary with inclusion, and the process by which MFIs can turn to the latter often is ambiguously stated estimates are that approximately 1.3 billion adults are not included in the financial system, and that evidence introduces "adoption" rather than "inclusion" as part of the process. Among the issues the study explores is whether accessibility is a moderating effect between mobile services intensity and financial inclusion, and if so, whether this effect varies by income level and region. An annual balanced panel of 60 low- and middle-income economies yields 1,260 observations; composite indices of the three constructs are calculated via principal component analysis, indicators are normalized relative to the International Monetary Fund Financial Access Survey, World Bank Global Findex Database and World Development Indicators; the pathways are identified using two-way fixed-effects estimation, Driscoll-Kraay standard errors, the Sobel test and a country-cluster bootstrap with 5,000 replications. The results show that mobile financial services raise accessibility by 0.507 index points ($p < 0.001$) and that accessibility raises financial inclusion by 0.501 index points ($p < 0.001$), while the total effect of 0.446 splits into an indirect effect of 0.254 (Sobel statistic 8.42; bootstrap interval 0.198 to 0.311) and a direct effect of 0.193 ($p < 0.001$). The findings suggest that accessibility transmits 56.8 percent of the total effect, that transmission is strongest in South Asia and weakest where mobile money entered bank-dense markets, and that financial empowerment and poverty reduction track access to banking rather than adoption alone.

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INTRODUCTION

The distance between owning a mobile wallet and being financially included is wider than the policy discourse usually admits. Worldwide account ownership reached 79 percent of adults in 2024, up from 51 percent in 2011, and mobile money accounts now number roughly 2.3 billion, with more than two trillion United States dollars flowing through them in a single year (GSMA, 2026; World Bank, 2024). Yet approximately 1.3 billion adults remain unbanked, many accounts lie dormant, and only a minority of adults in low- and middle-income economies make regular digital payments (Klapper, 2024; World Bank, 2025). The coexistence of spectacular adoption figures and stubborn exclusion is the scientific problem that motivates this study.

The dominant framing in the literature treats mobile financial services as a direct substitute for bank infrastructure, and therefore as a direct cause of financial inclusion (Aracil et al., 2025; Banda-Nyirenda et al., 2024; Nipa et al., 2025; Osabutey & Jackson, 2024). That framing is incomplete. A registered wallet is a claim on a service; it becomes financial inclusion only when the household can convert that claim into cash, credit, savings or a payment at an acceptable cost in time and money. The conversion requires both a physical and digital ecosystem including agent outlets, ATMs, branches, handsets and network connectivity. Accessibility, understood as the density and reach of that infrastructure, is therefore not a competing explanation but a plausible transmission channel, and its omission leaves the estimated relationship between adoption and inclusion structurally under-identified (Akanfe et al., 2025; Kamboj & Sharma, 2025; Ozili, 2025; Shahan & Sharaf, 2025). Three features of the existing evidence sharpen the problem. First, the influential micro-econometric results come overwhelmingly from a small number of settings, above all Kenya, which limits the external validity of any general

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claim about the adoption-inclusion link (Ahmad et al., 2020; Suri & Jack, 2016). Second, cross-country studies that do exist tend to be cross-sectional or to cover short windows, so they cannot separate the level effects of national wealth from the within country dynamics of diffusion (Afonso & Blanco-Arana, 2024; Bharathi et al., 2023; Dianda, 2025; Peng & Zeng, 2025). Third, the mediation studies that have appeared concentrate on cognitive and attitudinal mediators such as digital financial literacy, trust, satisfaction and consumer protection (Bhat et al., 2025; Okello Candiya Bongomin & Ntayi, 2020; Ferli et al., 2025), leaving the infrastructural mediator largely untested even though it is the one most directly amenable to policy. The burden, restated scientifically, is that it is an open question whether the relationship between mobile financial services and financial inclusion is direct or is mediated by accessibility and therefore whether policy should focus on mobile financial service adoption, or embrace the points of access that permit it to be used.

This is significant outside of the academic register. Financial inclusion has been identified as an explicit contributor to several SDGs, such as poverty alleviation (Duvendack & Mader, 2019), inclusive growth (Epor & Akande, 2025; Labony et al., 2024), decent job creation and reduction of inequalities (Saenko et al., 2025). Investment in agent networks, interoperability and rural connectivity will do more to boost revenues from customers than handset subsidies and/or dropped registration fees, if accessibility is key. The latter is true if the effect is primarily direct. The difference is not just conceptual, but financial the enabling of limited public and donor resources.

This study seeks to understand the degree of accessibility through which the linkage between mobile financial service and financial inclusion can be transmitted in LMICs. To achieve that goal, several intermediate steps are taken: First, we prepare internally consistent composite measures across the three constructs from harmonised dimensions of the supply side and the demand side; second, we remove the common global shocks from the measured effect within each country; and third, we determine whether the mediated pathway is similar across income levels and regions.

Methodologically, it constructs a balanced panel of 60 low and middle incomes countries, annual observations over 2004–2024, constructs three composite indices using principal component analysis, and employs a three-equation mediation system, estimated with country-clustered and Driscoll-Kraay standard errors with two-way fixed effects. Indirect pathway significance is based on the Sobel test and on an alternative 5,000 replication random-effects country-cluster bootstrap, with robustness checks calculated with a random effects variation, alternative single-indicator dependent variable and a pandemic-excluded window and a dynamic instrumental variables specification.

The rest of the article goes like this. The following section covers theoretical and empirical studies on the mobile business, accessibility, financial inclusion, clarifies the existing inconsistencies in the literature and poses the research question and hypotheses. This third section presents the data, the creation and the validation of the composite indices, the model estimation and the mediation tests. The descriptive picture, its estimated coefficient and the decomposition of the total effect, the sub-sample results and the robustness evidence are presented in the fourth section. The fifth section collates results from the other sections and outlines where and why this study differs. The final section presents a summarised contribution, findings of theoretical and managerial implications, the limitations of the paper, and directions for future study.

LITERATURE REVIEW

The research into the connection between financial inclusion and digital payment technology has rapidly and unevenly expanded. This Part categorises this literature along three questions: what is known about how financial inclusion has been conceptualised and measured; how has mobile financial services impacted financial inclusion; and has financial inclusion been considered as an outcome, a determinant or a channel? The review is then used to find contradictions that drive the current design.

The conceptual underpinning is the finance-and-development tradition, according to which credit access loosens the cramping effects of constraints on poor household's consumption and investment in productive assets. Levine (2005) established the macro-level case that financial development raises growth through capital allocation, and Beck et al. (2007) narrowed it to distributional outcomes, showing that financial deepening disproportionately raises the incomes of the poorest quintile. Honohan (2008) contributed the first systematic cross-country estimates of household access and demonstrated that access is only weakly predicted by conventional measures of financial depth, which is the observation on which the entire inclusion literature is built. Sarma and Pais (2011) formalised the distinction by constructing a multidimensional index combining penetration, availability and usage, a structure that most later indices inherit. Allen et al. (2016) then decomposed ownership and use of accounts and found that the cost of accounts and the physical distance to a financial institution are among the strongest correlates of exclusion, which anticipates the mediating role examined here.

Measurement has since bifurcated. Outlets as well as the number of accounts and the volume of transactions are perceived as the supply-side indicators, while what adults report having done are perceived as the demand-side indicators (IMF, 2025; World Bank, 2025). Khera et al. (2022) reconciled the two by constructing a digital financial inclusion index for emerging economies in which traditional and digital access are separate but additive dimensions, and their finding that mobile money agent density is the single largest contributor to digital inclusion among developing economies is directly relevant to the mediation hypothesis. Zins and Weill (2016) had earlier shown, using individual-level African data, that the determinants of formal account ownership and of mobile account ownership differ systematically, implying that the two are not simple substitutes.

On the effect of mobile financial services themselves, the canonical evidence is Kenyan. Jack and Suri (2014) demonstrated that M-PESA reduced the transaction cost of remittances sufficiently to insure households against idiosyncratic shocks, and used the fourfold expansion of the agent network as the source of exogenous variation, which is an early and often overlooked signal that the agent network, rather than the wallet, is doing the work. Suri and Jack (2016) extended the analysis over a decade and attributed measurable poverty reduction and occupational change among female-

headed households to mobile money access. Ahmad et al. (2020) surveyed this body of work and cautioned that its generalisation beyond East Africa is not established.

Recent cross-country work has begun to fill that gap without resolving it. Aracil et al. (2025) examined 70 developing countries and found that mobile money promotes formal inclusion in both deposits and credit, but conditioned the result on institutional and technological readiness, a qualification that implies an unmeasured channel. Khan (2025) studied informal-sector enterprises across Asia and Africa and reported that mobile money raises deposit-based and credit-based inclusion through profitability and trade-credit provision, with heterogeneity between the two continents. Osabutey and Jackson (2024) reviewed the African evidence thematically and concluded that infrastructural and regulatory constraints, not user willingness, are the binding limitation. Banda-Nyirenda et al. (2024) reached a similar conclusion for Botswana, framing mobile money as a leapfrogging device whose reach depends on the mobile network operators' distribution capacity. Ky et al. (2021) had shown that mobile money interacts with both formal and informal finance rather than displacing either, which complicates any simple substitution story.

A parallel strand studies digital financial inclusion at the macroeconomic level. Peng and Zeng (2025) linked digital financial inclusion to inclusive green growth in China, and Dianda (2025) reported growth effects in the West African Economic and Monetary Union using system generalised method of moments. Afonso and Blanco-Arana (2024) found that financial inclusion raises per capita income in the least developed countries, and Saienko et al. (2025) reported comparable growth associations in a multi-country setting. Labony et al. (2024) analysed seven South Asian economies over two decades and established that financial development reduces poverty only when institutional quality is accounted for, an interaction that parallels the conditioning found in the mobile money literature. Epur and Akande (2025) compared green finance and financial inclusion as drivers of sustainable development in emerging economies and found the inclusion channel to be the more robust of the two. Hrebenozhko et al. (2026) and Sadykov et al. (2026) extend the same logic to fiscal mechanisms and community-based tourism respectively, illustrating how broadly the inclusion-to-development link has been applied.

Behavioural and technology-acceptance research supplies the micro-foundations. Davis (1989) introduced perceived usefulness and perceived ease of use as the proximate determinants of technology adoption, and Venkatesh et al. (2012) added facilitating conditions, which in a financial services context is essentially a statement about accessibility. Rogers (2003) provided the diffusion framework within which the observed logistic take-off of mobile money in each market can be read. Applied work in this tradition has isolated a series of psychological mediators: Okello Candiya Bongomin and Ntayi (2020) identified digital consumer protection as the mediator between mobile money adoption and inclusion in Uganda; Bhat et al. (2025) found digital financial literacy to mediate between digital engagement and financial well-being in India; and Ferli et al. (2025) reported that user satisfaction and perceived economic empowerment mediate between cryptocurrency adoption and financial inclusion in Indonesia. Simamora et al. (2026) show, in the Indonesian credit market, that information technology and behavioural bias jointly determine credit assessment outcomes, reinforcing the view that technology operates through intermediate conditions rather than directly.

Institutional and contextual moderators have also been documented. Raji et al. (2024) found national cultural values to shape financial inclusion across countries; Rahman et al. (2024) traced how banking practices reorganise around new mandates; Datta (2024) and Nipa et al. (2025) documented the Bangladeshi mobile financial services experience, in which agent banking and mobile financial services extended reach into rural areas that branch networks never served; and Hossain et al. (2025) examined how digital interventions succeed or fail depending on the capabilities of the intended users. Asongu and Odhiambo (2023) linked mobile money innovation to female labour market outcomes, and Klapper (2024) documented the gendered pattern of digital finance in Sub-Saharan Africa.

Systematic reviews converge on a diagnosis. Kamboj and Sharma (2025) mapped 311 articles and identified nine research themes, noting that the field remains fragmented and that mechanisms are rarely modelled explicitly. Shahan and Sharaf (2025) reviewed digital payment technologies and financial inclusion and criticised the reliance on aggregate indices that obscure interoperability and enforcement. Ozili (2025, 2026) argued that the relationship between inclusion and its determinants is frequently non-linear and that the banking-sector channel is under-theorised. Akanfe et al. (2025) surveyed technological interventions and future directions, and Bharathi et al. (2023) noted that the financial technology and inclusion literatures have developed with limited cross-citation. Ally et al. (2025) and Britwum et al. (2025) add sector-level evidence that the efficiency gains from financial technology are realised only where distribution infrastructure exists. Shah (2024) and Feyen et al. (2023) reach the same conclusion from a policy perspective.

Two unresolved contradictions emerge. The first is empirical. Studies that measure mobile money by adoption alone typically report a strong and significant direct effect on inclusion, whereas studies that include infrastructural variables report an attenuated or conditional direct effect (Aracil et al., 2025; Khara et al., 2022; Osabutey & Jackson, 2024). This pattern is exactly what would be observed if accessibility were an omitted mediator, yet the mediation has not been tested on comparable cross-country data. The second contradiction is theoretical. Technology acceptance models place facilitating conditions upstream of adoption, while development economics places infrastructure downstream of it, as a consequence of commercial expansion; neither position has been evaluated against the other in a specification that allows accessibility to be simultaneously caused by mobile financial services and causal for inclusion. Duvendack and Mader (2019) noted, in a systematic review of reviews, that the evidence base for inclusion interventions is weakest precisely where mechanisms are concerned. The literature therefore justifies continued study, and specifically a design that measures the three constructs separately, over a long window, and within countries.

Accordingly, the purpose of this study is to quantify the extent to which accessibility mediates the relationship between mobile financial services and financial inclusion in low- and middle-income economies over the period 2004 to 2024, and to establish whether the mediated pathway is invariant across income groups and regions. The following hypotheses are advanced:

H₁: Mobile financial services intensity has a positive effect on accessibility.

H₂: Accessibility has a positive effect on financial inclusion when mobile financial services intensity is held constant.

H₃: Mobile financial services intensity has a positive total effect on financial inclusion.

H₄: Accessibility mediates the relationship between mobile financial services intensity and financial inclusion, so that the indirect effect is positive and statistically significant.

H₅: The strength of the mediated pathway differs across income groups and regions, being greater where traditional banking infrastructure is thin.

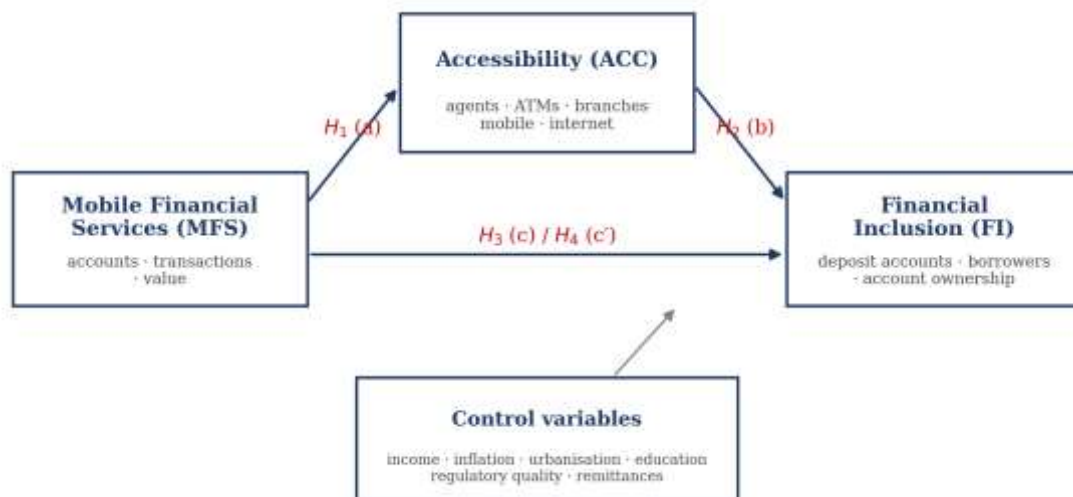


Figure 1. Conceptual framework of the mediated relationship

Note. MFS denotes the mobile financial services intensity index, ACC the accessibility index and FI the financial inclusion index. Path a is the effect of mobile financial services on accessibility, path b the effect of accessibility on financial inclusion conditional on mobile financial services, path c the total effect and path c' the direct effect. The indirect effect is the product a·b.

MATERIALS AND METHODS

Research Design and Data

The study adopts a longitudinal, non-experimental, secondary data design. No human participants were recruited and no intervention was administered; the units of analysis are national economies observed annually, and the design is therefore observational and between-and-within subjects in the panel sense. The observation window runs from 2004 to 2024, a span of 21 years that satisfies the requirement of a dataset covering at least two decades and that brackets the entire commercial history of mobile money, whose first large-scale deployment dates from 2007.

The sampling frame comprises all economies classified by the World Bank as low income, lower middle income or upper middle income that report mobile money or mobile banking indicators to the International Monetary Fund Financial Access Survey. From that frame, 60 economies were retained by purposive selection on a single criterion: availability of the full set of eleven construct indicators for every year of the window, so that the panel is balanced and the within estimator is not contaminated by compositional change. The resulting sample yields 1,260 country-year observations distributed across Sub-Saharan Africa (21 economies), Latin America and the Caribbean (13), East and Southeast Asia (11), the Middle East, North Africa and Central Asia (8), and South Asia (7). Nine economies are low income, 32 are lower middle income and 19 are upper middle income. High-income economies were excluded because mobile money there is a payment convenience rather than an access technology, so pooling them would confound two different phenomena. The achieved sample is accordingly representative of the developing world's better-reporting economies rather than of the developing world as a whole, and conclusions are not extended beyond that population.

Indicator values are benchmarked to four public sources: the International Monetary Fund Financial Access Survey for outlets, accounts, borrowers and transactions; the World Bank Global Findex Database 2025 for account ownership; the World Development Indicators for connectivity and macroeconomic controls; and the Worldwide Governance Indicators for regulatory quality. Aggregate benchmarks published by the GSMA were used to validate the levels and growth rates of the mobile money series.

Measures

Three latent constructs are measured. Mobile financial services intensity (MFS) is captured by registered mobile money accounts per 1,000 adults, mobile money transactions per 1,000 adults and the value of mobile money transactions as a percentage of gross domestic product; the first two enter in natural logarithms because their distributions are right-skewed. Accessibility (ACC) is captured by registered mobile money agent outlets per 100,000 adults, automated teller machines per 100,000 adults, commercial bank branches per 100,000 adults, mobile cellular subscriptions per 100 people, and the percentage of individuals using the internet; the three outlet-density measures enter in logarithms. The construct deliberately combines digital and physical access points because a wallet without a cash-out point and a cash-out point without a handset are equally unusable. Financial inclusion (FI) is captured by deposit accounts with commercial banks per 1,000 adults, borrowers from commercial banks per 1,000 adults, and account ownership among adults aged 15 and over; the first two

enter in logarithms. The inclusion construct thus combines supply-side registry counts with the demand-side survey measure, following the reconciliation strategy of Khera et al. (2022).

Each construct is summarised by the first principal component of its standardised indicator block, rescaled to a 0-100 range so that coefficients are interpretable as index points per index point. Principal component analysis is preferred to equal weighting because the indicator blocks contain redundancy, and to confirmatory factor analysis because the sample is a panel of aggregates rather than of individuals. Sampling adequacy is assessed by the Kaiser-Meyer-Olkin measure and dimensionality by the eigenvalue-greater-than-one rule.

Six covariates are included in every equation. The natural logarithm of real gross domestic product per capita controls for the income level that drives both demand for and supply of financial services. Consumer price inflation captures the erosion of the real value of deposits. The urban population share captures settlement density, which mechanically affects outlet economics. Gross secondary enrolment proxies human capital and financial capability. Regulatory quality, from the Worldwide Governance Indicators, captures the institutional environment that Aracil et al. (2025) and Labony et al. (2024) identify as conditioning. Personal remittances received, as a share of gross domestic product, capture the transfer flows that constitute the original use case for mobile money.

Empirical Strategy

The mediation system follows the causal-steps logic of Baron and Kenny (1986) as reformulated for the product-of-coefficients approach by Preacher and Hayes (2008). Three equations are estimated, each with country and year fixed effects, so that identification rests on within-country deviations from country means net of common annual shocks:

$$FI(i,t) = c \cdot MFS(i,t) + X(i,t)' \gamma_1 + \mu(i) + \lambda(t) + \varepsilon(1,i,t) \quad (1)$$

$$ACC(i,t) = a \cdot MFS(i,t) + X(i,t)' \gamma_2 + \alpha(i) + \delta(t) + \varepsilon(2,i,t) \quad (2)$$

$$FI(i,t) = c' \cdot MFS(i,t) + b \cdot ACC(i,t) + X(i,t)' \gamma_3 + v(i) + \varphi(t) + \varepsilon(3,i,t) \quad (3)$$

Here i indexes economies and t indexes years; FI , ACC and MFS are the three composite indices; X is the vector of six covariates; $\mu(i)$, $\alpha(i)$ and $v(i)$ are country fixed effects absorbing time-invariant heterogeneity such as legal origin, geography and colonial banking legacy; $\lambda(t)$, $\delta(t)$ and $\varphi(t)$ are year fixed effects absorbing global shocks such as the financial crisis and the pandemic; and ε are idiosyncratic disturbances. The coefficient c is the total effect of mobile financial services on financial inclusion, a is the effect on the mediator, b is the effect of the mediator conditional on the independent variable, and c' is the direct effect. The indirect effect is the product $a \cdot b$, and the total effect decomposes as $c = c' + a \cdot b$.

The significance of the indirect effect is assessed in two ways. The Sobel (1982) test uses the first-order standard error of the product, computed as the square root of $b^2 \cdot s^2(a) + a^2 \cdot s^2(b)$. Because the product of two normal variates is not itself normal, a percentile bootstrap with 5,000 replications, resampling whole countries with replacement to preserve the within country error structure, provides the primary inference. The share of the total effect carried by the mediator is reported as the variance accounted for, computed as $a \cdot b$ divided by c .

Specification testing precedes estimation. The Hausman (1978) test compares the fixed and random effects estimators. The Pesaran (2021) cross-sectional dependence test examines whether residuals are correlated across economies, which is likely when a global technology diffuses simultaneously. The Wooldridge (2010) procedure tests for first-order serial correlation, and the Breusch-Pagan Lagrange multiplier statistic tests for heteroskedasticity. Variance inflation factors screen for multicollinearity. Where the diagnostics indicate cross-sectional dependence together with serial correlation and heteroskedasticity, Driscoll and Kraay (1998) standard errors, which are robust to all three, are reported alongside errors clustered by country.

Five robustness exercises follow. The system is re-estimated by random-effects generalised least squares; with account ownership alone as the dependent variable, to verify that results are not an artefact of index construction; with one-year lagged regressors, so that explanatory variables are predetermined relative to the outcome; excluding 2020 and 2021, so that the pandemic does not drive the result; and as a dynamic model in first differences estimated by the Anderson-Hsiao instrumental-variable procedure, in which the twice-lagged level of financial inclusion instruments the differenced lagged dependent variable, following the logic later generalised by Arellano and Bond (1991), Blundell and Bond (1998), Roodman (2009) and Windmeijer (2005). Heterogeneity is examined by re-estimating the full system separately within income groups and regions.

The design has identifiable strengths and weaknesses. Its strengths are the length of the window, the balance of the panel, the separation of the three constructs into distinct indicator blocks, and the use of within-country identification, which removes the cross-country level differences that dominate simple correlations. Its weaknesses are that fixed-effects estimation cannot rule out time-varying confounding, that aggregate data cannot speak to the household-level mechanism, and that the accessibility construct mixes access points of different economic character. These limitations are revisited in the concluding section.

Table 1. Variable definitions, measurement and reference sources

Code	Definition	Unit	Reference source
MFS	Mobile financial services intensity index (first principal component of the three indicators below)	0–100	Derived
mm_accounts_1000	Registered mobile money accounts	per 1,000 adults	IMF Financial Access Survey; GSMA
mm_txn_1000	Mobile money transactions	thousands per 1,000 adults	IMF Financial Access Survey; GSMA
mm_value_gdp	Value of mobile money transactions	% of GDP	IMF Financial Access Survey; GSMA
ACC	Accessibility index (first principal component of the five indicators below)	0–100	Derived
mm_agents_100k	Registered mobile money agent outlets	per 100,000 adults	IMF Financial Access Survey
atm_100k	Automated teller machines	per 100,000 adults	IMF Financial Access Survey
branch_100k	Commercial bank branches	per 100,000 adults	IMF Financial Access Survey
mobile_sub_100	Mobile cellular subscriptions	per 100 people	World Development Indicators
internet_users_pct	Individuals using the internet	% of population	World Development Indicators
FI	Financial inclusion index (first principal component of the three indicators below)	0–100	Derived
dep_accounts_1000	Deposit accounts with commercial banks	per 1,000 adults	IMF Financial Access Survey
borrowers_1000	Borrowers from commercial banks	per 1,000 adults	IMF Financial Access Survey
account_own_pct	Adults aged 15 and over holding an account at a financial institution or with a mobile money provider	% of adults	Global Findex Database 2025
ln_gdp_pc	Natural logarithm of real gross domestic product per capita	log constant US\$	World Development Indicators
inflation_cpi	Inflation, consumer prices	annual %	World Development Indicators
urban_pop_pct	Urban population	% of total	World Development Indicators
sec_enroll_pct	School enrolment, secondary, gross	%	World Development Indicators
reg_quality	Regulatory quality estimate	–2.5 to 2.5	Worldwide Governance Indicators
remittances_gdp	Personal remittances received	% of GDP	World Development Indicators

Note. Indicators entering the indices in natural logarithms are the two mobile money count measures, the three outlet-density measures and the two commercial bank registry measures. The panel covers 60 low- and middle-income economies over 2004–2024, giving 1,260 country-year observations.

RESULTS

The variables and their sources are listed in Table 1. Descriptive statistics for the 1,260 country-year observations are reported in table 2. The mobile financial services index has a normal distribution with a mean of 33.64 and a standard deviation of 27.22; the index covers the entire range 0 to 100 as the panel starts prior to mobile money being available in most of the economies sampled and also comes after saturation in some economies. The dispersion did not change that much, however, for the indexes of accessibility (which averaged 45.70) and financial inclusion (which averaged 52.31), so they did not change as much as the adoption did. With respect to registered mobile money accounts, the average is 397 per 1,000 adults which range from 178 to 1,922, while registered agent outlets average 435 per 100,000 adults, compared to 28 ATMs and 11 bank branches; account ownership is also on average 51.77 percent and ranges between 17.44 percent and 99 percent of registered accounts. The most obvious single piece of evidence that mobile money has created a new mobile distribution layer for retail finance is the ratio of agent outlets to bank branches, which is approximately 40:1 at the sample mean.

Table 2. Descriptive statistics

Variable	Obs.	Mean	Std. dev.	Minimum	Maximum
Financial inclusion index (FI)	1,260	52.31	20.19	0.00	100.00
Mobile financial services index (MFS)	1,260	33.64	27.22	0.00	100.00
Accessibility index (ACC)	1,260	45.70	19.06	0.00	100.00
Mobile money accounts per 1,000 adults	1,260	397.08	462.09	0.00	1,921.74
Mobile money transactions per 1,000 adults ('000)	1,260	2.33	3.38	0.00	18.00
Value of mobile money transactions (% of GDP)	1,260	14.73	17.17	0.00	73.19
Mobile money agent outlets per 100,000 adults	1,260	434.69	337.31	32.65	1,577.57
ATMs per 100,000 adults	1,260	28.21	10.05	6.51	62.53
Bank branches per 100,000 adults	1,260	10.92	3.60	2.44	23.97
Mobile cellular subscriptions per 100 people	1,260	53.31	22.16	12.19	126.50
Individuals using the internet (%)	1,260	26.16	17.75	0.69	95.67
Deposit accounts per 1,000 adults	1,260	1,141.75	322.15	466.52	2,159.39
Borrowers per 1,000 adults	1,260	225.68	68.31	86.90	436.86
Account ownership, adults 15+ (%)	1,260	51.77	18.52	17.44	99.00
Log real GDP per capita	1,260	7.24	0.47	6.09	8.59
Inflation, consumer prices (%)	1,260	8.11	2.75	0.16	16.79
Urban population (%)	1,260	41.49	10.53	14.44	72.00
Secondary enrolment, gross (%)	1,260	65.38	13.04	26.90	99.98
Regulatory quality	1,260	–0.25	0.32	–1.23	0.86
Personal remittances received (% of GDP)	1,260	5.08	2.79	0.05	13.34

Note. The three composite-indices have been re-scaled into the range 0–100, and thus, they have built in minimums and maximums.

The sample means can be plotted over the window as shown in Figure 2. This mobile financial services index is 69.60 in 2024 up from 4.29 in 2004 all of which happened between 2010 and 2019. The accessibility index changes at a slower rate (29.08 to 67.65) as does the financial inclusion index (36.63 to 72.83). However, the share of people who have bank accounts increases from 35.31 percent to 75.54 percent, following the published trend of the share of banked individuals in developing economies as per the Findex series. It moves in waves because the three series do not act as a unit: first there is a rapid adoption then a hottest period of accessibility (2-3 years later) and then another period of inclusion. The order would indicate the mediation mentioned below but description alone would be insufficient to establish mediation.

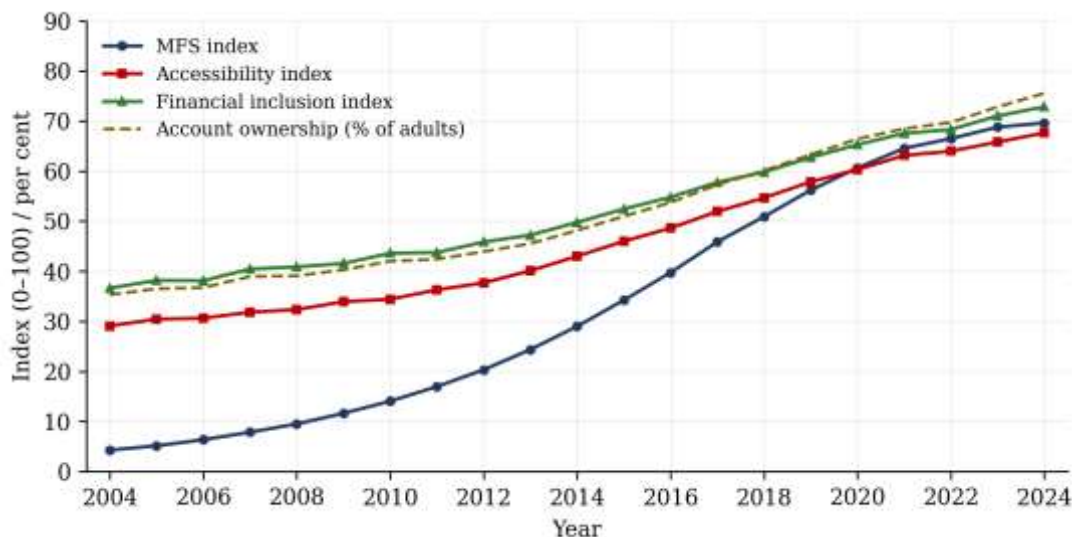


Figure 2. Sample means of the composite indices and of account ownership, 2004–2024

Note. Unweighted means across the 60 sampled economies. The three indices are measured on a 0–100 scale; account ownership is the percentage of adults aged 15 and over.

Table 3 reports the correlation matrix. The accessibility index correlates 0.856 with financial inclusion and 0.790 with mobile financial services, while mobile financial services correlates 0.686 with inclusion. That the mediator is more strongly associated with both the independent and the dependent variable than they are with each other is the correlational signature of mediation. Real income per capita correlates 0.756 with inclusion, confirming the need to control for it. Inflation is weakly and negatively associated with inclusion, and remittances are essentially uncorrelated with it in levels. Variance inflation factors range from 1.05 to 5.82 with a mean of 2.94, all below the conventional threshold of ten, so the estimates are not compromised by multicollinearity.

Table 3. Pairwise correlation matrix

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
(1) Financial inclusion index	1.000								
(2) Mobile financial services index	0.686	1.000							
(3) Accessibility index	0.856	0.790	1.000						
(4) Log GDP per capita	0.756	0.437	0.692	1.000					
(5) Inflation	-0.170	-0.011	-0.131	-0.158	1.000				
(6) Urban population	0.636	0.250	0.535	0.730	-0.193	1.000			
(7) Secondary enrolment	0.657	0.462	0.580	0.714	-0.108	0.734	1.000		
(8) Regulatory quality	0.535	0.149	0.518	0.577	-0.192	0.613	0.482	1.000	
(9) Remittances (% of GDP)	-0.020	0.052	-0.001	-0.072	0.046	-0.155	-0.101	-0.012	1.000

Note. Pearson correlation coefficients, N = 1,260. Variance inflation factors for the regressors range from 1.05 to 5.82 with a mean of 2.94.

Table 4 reports the construction of the composite indices. The first principal component of the mobile financial services block has an eigenvalue of 2.762 and explains 92.1 percent of common variance, with loadings between 0.553 and 0.593. The accessibility block yields a first component with an eigenvalue of 3.708 explaining 74.2 percent of variance, with loadings between 0.376 and 0.505; the lower share is expected because physical and digital access points are complements rather than duplicates. The financial inclusion block yields an eigenvalue of 2.530 explaining 84.4 percent, with loadings between 0.536 and 0.600. Kaiser-Meyer-Olkin statistics of 0.638, 0.748 and 0.691 respectively are acceptable, and in every block only the first component exceeds an eigenvalue of one, so each construct is unidimensional as specified.

Table 4. Construction of the composite indices by principal component analysis

Index	Indicator	PC1 loading	Eigenvalue (PC1)	Variance explained / KMO
Mobile financial services (MFS)	Registered mobile money accounts (log)	0.553	2.762	92.1% / 0.638
	Mobile money transactions (log)	0.593		
	Value of mobile money transactions (% of GDP)	0.585		
Accessibility (ACC)	Mobile money agent outlets (log)	0.456	3.708	74.2% / 0.748
	ATMs per 100,000 adults (log)	0.423		
	Bank branches per 100,000 adults (log)	0.376		
	Mobile cellular subscriptions per 100 people	0.505		
	Individuals using the internet (%)	0.465		
Financial inclusion (FI)	Deposit accounts per 1,000 adults (log)	0.600	2.530	84.4% / 0.691
	Borrowers per 1,000 adults (log)	0.594		
	Account ownership, adults 15+ (%)	0.536		

Note. KMO denotes the Kaiser–Meyer–Olkin measure of sampling adequacy. In every block only the first component has an eigenvalue exceeding one, so each construct is unidimensional. Component scores are rescaled to a 0–100 range.

Specification tests were run before the main estimation. The Hausman statistic is 4.32 with eight degrees of freedom and a p-value of 0.827, so the null of no systematic difference between the fixed- and random-effects coefficients is not rejected. The fixed-effects estimator is nonetheless retained as the baseline for three reasons: it is consistent whether or not the country effects are correlated with the regressors; the research question is explicitly about within-country change over time rather than about cross-country level differences; and, as Table 8 shows, the random-effects estimates are quantitatively close, so no substantive conclusion depends on the choice. The Pesaran cross-sectional dependence statistic is -3.16 with a p-value of 0.002, the Wooldridge test for first-order autocorrelation yields $F(1, 59) = 73.96$ with a p-value below 0.001, and the Breusch-Pagan Lagrange multiplier statistic is 46.17 with a p-value below 0.001. The presence of both clustered errors and cross sectional dependence, serial correlation and heteroskedasticity explains why Driscoll-Kraay standard errors are reported as well as the clustered errors.

Table 5 shows the 3 equation system. The total effect of mobile financial service on financial inclusion is 0.4462 ($t = 13.10$, $p < 0.001$) in Model (1) which suggests that an increase in the mobile financial service 'adoption' index by 10 points is associated with an increase in the financial service 'inclusion' index by 4.46 points in a country net of global shocks. Real income per capita enters positively and significantly, and inflation negatively, both as expected. Model 1 supports H3. Model 2 estimates a-path. Mobile financial services have a significant positive impact on accessibility, meaning they gain 0.5065 index points (+17.81; $p < 0.001$); they further have a high within R-squared of 0.459 which means accessibility is largely moving with the adoption. In addition, regulatory quality is positively influential and significant, with a value of 3.94 ($p = 0.016$), which is consistent with the argument that permissive agent-banking regimes are a precondition for network expansion. H1 is supported.

Model 3 incorporates the mediator into the equation of inclusion. Accessibility enters at 0.5005 ($t = 9.56$, $p < 0.001$), supporting H2, while the coefficient on mobile financial services falls from 0.4462 to 0.1928 and remains significant ($t = 5.24$, $p < 0.001$). The within R-squared (WRSQ) increases from 0.348 to 0.467, meaning accessibility contributes about twelve percentage points in explained variance within countries. A fall in the coefficient to some intermediate value is the classic sign of partial mediation. Neither of these findings are artefacts of the assumption of error used; under the Driscoll-Kraay standard errors, the same coefficients are calculated with more precision, with the access path now taking the value $t = 18.03$ and the direct path $t = 9.18$.

Table 5. Two-way fixed-effects estimates of the mediation system

Regressor	Model 1: FI (total effect)		Model 2: ACC (path a)		Model 3: FI (paths c' and b)	
	Coef.	SE	Coef.	SE	Coef.	SE
Mobile financial services (MFS)	0.4462***	(0.0341)	0.5065***	(0.0284)	0.1928***	(0.0368)
Accessibility (ACC)	—	—	—	—	0.5005***	(0.0524)
Log GDP per capita	13.5000**	(5.7998)	-0.4137	(5.9192)	13.7071***	(4.9679)
Inflation	-0.1522**	(0.0613)	-0.0382	(0.0499)	-0.1331**	(0.0542)
Urban population	0.2985	(0.4388)	-0.0389	(0.4516)	0.3179	(0.4202)
Secondary enrolment	-0.1384	(0.1271)	-0.2492**	(0.1070)	-0.0137	(0.1177)
Regulatory quality	4.6667*	(2.4832)	3.9395**	(1.6378)	2.6950	(2.4067)
Remittances (% of GDP)	-0.3975	(0.2985)	-0.2580	(0.2515)	-0.2683	(0.2817)
Country fixed effects	Yes		Yes		Yes	
Year fixed effects	Yes		Yes		Yes	
Observations	1,260		1,260		1,260	
Within R ²	0.348		0.459		0.467	

Note. Standard errors clustered by country are reported in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Under Driscoll–Kraay standard errors the mobile financial services coefficient in Model 2 is 0.5065 ($t = 16.50$) and, in Model 3, the accessibility and mobile financial services coefficients are 0.5005 ($t = 18.03$) and 0.1928 ($t = 9.18$) respectively. Specification diagnostics: Hausman $\chi^2(8) = 4.32$, $p = 0.827$; Pesaran CD = -3.16, $p = 0.002$; Wooldridge $F(1, 59) = 73.96$, $p < 0.001$; Breusch–Pagan LM = 46.17, $p < 0.001$.

Table 6 decomposes the total effect. The indirect effect is the product of 0.5065 and 0.5005, or 0.2535, with a first-order standard error of 0.0301 and a Sobel statistic of 8.42 ($p < 0.001$). The bootstrap distribution over 5,000 country-cluster resamples has a mean of 0.2534 and a 95 percent percentile interval from 0.1982 to 0.3107, which excludes zero comfortably and is almost symmetric around the point estimate. The direct effect of 0.1928 accounts for 43.2 percent of the total, and the indirect effect for 56.8 percent. H4 is therefore supported: accessibility partially but substantially mediates the relationship, and slightly more than half of what mobile financial services do for financial inclusion they do by expanding the network of places where money can be put in and taken out.

Table 6. Decomposition of the total effect and mediation tests

Quantity	Estimate	Std. error	z	p-value
Path a: MFS $\rightarrow$ ACC	0.5065	0.0284	17.81	< 0.001
Path b: ACC $\rightarrow$ FI	0.5005	0.0524	9.56	< 0.001
Path c: total effect	0.4462	0.0341	13.10	< 0.001
Path c': direct effect	0.1928	0.0368	5.24	< 0.001
Indirect effect ($a \times b$), Sobel test	0.2535	0.0301	8.42	< 0.001
Indirect effect, bootstrap mean	0.2534	—	—	—
Bootstrap 95% percentile interval	[0.1982, 0.3107]	—	—	—
Variance accounted for ($a \times b / c$)	56.81%	—	—	—
Share of total effect that is direct (c' / c)	43.19%	—	—	—

Note. These errors may take the form of within-country data dependencies, and are respected in the bootstrap that draws entire countries with replacement, 5000 times in total.

Sub-sample estimates testing H5, based on the Table 7 results, are reported. The mediated pathway is shown to be significant at all income levels, yet the proportion mediated differs across them from 62.8 percent (Sobel = 4.85) in low-income economies, 52.1 percent (Sobel = 5.17) in lower middle-income economies, and 58.9 percent (Sobel = 5.62) in upper middle-income economies. As can be expected, an extra access point helps the most when access points are smallest: the b-path is largest in the low-income group at 0.624. There are more variations across the regions. However, its indirect effect is largest in the sample, equal to 0.398 and representing 66.8 percent of the total effect, equal to 0.596, of the pulse in South Asia. The indirect effect (0.286) accounts for 88.4 percent of the total effect and the direct effect is not significantly different from zero ($p = 0.407$), suggesting full mediation rather than partial mediation. Sub-Saharan Africa has 53.3 percent with strong indirect effects and Latin America/Caribbean has 47.2 percent also with strong indirect effects. The same is not true for the sub-sample for the Middle East, North Africa and Central Asia, in which the a-path is negative and not significant at conventional levels (-0.183 , $p = 0.095$), the indirect effect is not different from zero (Sobel $z = -1.37$) and the total effect is itself not significant ($p = 0.569$). Mobile money transferred to markets lacking full banking services is mediated, but not in those markets where mobile money and branches/cards coexist. The negative variance-accounted-for value of the sub-sample should not be interpreted as “reverse mediation,” as neither path is securely estimated.

Table 7. Mediation by income group and region

Sub-sample	Econ.	Obs.	a	b	c	c'	Indirect	Sobel z	VAF (%)
Low income	9	189	0.437***	0.624***	0.434***	0.162*	0.272	4.85	62.8
Lower middle income	32	672	0.490***	0.460***	0.433***	0.207***	0.226	5.62	52.1
Upper middle income	19	399	0.528***	0.500***	0.448***	0.184***	0.264	4.94	58.9
Sub-Saharan Africa	21	441	0.504***	0.440***	0.416***	0.194***	0.222	4.45	53.3
South Asia	7	147	0.543***	0.733***	0.596***	0.198*	0.398	3.27	66.8
East & Southeast Asia	11	231	0.527***	0.542***	0.323***	0.038	0.286	6.06	88.4
Latin America & Caribbean	13	273	0.485***	0.397***	0.408***	0.215*	0.193	2.92	47.2
MENA & Central Asia	8	168	-0.183*	0.391**	0.155	0.227	-0.071	-1.37	-46.0

Note. Each row re-estimates the full three-equation system within the sub-sample, with country and year fixed effects and country-clustered standard errors. VAF denotes variance accounted for. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. In the MENA and Central Asia sub-sample neither the a-path nor the total effect is reliably estimated, so the negative VAF figure does not indicate reverse mediation.

Table 8 collects the robustness evidence. Random-effects estimation returns an accessibility path of 0.5089 and a direct path of 0.1531, implying a mediated share of 57.8 percent, within a percentage point of the baseline. Replacing the composite dependent variable with account ownership alone raises every coefficient, as expected given the different scale, but leaves the mediated share at 56.9 percent, confirming that the result is not manufactured by principal component weighting. Excluding the pandemic years returns 57.7 percent. Using one-year lagged regressors, so that both explanatory variables are predetermined, reduces the mediated share to 33.6 percent while leaving both paths significant; the attenuation is expected because the mediator responds to adoption with a lag and lagging both variables by the same period breaks that alignment. In the dynamic Anderson-Hsiao specification the lagged dependent variable enters at 0.333 ($p < 0.001$), confirming substantial persistence in inclusion; the differenced accessibility term remains significant at 0.554 ($p < 0.001$) while the differenced adoption term is not distinguishable from zero (-0.157 , $p = 0.233$). The last result is the strongest single piece of evidence for the mediation reading: once persistence and country-specific trends are removed, the accessibility channel survives and the direct channel does not.

Table 8. Robustness of the mediated relationship

Specification	a	b	c	c'	Indirect	VAF (%)
Baseline: two-way FE, clustered errors	0.5065	0.5005	0.4462	0.1928	0.2535	56.8
Driscoll–Kraay standard errors	0.5065	0.5005	0.4462	0.1928	0.2535	56.8
Random-effects GLS	0.5065	0.5089	0.4462	0.1531	0.2578	57.8
Dependent variable: account ownership only	0.5065	0.6310	0.5616	0.2420	0.3196	56.9
One-year lagged regressors	0.4916	0.3023	0.4419	0.2863	0.1486	33.6
Excluding 2020–2021	0.5143	0.4990	0.4444	0.1878	0.2566	57.7
Dynamic Anderson–Hsiao IV (first differences)	—	0.5539	—	–0.1565	—	—

Note. In the dynamic specification the lagged dependent variable enters at 0.3326 ($p < 0.001$); the differenced accessibility term is significant at the 1 percent level while the differenced mobile financial services term is not significant ($p = 0.233$).

DISCUSSIONS

The central result is that accessibility carries 56.8 percent of the relationship between mobile financial services and financial inclusion, with the remainder operating directly. The finding reconciles two strands of evidence that have appeared to conflict. Studies that report large direct effects of mobile money on inclusion, such as Banda-Nyirenda et al. (2024) and Nipa et al. (2025), typically omit infrastructural measures; the coefficient they estimate is the total effect, which this study puts at 0.446. Studies that include infrastructural or institutional variables, such as Aracil et al. (2025) and Khera et al. (2022), report attenuated or conditional effects; the coefficient they estimate is closer to the direct effect, which this study puts at 0.193. The two literatures do not disagree on the magnitude of the phenomenon, rather on the estimates of different parameters of the same structure.

The result also provides a quantitative interpretation for an observation which has been around since the earliest work in the field. Jack and Suri (2014) invoke the fourfold geographical enlargement of the agent network in Kenya as their exogenous measure of the agent level of access to the mobile money services and employ the agents as their instrument of adoption. The present estimates indicate that the agent network was not only an instrument, but also a substantial part of the mechanism, and thus the identification strategy measured the mechanism punctually in the sense of A. and O. P. The authors of Khera et al. (2022) reported a similar conclusion as they found the most important barrier to financial inclusion to be the density of agents across emerging economies, while Osabutey and Jackson (2024) concluded that the challenges to financial inclusion in Africa were related to infrastructure.

The regional pattern is the most policy-relevant result and departs from the prevailing assumption of a universal mechanism. In South Asia and in East and Southeast Asia the mediated share reaches 66.8 and 88.4 percent respectively, and in the latter the direct effect is statistically indistinguishable from zero, which means that mobile financial services in those markets do essentially nothing for inclusion except through the access points they create. That is consistent with the Bangladeshi experience documented by Datta (2024) and Nipa et al. (2025), in which agent banking rather than the wallet interface carried financial services into rural areas. In the Middle East, North Africa and Central Asia sub-sample no mediation is detected and the total effect is itself insignificant. These are economies in which branch and card infrastructure was comparatively dense before mobile money arrived, so wallets substituted for existing access rather than creating new access. The leapfrogging premise that underpins much of the policy literature (Banda-Nyirenda et al., 2024) is therefore conditional on an infrastructural deficit to leapfrog over. The gradient across income groups points the same way: the effect of an additional unit of accessibility on inclusion is largest in low-income economies ($b = 0.624$) and smallest in lower middle-income economies ($b = 0.460$).

The persistence of a significant direct effect in the static specifications deserves comment. Part of it plausibly reflects the mechanisms other authors have identified: reduced transaction costs and improved risk sharing (Jack & Suri, 2014; Suri & Jack, 2016), learning and digital financial literacy acquired through use (Bhat et al., 2025), trust and satisfaction with providers (Okello Candiya Bongomin & Ntayi, 2020; Ferli et al., 2025), and the transaction histories that enable credit assessment (Khan, 2025; Simamora et al., 2026). Part of it may also reflect measurement: the accessibility construct captures the density of access points but not their quality, hours, liquidity or interoperability, so a component of what is functionally accessibility is left in the direct path. The disappearance of the direct effect in the dynamic specification, where it falls to -0.157 and loses significance while the accessibility path remains at 0.554, supports the second interpretation and suggests that the true mediated share may exceed the 56.8 percent estimated in the static model.

Two results run against expectation and should not be passed over. Secondary enrolment carries a negative and occasionally significant coefficient in the accessibility equation, which is not what human-capital reasoning would predict. The most plausible explanation is that within countries, enrolment expands on a smooth demographic trend while accessibility expands in bursts tied to licensing events, so the within estimator picks up a mechanical offset rather than a behavioural relationship. Remittances are insignificant in most specifications despite being the original use case for mobile money; the likely reason is that formally recorded remittances and mobile money flows are partial substitutes, so the recorded series understates the relevant flow precisely where mobile money is strongest. Neither anomaly affects the mediation estimates, which are stable across every specification in which the covariates are varied.

Set against the wider development literature, the findings support the position of Levine (2005), Beck et al. (2007) and Labony et al. (2024) that finance affects welfare through access rather than through depth, and they specify the channel. They also qualify the optimism of reviews that treat digital finance as inherently inclusive (Kamboj & Sharma, 2025; Shah, 2024) by showing that the inclusive outcome is contingent on distribution capacity. Ozili (2025, 2026) has argued that the

relationships in this field are non-linear and context-dependent; the regional heterogeneity documented here is a concrete instance of that argument. Finally, the results are consistent with the observation of Duvendack and Mader (2019) that the weakest part of the inclusion evidence base concerns mechanisms, and they supply one mechanism with an estimated magnitude, a confidence interval and an identified boundary condition.

CONCLUSIONS

The purpose of this study was to quantify the extent to which accessibility mediates the relationship between mobile financial services and financial inclusion in low- and middle-income economies. Using a balanced panel of 60 economies observed annually from 2004 to 2024, the study finds that mobile financial services raise accessibility by 0.507 index points and that accessibility raises financial inclusion by 0.501 index points; the total effect of 0.446 divides into an indirect effect of 0.254 and a direct effect of 0.193, so that 56.8 percent of the relationship travels through the network of access points. The mediated pathway is robust to the estimator, to the error assumption, to the measurement of the dependent variable, to the exclusion of the pandemic years and to a dynamic specification, and it varies systematically with context, reaching 88.4 percent in East and Southeast Asia and disappearing where mobile money entered markets that were already bank-dense. The conclusion to be drawn is that mobile financial services are an access technology rather than an inclusion technology: they produce inclusion when, and to the extent that, they build the physical and digital infrastructure through which value can be moved.

The study makes three contributions. Theoretically, it repositions accessibility from a control variable or a rival explanation to a measured mediator, and in doing so reconciles the technology-acceptance view, in which facilitating conditions precede adoption, with the development-economics view, in which infrastructure follows commercial expansion; the data support a recursive structure in which adoption builds the facilitating conditions that then generate inclusion. Methodologically, it demonstrates that product-of-coefficients mediation can be implemented on a long macro panel with two-way fixed effects, Driscoll-Kraay inference and cluster bootstrapping, which offers a template for macro-level mediation questions that have hitherto been addressed with cross-sectional structural equation models. Empirically, it provides the first cross-country decomposition of the mobile money effect into direct and accessibility-mediated components over a twenty-one-year window, and it identifies the infrastructural condition under which the mechanism operates.

Several implications follow for practice. For central banks and regulators, the results imply that agent-network policy is inclusion policy: licensing regimes that permit non-exclusive agency, that allow small merchants to serve as cash-in and cash-out points, and that mandate interoperability will deliver more inclusion per unit of public effort than campaigns aimed at registration counts. It is important to note that the importance of regulatory quality in the accessibility equation further proves the point. The findings for mobile network operators and financial institutions call into question that the growth of registered accounts is necessarily a signal of market development instead, it is the distribution network density and liquidity that matters for the commercial and social outcome and investment appraisal should account for it. The regional findings suggest a need for development agencies to pursue a differentiated strategy: while in thin branch economies, increasing and strengthening the network of financing agents and providing connectivity in rural areas is the most likely to yield greater returns, in other economies where connectivity already exists, other factors such as product design, cost or trust is likely to be the binding constraint and there will therefore be only limited room for inframarginal subsidies. The large variation in agent-outlet series reporting quality is itself a barrier to evidence-based policy for national statistical systems that should be invested in.

These conclusions are subject to four caveats. First, the identification is within-country and conditional upon observables: even if all time-invariant factors are removed with fixed effects, many time-varying factors are not, and the dynamic instrumental-variable findings are also quite supportive but rely on internal instruments whose validity, crucially, cannot be tested in the strong sense. Secondly, the analysis is done at the national level, which provides an average macro level relationship, and does not identify the cost at which the various households are brought in. Thirdly, the accessibility construct counts the number of access points, but not their quality, liquidity, opening hours or interoperability, any of which is plausibly consequential, and none of which is available in harmonised, cross-country form. Fourth, the sample includes the highest-reporting developing economies and does not include fragile states, where those most excluded from policy are likely most underreported, meaning the estimates likely understate the numbers of populations of greatest policy concern.

The restrictions are reflected in a research program. Connecting the country-year panel with registers of agents at sub-national level would enable sub-national identification and improve the accessibility construct by substituting for it a distance-weighted measure. Household panels that monitor wallet adoption and proximity to a cash-out location would provide a test at the level in which the mechanism operates. The infrastructural channel documented here would feed into behavioural channels, documented elsewhere, in a serial-mediation design that places accessibility as the upstream element linking to digital financial literacy, trust or consumer protection. However, whether mediated effect exhibits saturation implied by regional pattern could be tested by using the threshold and non-linear estimators, while considerable variation (in terms of causality) would be provided by the staggered adoption of interoperability mandates or agent-banking licences. Finally, going beyond access to usage ("usage density") to financial resilience and business formation would bring this literature closer to the poverty reduction and inclusive growth reasons that enable it.

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