

Digital Reach Is Not Financial Inclusion: Physical Banking Access and Account Ownership in Middle-Income Economies — A Within-Between Panel Analysis, 2011–2024

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Abstract

Purpose — This paper asks whether broad digital connectivity and physical banking outreach make distinct contributions to account ownership in middle-income economies. It separates persistent cross-country access conditions from shorter-run changes within countries. **Design/methodology/approach** — An unbalanced panel combines five World Bank Global Findex waves (2011, 2014, 2017, 2021, and 2024) with one-year-lagged World Development Indicators and IMF Financial Access Survey indicators. The estimation sample contains 312 country-wave observations from 76 lower- and upper-middle-income economies. Principal-component indices summarize digital access (internet use and mobile subscriptions) and physical access (commercial-bank branches and ATMs). Two-way fixed-effects and Mundlak-type within-between models use country-clustered standard errors. **Findings** — Country-average physical access is associated with a 7.735-percentage-point higher account-ownership rate per standard-deviation increase ($SE = 3.021$, $p = 0.012$). The comparable within-country estimate is 1.124 points and not statistically significant ($SE = 0.720$, $p = 0.122$); the between-within contrast is 6.611 points ($p = 0.028$). Neither the within nor between digital-connectivity coefficient is distinguishable from zero after physical access, income, female labour-force participation, urbanization, inflation, and survey-wave effects are controlled. The physical-access result survives alternative index weighting, exclusion of the 2011 definition-break wave, exclusion of 2021, component substitution, inflation winsorization, and a log-odds outcome; the smaller balanced sample preserves the coefficient magnitude but not its precision. **Originality/value** — The findings distinguish generic connectivity from usable financial-service infrastructure. They imply that digital reach alone is not a sufficient proxy for financial inclusion and that durable access ecosystems still require service points, cash-in/cash-out capacity, trust, identity systems, consumer protection, and active account use.

Keywords: financial inclusion; account ownership; digital connectivity; physical banking access; middle-income economies; panel data

JEL classification: C23; G21; O16; O33

1. Introduction

Financial inclusion concerns whether households and firms can access and use affordable, appropriate, and secure financial services. Its economic relevance extends beyond the possession of a bank account. Formal accounts allow households to receive wages and public transfers, smooth consumption, accumulate savings, manage risk, and build transaction histories that can support credit. At the macro level, wider access can strengthen financial intermediation and reduce the unequal distribution of opportunities (Claessens, 2006; Beck et al., 2007b). The expansion has been substantial: Global Findex data show that worldwide account ownership rose from 51% in 2011 to 79% in 2024, while the average for low- and middle-income economies reached 75% (Klapper et al., 2025). Yet national rates continue to differ sharply even within the same income group.

Digitalization is commonly presented as the principal route to the remaining unbanked population. Mobile phones, internet access, electronic identification, instant payments, and remote onboarding can lower distance and transaction costs. Evidence from mobile-money systems demonstrates that appropriately designed digital finance can improve risk sharing, savings, consumption, and poverty outcomes (Jack and Suri, 2014; Suri and Jack, 2016). Cross-country indices also record rapid growth in digital financial inclusion (Khera et al., 2022). These developments have encouraged analysts to treat national mobile and internet penetration as leading indicators of financial inclusion.

That interpretation may be too quick. Generic connectivity is an enabling condition, not evidence that an adult can open, fund, trust, and use a regulated financial account. A mobile subscription does not reveal handset ownership, affordability, digital literacy, identity documentation, network reliability, or the availability of a

suitable financial product. Internet use similarly combines many non-financial activities. Even a digital account depends on institutional rails: regulated providers, interoperable payment systems, agent networks, branches or service points, cash-in/cash-out facilities, complaint resolution, and consumer protection. The relevant economic distinction is therefore between technological reach and a functioning access ecosystem.

Physical banking outreach also deserves a more careful interpretation. Branches and automated teller machines (ATMs) reduce travel, information, and liquidity costs and remain important for onboarding, documentation, cash conversion, problem resolution, and trust. Earlier cross-country research found that branch and ATM penetration closely predict household and firm use of financial services (Beck et al., 2007a). India's social-banking experiment further demonstrated that mandated rural branch expansion can affect poverty and non-agricultural output (Burgess and Pande, 2005). Physical and digital channels may therefore be complements rather than substitutes, especially in economies where cash remains important and digital capability is uneven.

The empirical difficulty is that cross-country and within-country evidence answer different questions. Countries with mature banking networks tend also to be richer, more urban, better connected, and institutionally stronger. A pooled coefficient may attribute these persistent differences to a time-varying access measure. Country fixed effects solve part of the problem but identify only whether changes within a country are followed by changes in account ownership. When infrastructure and institutional capability accumulate slowly, short-run and structural coefficients need not be equal. Combining them can obscure the economic meaning of the association (Mundlak, 1978; Bell and Jones, 2015).

This paper addresses that problem using five Global Findex waves from 2011 to 2024 for current lower- and upper-middle-income economies. It constructs separate indices for digital access and physical financial access, lags explanatory indicators by one year, and estimates both two-way fixed-effects and within-between models. The contribution is threefold. First, it evaluates digital and physical access in the same model rather than using connectivity as financial inclusion itself. Second, it separates durable cross-country access conditions from shorter-run within-country changes. Third, it incorporates the 2024 Findex wave and subjects the result to definition, pandemic-wave, balanced-panel, component, outlier, and bounded-outcome checks.

The central result is a qualification of digital-first narratives. The unconditional correlation between digital access and account ownership is strong, but it disappears after the correlated physical-access and development environment is considered. Persistent physical access remains positively associated with account ownership, whereas short-run movement in either access index is imprecisely estimated. The findings do not argue against digital finance. They show that generic connectivity statistics should not be mistaken for verified financial access and that the economic value of digital channels depends on complementary institutions and service infrastructure.

2. Literature Review and Hypotheses

2.1 Financial inclusion and economic development

The financial-development literature emphasizes allocation, risk management, monitoring, and exchange. When households and firms are excluded from formal finance, fixed transaction costs, information asymmetries, collateral constraints, and geographic distance can prevent otherwise productive saving and investment. Broader financial development is associated with stronger income growth among poorer groups and lower inequality (Beck et al., 2007b). Financial inclusion is the distributional edge of this argument: it concerns who can participate in the formal system, not only the size of aggregate credit or deposits.

Measurement accordingly spans access, availability, and use. Sarma and Pais (2011) combine banking penetration, availability, and usage into a multidimensional index and associate inclusion with income, human development, urbanization, and infrastructure. Global Findex shifted the field toward demand-side measures by asking nationally representative samples how adults save, borrow, pay, and manage risk (Demirguc-Kunt and Klapper, 2012). Account ownership is narrower than full inclusion because dormant or unsuitable accounts may generate little welfare. It nevertheless captures the institutional gateway through which payments, saving, borrowing, and insurance can occur and is consistently available across five global survey rounds.

Country and individual determinants overlap. Income, education, age, gender, legal rights, political stability, cost, documentation, and proximity influence the probability of owning and using an account (Allen et al., 2016; Zins and Weill, 2016; Grohmann et al., 2018). This mix shows why a single supply variable is unlikely to explain inclusion. A credible macro model must control for economic capacity and distinguish access channels from the broader demand environment.

2.2 Digital connectivity as an enabling input

Digital finance can lower marginal transaction costs, relax geographic constraints, support small-value payments, and enable remote service delivery. Mobile money is especially relevant where formal branches are scarce. In Kenya, the diffusion of M-PESA improved risk sharing and reduced the cost of transferring resources across households (Jack and Suri, 2014); later evidence linked agent access to higher consumption, lower extreme

poverty, and occupational change among women (Suri and Jack, 2016). At a broader level, Lenka and Barik (2018) report positive associations between mobile and internet expansion and financial inclusion in South Asian economies.

However, digital connectivity and digital financial inclusion are different constructs. Khera et al. (2022) measure the latter with access and usage indicators drawn from actual financial services, not generic telecommunications alone. Ozili (2018) similarly notes that digital finance can broaden inclusion but also creates risks involving exclusion, data, stability, pricing, and consumer protection. A population may be connected yet unable or unwilling to use regulated digital finance because of device-sharing, identity gaps, weak digital skills, fraud concerns, unreliable networks, or limited merchant acceptance.

The conceptual expectation remains positive: greater internet use and mobile-network reach enlarge the feasible market for remote finance. But the relationship should be treated as an empirical hypothesis rather than an identity. Once income, banking outreach, and common time shocks are controlled, the residual association may be small if generic connectivity must first be converted into trusted financial products and regular account use.

***H1:** Higher digital access is positively associated with adult account ownership in middle-income economies.*

2.3 Physical financial access and last-mile capability

Branches and ATMs represent demographic proximity to formal finance. They lower travel and waiting costs, provide cash conversion, make providers visible, and support services that remain difficult to complete remotely. Branch staff and agents can verify identity, explain products, resolve errors, and build trust. ATMs extend cash availability and account functionality beyond business hours. These mechanisms are particularly important where informal employment, cash-based commerce, limited digital literacy, or weak consumer recourse constrain fully remote finance.

Cross-country evidence supports the relevance of outreach. Beck et al. (2007a) show that branch and ATM indicators predict household and firm use and are associated with lower financing obstacles. Allen et al. (2016) find that proximity and lower account costs are associated with formal account ownership. The Indian rural-branch program provides stronger causal evidence that geographic banking expansion can reduce rural poverty and increase non-agricultural output (Burgess and Pande, 2005). Recent work continues to find that banking-sector conditions shape both traditional and digital inclusion (Sha'ban et al., 2024).

Physical access need not conflict with digitalization. Digital transactions still require regulated institutions, settlement systems, customer support, and often cash-in/cash-out points. A mature physical network may therefore proxy a broader stock of organizational capability and trust. Because that stock develops cumulatively, country-average physical access may be more informative than short-run changes in branch or ATM density.

***H2:** Higher physical financial access is positively associated with adult account ownership in middle-income economies.*

***H3:** The between-country association of physical access with account ownership is stronger than its within-country association.*

2.4 Structural and transitional effects

A time-varying access indicator contains two sources of information. Its country mean captures whether a country persistently operates at a higher access level than others. Its deviation from that mean captures whether the country is temporarily above or below its own long-run level. The first is structural and may bundle accumulated institutions, provider capability, regulation, trust, and complementary investment. The second is transitional and asks whether incremental access change is followed by a change in account ownership over the observed survey interval.

This distinction matters for policy evaluation. A positive between-country coefficient does not establish that building a discrete number of branches or towers will mechanically raise ownership. A positive within-country coefficient would provide more direct evidence that marginal expansion is followed by adoption, although it would still be observational. Comparing the two estimates helps identify whether access behaves like an immediately productive input or a component of a slowly formed financial ecosystem.

3. Data and Methodology

3.1 Research design and sample

The study uses a country-wave panel assembled from the World Bank's Global Findex series, World Development Indicators (WDI), and the IMF Financial Access Survey series distributed through WDI. The outcome is observed in 2011, 2014, 2017, 2021, and 2024. Each explanatory variable is measured one year before

the corresponding Findex wave (2010, 2013, 2016, 2020, and 2023) to establish temporal order and reduce simultaneity. The lag does not by itself establish causality.

The sampling frame comprises economies classified by the World Bank as lower-middle income or upper-middle income when the data were retrieved on 3 September 2026. Aggregates and entries without geographic-region metadata are excluded. A country must contribute at least two complete country-wave observations to identify within-country variation. Complete-case estimation yields 312 observations from 76 economies: 62 in 2011, 65 in 2014, 68 in 2017, 60 in 2021, and 57 in 2024. Thirty-seven economies are observed in all five waves.

Global Findex is based on nationally representative adult surveys, and the 2024 wave was conducted across 141 economies (Klapper et al., 2025). Country-level estimates contain sampling uncertainty that is not fully propagated through this macro panel. Mobile-money accounts entered the headline account-ownership definition after the first wave. The main model uses all waves with survey-year effects; a robustness model excludes 2011 so that the outcome definition is consistent with the later waves.

3.2 Variables and operationalization

Table 1. Variables, indicator codes, and operational definitions

Variable	WDI code	Operationalization	Role
Account ownership	FX.OWN.TOTL.ZS	Adults with a financial-institution or mobile-money account (%)	Outcome
Internet use	IT.NET.USER.ZS	Individuals using the internet (% of population), $t-1$	Digital access
Mobile subscriptions	IT.CEL.SETS.P2	Subscriptions per 100 people, $t-1$	Digital access
Bank branches	FB.CBK.BRCH.P5	Commercial-bank branches per 100,000 adults, $\ln(1+x)$, $t-1$	Physical access
ATMs	FB.ATM.TOTL.P5	ATMs per 100,000 adults, $\ln(1+x)$, $t-1$	Physical access
Real GDP per capita	NY.GDP.PCAP.KD	Constant-price GDP per capita, natural log, $t-1$	Economic control
Female labour participation	SL.TLF.CACT.FE.ZS	Female labour-force participation rate (%), $t-1$	Demand control
Urbanization	SP.URB.TOTL.IN.ZS	Urban population (% of total), $t-1$	Spatial control
Inflation	FP.CPI.TOTL.ZG	Annual consumer-price inflation (%), $t-1$	Macro-stability control

Account ownership measures the percentage of adults aged 15 or older who report having an account at a bank or another financial institution or personally using a mobile-money service during the reference period. It is a gateway measure of formal financial participation, not a measure of activity, balance, credit quality, or welfare. Using the direct demand-side outcome avoids defining inclusion from the same branches and ATMs that appear as explanatory variables.

The digital-access index is the first principal component of standardized internet use and mobile-cellular subscriptions. Both loadings equal 0.707, and the component explains 74.7% of their common variance. The physical-access index is the first component of log branches and log ATMs; both loadings equal 0.707, and it explains 83.6% of common variance. Each index is re-standardized to mean zero and unit variance. With two positively correlated components, equal weighting reproduces the PCA score and is reported as a mechanical robustness check.

Controls capture prominent macro correlates of financial inclusion. Real GDP per capita represents household and institutional capacity; female labour-force participation proxies connection to earnings and payment flows; urbanization captures settlement density and geographic service costs; and inflation captures macroeconomic instability that may alter confidence in formal money. These controls are not interpreted causally and do not exhaust institutional determinants such as identification systems, financial literacy, legal quality, competition, or consumer protection.

3.3 Econometric specification

The first specification is a conventional two-way fixed-effects model:

$$FI_{it} = \alpha_i + \delta_t + \beta_D D_{i,t-1} + \beta_P P_{i,t-1} + \gamma' X_{i,t-1} + \varepsilon_{it}$$

FI is the account-ownership rate, D is digital access, P is physical access, X contains the controls, α_i absorbs time-invariant country characteristics, and δ_t absorbs common Findex-wave shocks. Coefficients are identified only

from change within countries. Standard errors are clustered by country to allow heteroskedasticity and serial dependence within national panels.

The focal within-between specification decomposes every time-varying regressor into a country mean and a deviation from that mean:

$$FI_{it} = \delta_i + \beta_w(Z_{it} - \bar{Z}_i) + \beta_B \bar{Z}_i + \gamma_w'(X_{it} - \bar{X}_i) + \gamma_B' \bar{X}_i + \varepsilon_{it}$$

Z contains the digital- and physical-access indices. β_w estimates the association of a one-standard-deviation within-country deviation with account ownership. β_B estimates the association of a one-standard-deviation difference in country-average access. Controls are decomposed in the same way. A clustered Wald test evaluates $\beta_B - \beta_w = 0$ for each access channel. A second contrast compares the two between-country access coefficients.

The within-between model is a descriptive panel decomposition rather than a causal design. Lagging, wave effects, country clustering, and separate within/between controls strengthen interpretation but do not remove omitted variables, reverse causality, measurement error, or policy endogeneity. Coefficients are reported as percentage-point differences in account ownership per one-standard-deviation increase in the relevant regressor component.

3.4 Robustness strategy

Seven checks probe the central result. First, arithmetic-mean indices replace the PCA scores. Second, the 2021 pandemic-period wave is excluded. Third, the 2011 wave is excluded because mobile-money accounts were not part of the headline definition. Fourth, estimation is restricted to the 37 economies observed in all five waves. Fifth, inflation is winsorized at the first and ninety-ninth percentiles. Sixth, internet use and mobile subscriptions replace the digital composite separately. Seventh, the bounded account-ownership share is transformed to log-odds and re-estimated.

Inference is two-sided. $p < 0.05$ is treated as statistically significant, while $p < 0.10$ is described as suggestive. Because the panel has only five irregular survey waves, the discussion emphasizes effect size, uncertainty, temporal interpretation, and cross-specification consistency rather than isolated significance levels.

4. Results

4.1 Descriptive evidence

Table 2. Descriptive statistics for the estimation sample

Variable	N	Mean	SD	Min	Max
Account ownership (%)	312	48.921	22.710	2.535	98.455
Digital-access index	312	0.035	0.967	-2.596	2.977
Physical-access index	312	-0.007	1.014	-3.162	2.080
Internet users (%)	312	43.504	25.794	1.000	97.693
Mobile subscriptions / 100	312	104.141	29.364	13.593	207.238
Bank branches / 100,000	312	14.179	12.523	0.226	70.146
ATMs / 100,000	312	34.751	28.289	0.612	127.766
Log real GDP per capita	312	8.090	0.728	6.516	9.611
Female labour participation (%)	312	48.017	16.569	10.885	83.896
Urban population (%)	312	56.546	17.140	17.249	92.682
Inflation (%)	312	8.329	32.978	-2.405	557.202

Average account ownership is 48.9%, with a range from 2.5% to 98.5%. The sample therefore contains large differences in formal financial participation even within the middle-income category. Mean account ownership rises across the observed sample from 33.3% in 2011 to 62.4% in 2024. Over the same country-wave observations, mean internet use rises from 20.9% to 69.0%. These trends are absorbed by survey-wave indicators in the regressions and should not be read as a causal digital effect.

Table 3. Pairwise correlations

Variable	1	2	3	4	5	6
Account ownership	1.000	–	–	–	–	–

Variable	1	2	3	4	5	6
Digital access	0.549	1.000	–	–	–	–
Physical access	0.504	0.609	1.000	–	–	–
Log GDP pc	0.451	0.616	0.655	1.000	–	–
Female LFP	0.096	0.001	–0.108	–0.119	1.000	–
Urbanization	0.163	0.407	0.459	0.665	–0.259	1.000

Notes: 1 = Account ownership; 2 = Digital access; 3 = Physical access; 4 = Log real GDP per capita; 5 = Female labour-force participation; 6 = Urbanization. Complete cases, $N = 312$.

The bivariate association between account ownership and digital access is 0.549; the corresponding correlation with physical access is 0.504. Digital and physical access correlate at 0.609, while both are strongly related to income. The pattern confirms that simple correlations cannot identify whether connectivity has an independent relationship with inclusion or mainly tracks a broader development and banking environment.

4.2 Two-way fixed-effects estimates

Table 4. Two-way fixed-effects model

Regressor	Account ownership (%)
Digital access	–0.239 (1.808)
Physical access	2.734 (2.511)
Log real GDP per capita	9.370 (6.509)
Female labour-force participation	–12.848*** (3.981)
Urbanization	–3.854 (4.850)
Inflation	0.090 (0.349)
Country fixed effects	Yes
Wave fixed effects	Yes
Observations	312
Countries	76
Overall R-squared	0.923

Notes: Continuous regressors are standardized. Country-clustered standard errors are in parentheses. All predictors are lagged one year. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

Neither access index is significant in the two-way fixed-effects model. A one-standard-deviation within-country increase in digital access is associated with –0.239 percentage points ($SE = 1.808$, $p = 0.895$), while the physical-access coefficient is 2.734 points ($SE = 2.511$, $p = 0.280$). The estimates do not support an immediate, common within-country payoff from generic connectivity or measured branch/ATM expansion after stable country differences and wave shocks are removed.

4.3 Within-between estimates

Table 5. Mundlak-type within-between model

Regressor or contrast	Account ownership (%)
Digital access: within	–2.734 (2.330)
Digital access: between	–0.253 (2.671)
Physical access: within	1.124 (0.720)

Regressor or contrast	Account ownership (%)
Physical access: between	7.735** (3.021)
Log GDP pc: within	2.575** (1.112)
Log GDP pc: between	8.514*** (2.930)
Female LFP: within	-1.423** (0.614)
Female LFP: between	2.630 (1.881)
Urbanization: within	0.213 (0.905)
Urbanization: between	-5.859** (2.440)
Inflation: within	0.154 (0.168)
Inflation: between	1.849** (0.788)
Digital: between – within	2.482 (2.958)
Physical: between – within	6.611** (2.960)
Physical – digital: between	7.987 (5.065)
Wave fixed effects	Yes
Observations	312
Countries	76
Overall R-squared	0.500

Notes: Each within and between regressor is standardized separately. Coefficients are percentage-point differences in account ownership per one-standard-deviation increase. Country-clustered standard errors are in parentheses. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

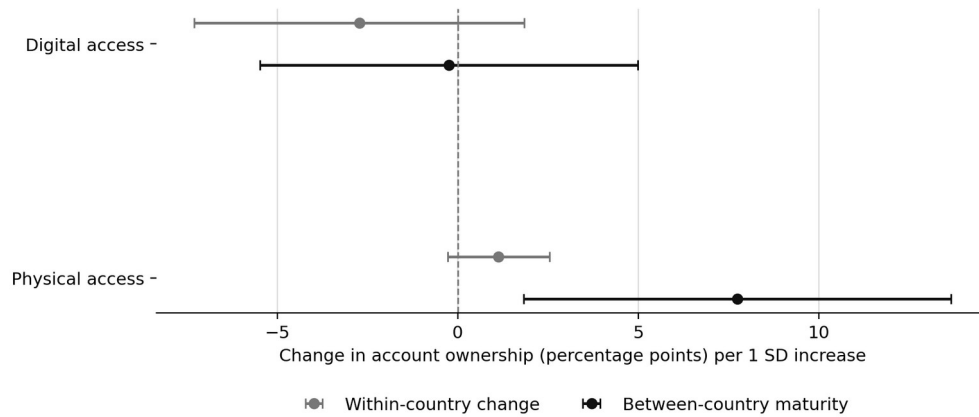
The within-between model does not support H1. The digital-access within coefficient is -2.734 (SE = 2.330, $p = 0.244$), and the between coefficient is -0.253 (SE = 2.671, $p = 0.925$). Their confidence intervals include economically meaningful positive and negative values. Generic internet and mobile penetration therefore do not have a detectable independent association with account ownership after physical access and the development controls are separated into within and between components.

The result supports the structural portion of H2. A one-standard-deviation higher country-average physical-access index is associated with 7.735 percentage points more account ownership (SE = 3.021, $p = 0.012$). The within-country coefficient is 1.124 points (SE = 0.720, $p = 0.122$). The estimated difference between the two is 6.611 points (SE = 2.960, $p = 0.028$), supporting H3. Physical access behaves more like a persistent ecosystem attribute than an immediately productive marginal input.

The point-estimate difference between the physical and digital between-country coefficients is 7.987 percentage points, but the clustered Wald test is not significant at 5% (SE = 5.065, $p = 0.119$). The paper therefore does not claim a precisely estimated horse race between channels. Its narrower conclusion is that physical access retains a positive structural association in the joint model, while generic connectivity does not.

Income has positive within and between coefficients, consistent with the demand and institutional capacity associated with higher development. Other controls should be interpreted cautiously because they proxy multiple structural processes and some are highly correlated. The wave effects remain large and positive, reflecting the broad expansion of account ownership that is common across the sampled economies.

Figure 1. Within- and between-country access associations with account ownership



Notes: Points are standardized-regressor coefficients; bars are 95% confidence intervals based on country-clustered standard errors. The outcome is the percentage of adults owning a financial-institution or mobile-money account.

4.4 Robustness checks

Table 6. Robustness of the focal within-between estimates

Specification	Digital W	Digital B	Physical W	Physical B	N / countries
Baseline hybrid	-2.734 (2.330)	-0.253 (2.671)	1.124 (0.720)	7.735** (3.021)	312 / 76
Equal-weight indices	-2.734 (2.330)	-0.253 (2.671)	1.124 (0.720)	7.735** (3.021)	312 / 76
Exclude 2021 wave	-1.229 (2.239)	-2.504 (2.686)	1.116 (0.731)	8.858*** (3.137)	252 / 76
Exclude 2011 wave	-3.671* (2.057)	1.289 (2.797)	0.926 (0.646)	6.649** (2.961)	250 / 76
Five-wave balanced sample	-0.909 (1.387)	-2.993 (4.560)	0.700 (0.829)	7.703 (5.431)	185 / 37
Winsorized inflation	-2.590 (2.241)	-0.051 (2.662)	1.061 (0.701)	7.650** (3.028)	312 / 76

Notes: W = within-country; B = between-country. Entries are coefficients with clustered standard errors in parentheses. The log-odds and component models are discussed in the text. *** $p < 0.01$; ** $p < 0.05$; * $p < 0.10$.

The physical between-country coefficient remains positive and significant when the 2021 wave is excluded (8.858, $p = 0.006$), when the 2011 definition-break wave is excluded (6.649, $p = 0.028$), and when inflation is winsorized (7.650, $p = 0.014$). Equal weighting reproduces the two-item PCA result. In the five-wave balanced sample, the coefficient remains similar at 7.703 points but is imprecise ($SE = 5.431$, $p = 0.165$), consistent with the loss of more than half of the countries rather than a reversal in magnitude.

Replacing the digital composite with internet use yields an insignificant between coefficient (-4.419 , $p = 0.221$), while physical access remains positive (9.160 , $p = 0.004$). Replacing it with mobile subscriptions produces the same pattern: 1.337 ($p = 0.487$) for the mobile between component and 7.135 ($p = 0.009$) for physical access. When account ownership is transformed to log-odds, the physical between coefficient remains positive (0.420 , $SE = 0.176$, $p = 0.019$), while the digital between coefficient remains insignificant (-0.052 , $p = 0.706$).

Across checks, the evidence is therefore stable in sign and broad interpretation. Persistent physical outreach is associated with higher account ownership. Generic connectivity does not independently explain ownership once the correlated access and development environment is modeled. Short-run coefficients remain much smaller and less precise than the structural physical-access coefficient.

5. Discussion

5.1 Interpreting the digital null

The digital null should not be read as evidence that digital finance is economically unimportant. The study measures broad national connectivity, not ownership of a smartphone, registration with a mobile-money provider, digital identification, merchant acceptance, payment interoperability, affordability, or actual digital financial use.

Digital-finance studies that measure access and usage directly find substantial gains and important welfare effects (Suri and Jack, 2016; Khera et al., 2022). The present result instead shows that internet and mobile penetration are weak stand-alone proxies for account ownership in a multivariate macro panel.

The strong bivariate correlation between digital access and account ownership disappears after physical outreach, income, and other structural controls are included. This is consistent with a complementarity interpretation. Connected countries also tend to have stronger banking networks and higher incomes; those correlated capabilities may be the channels through which digital reach is converted into financial participation. A tower or subscription enlarges technical possibility, but conversion requires products, identity, trust, skills, service support, settlement, and liquidity.

The absence of a positive within effect may also reflect timing and measurement. Findex waves are separated by three or four years, national telecommunications measures are aggregate, and account estimates contain survey error. A country's expansion in connectivity may affect active use before ownership, or it may benefit already included adults first. Conversely, account-opening campaigns linked to public transfers can raise ownership without an equivalent contemporaneous change in generic connectivity. More granular measures and quasi-experimental designs are required to isolate these pathways.

5.2 Why structural physical access remains relevant

The physical-access coefficient is best understood as an ecosystem association. Branch and ATM density measure more than buildings and machines. They indicate provider presence, cash liquidity, installed operational capacity, customer-service reach, and the accumulated willingness of institutions to serve a market. These conditions can lower effective transaction costs and reinforce trust, especially where cash remains central to household and small-business activity.

The stronger between than within coefficient supports this interpretation. Countries with persistently denser physical access have higher ownership, but marginal changes within a country do not generate an immediate common increase. Network expansion may be endogenous to expected demand, may occur in already served locations, or may need complementary policy before adults adopt accounts. The result therefore does not justify branch construction as a mechanical treatment. It identifies physical outreach as a visible component of a durable financial-inclusion environment.

This finding also fits the emerging distinction between traditional and digital inclusion. Sha'ban et al. (2024) show that digital and traditional inclusion have different drivers but remain linked through banking-system conditions. The channels are likely hybrid: a customer may open an account with assisted onboarding, fund it through an agent or branch, transact digitally, withdraw cash at an ATM, and seek human support when a payment fails. Policy that labels one channel obsolete can miss these complementarities.

5.3 Economic and policy implications

First, policymakers should separate connectivity inputs from verified inclusion outcomes. Mobile subscriptions and internet use are useful readiness indicators, but they should be paired with account ownership, active use, transaction frequency, formal saving, digital-payment acceptance, dormancy, complaint resolution, and financial resilience. A layered scorecard would reveal whether exclusion arises from access, adoption, affordability, trust, or use.

Second, digital strategies should invest in conversion infrastructure: reliable identity and e-KYC, interoperable low-cost payments, open and competitive agent networks, cash-in/cash-out capacity, cybersecurity, consumer recourse, accessible product design, and financial and digital capability. Without these complements, generic connectivity can coexist with exclusion or inactive accounts.

Third, physical-network policy should shift from counting conventional branches to optimizing service reach. Shared service points, banking correspondents, post offices, mobile branches, interoperable ATMs, and assisted digital kiosks may deliver last-mile functions at lower fixed cost. The relevant objective is not preserving a particular organizational form; it is ensuring proximity, liquidity, onboarding, and problem resolution.

Fourth, financial institutions should plan channels as a portfolio. Digital interfaces reduce the cost of routine transactions, while trusted human and physical touchpoints can support acquisition, complex products, vulnerable customers, and error resolution. Location analytics should identify areas where high mobile reach coincides with low account ownership and insufficient cash or service access. Those gaps are plausible targets for hybrid distribution rather than digital-only marketing.

Finally, impact evaluation should follow reforms over multiple Findex waves and use policy discontinuities where possible. Account-opening mandates, identity rollout, agent regulation, interoperability reforms, and branch-licensing changes offer more credible identification than contemporaneous cross-country correlations. The design should distinguish ownership from active use and examine distributional effects by gender, income, age, and rural residence.

5.4 Limitations and future research

The study is observational. The within-between decomposition clarifies what variation identifies each coefficient, but it does not remove reverse causality, omitted institutions, policy endogeneity, or selection into infrastructure. Coefficients must be interpreted as conditional associations rather than causal effects.

Account ownership is a survey estimate and does not reveal dormancy, balances, product suitability, service quality, or welfare. Sampling error differs across economies and waves. Future work should use microdata or survey standard errors and model active use, formal saving, digital payments, borrowing, and resilience as distinct outcomes.

The headline account definition changed after 2011 to incorporate mobile money. Wave effects and the exclusion-of-2011 test reduce concern, and the physical-access coefficient remains positive, but perfect comparability cannot be assumed. The 2021 survey also involved pandemic-related mode changes in some economies; excluding that wave does not alter the conclusion.

The digital index measures generic connectivity rather than digital finance. It cannot observe smartphone ownership, SIM registration, affordability, digital ID, agent density, payment interoperability, cybersecurity, fraud, trust, or financial literacy. The null coefficient therefore cannot be generalized to actual digital financial service access or use.

The physical index covers commercial-bank branches and ATMs but omits agents, post offices, microfinance institutions, cooperatives, and non-bank e-money providers. This limitation is especially important in Sub-Saharan Africa and South Asia. Future panel work should integrate the IMF Financial Access Survey's mobile-money and agent indicators where coverage permits.

Current income classification provides a transparent contemporary sample but can create survivorship and reclassification concerns. The five-wave balanced panel is smaller, and its standard errors are wide. Future research should use historical income classifications, region-specific models, Bayesian partial pooling, or multilevel designs and should examine whether physical and digital channels substitute or complement one another at different stages of development.

6. Conclusion

This paper examined whether digital connectivity and physical banking outreach have distinct relationships with adult account ownership in middle-income economies. Evidence from 312 observations across 76 economies and five Global Findex waves shows a clear structural pattern. Countries with persistently stronger branch and ATM access have higher account ownership after digital access, income, labour participation, urbanization, inflation, and common survey shocks are considered. Short-run physical-access change is much smaller and not significant. Generic internet and mobile connectivity has no detectable independent within or between association in the joint model.

The conclusion is not that financial inclusion must remain branch-based. It is that digital reach is not equivalent to financial inclusion. Connectivity creates an option; institutions, products, service networks, liquidity, trust, consumer protection, and repeated use turn that option into economic participation. The most credible strategy for middle-income economies is therefore hybrid and capability-oriented: build interoperable digital rails while preserving accessible last-mile functions and measure success through ownership, active use, service quality, and resilience rather than connectivity alone.

References

- Aker, J.C. and Mbiti, I.M. (2010), 'Mobile phones and economic development in Africa', *Journal of Economic Perspectives*, Vol. 24 No. 3, pp. 207–232. <https://doi.org/10.1257/jep.24.3.207>
- Allen, F., Demirguc-Kunt, A., Klapper, L. and Martinez Peria, M.S. (2016), 'The foundations of financial inclusion: understanding ownership and use of formal accounts', *Journal of Financial Intermediation*, Vol. 27, pp. 1–30. <https://doi.org/10.1016/j.jfi.2015.12.003>
- Aron, J. (2018), 'Mobile money and the economy: a review of the evidence', *The World Bank Research Observer*, Vol. 33 No. 2, pp. 135–188. <https://doi.org/10.1093/wbro/lky001>
- Baltagi, B.H. (2021), *Econometric Analysis of Panel Data*, 6th ed., Springer, Cham.
- Beck, T., Demirguc-Kunt, A. and Levine, R. (2007b), 'Finance, inequality and the poor', *Journal of Economic Growth*, Vol. 12 No. 1, pp. 27–49. <https://doi.org/10.1007/s10887-007-9010-6>
- Beck, T., Demirguc-Kunt, A. and Martinez Peria, M.S. (2007a), 'Reaching out: access to and use of banking services across countries', *Journal of Financial Economics*, Vol. 85 No. 1, pp. 234–266. <https://doi.org/10.1016/j.jfineco.2006.07.002>
- Bell, A. and Jones, K. (2015), 'Explaining fixed effects: random effects modeling of time-series cross-sectional and panel data', *Political Science Research and Methods*, Vol. 3 No. 1, pp. 133–153. <https://doi.org/10.1017/psrm.2014.7>
- Burgess, R. and Pande, R. (2005), 'Do rural banks matter? Evidence from the Indian social banking experiment', *American Economic Review*, Vol. 95 No. 3, pp. 780–795. <https://doi.org/10.1257/0002828054201242>

- Claessens, S. (2006), 'Access to financial services: a review of the issues and public policy objectives', *The World Bank Research Observer*, Vol. 21 No. 2, pp. 207–240. <https://doi.org/10.1093/wbro/lkl004>
- Demirguc-Kunt, A. and Klapper, L. (2012), 'Measuring financial inclusion: the Global Findex Database', Policy Research Working Paper 6025, World Bank, Washington, DC. <https://doi.org/10.1596/1813-9450-6025>
- Demirguc-Kunt, A., Klapper, L., Singer, D. and Ansar, S. (2022), *The Global Findex Database 2021: Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19*, World Bank, Washington, DC. <https://doi.org/10.1596/978-1-4648-1897-4>
- Demirguc-Kunt, A., Klapper, L., Singer, D., Ansar, S. and Hess, J. (2018), *The Global Findex Database 2017: Measuring Financial Inclusion and the Fintech Revolution*, World Bank, Washington, DC. <https://doi.org/10.1596/978-1-4648-1259-0>
- Grohmann, A., Kluhs, T. and Menkhoff, L. (2018), 'Does financial literacy improve financial inclusion? Cross country evidence', *World Development*, Vol. 111, pp. 84–96. <https://doi.org/10.1016/j.worlddev.2018.06.020>
- Jack, W. and Suri, T. (2014), 'Risk sharing and transactions costs: evidence from Kenya's mobile money revolution', *American Economic Review*, Vol. 104 No. 1, pp. 183–223. <https://doi.org/10.1257/aer.104.1.183>
- Khera, P., Ng, S., Ogawa, S. and Sahay, R. (2022), 'Measuring digital financial inclusion in emerging market and developing economies: a new index', *Asian Economic Policy Review*, Vol. 17 No. 2, pp. 213–230. <https://doi.org/10.1111/aep.12377>
- Klapper, L., Singer, D., Starita, L. and Norris, A. (2025), *The Global Findex Database 2025: Connectivity and Financial Inclusion in the Digital Economy*, World Bank, Washington, DC. <https://doi.org/10.1596/978-1-4648-2204-9>
- Lenka, S.K. and Barik, R. (2018), 'Has expansion of mobile phone and internet use spurred financial inclusion in the SAARC countries?', *Financial Innovation*, Vol. 4, Article 5. <https://doi.org/10.1186/s40854-018-0089-x>
- Mundlak, Y. (1978), 'On the pooling of time series and cross section data', *Econometrica*, Vol. 46 No. 1, pp. 69–85. <https://doi.org/10.2307/1913646>
- Ozili, P.K. (2018), 'Impact of digital finance on financial inclusion and stability', *Borsa Istanbul Review*, Vol. 18 No. 4, pp. 329–340. <https://doi.org/10.1016/j.bir.2017.12.003>
- Sahay, R., von Allmen, U.E., Lahreche, A., Khera, P., Ogawa, S., Bazarbash, M. and Beaton, K. (2020), *The Promise of Fintech: Financial Inclusion in the Post COVID-19 Era*, Departmental Paper 20/09, International Monetary Fund, Washington, DC.
- Sarma, M. and Pais, J. (2011), 'Financial inclusion and development', *Journal of International Development*, Vol. 23 No. 5, pp. 613–628. <https://doi.org/10.1002/jid.1698>
- Sha'ban, M., Ayadi, R., Forouheshfar, Y., Challita, S. and Sandri, S. (2024), 'Digital and traditional financial inclusion: trends and drivers', *Research in International Business and Finance*, Vol. 72, 102528. <https://doi.org/10.1016/j.ribaf.2024.102528>
- Suri, T. and Jack, W. (2016), 'The long-run poverty and gender impacts of mobile money', *Science*, Vol. 354 No. 6317, pp. 1288–1292. <https://doi.org/10.1126/science.aah5309>
- World Bank (2026), *World Development Indicators database*, World Bank, Washington, DC, available at: <https://databank.worldbank.org/source/world-development-indicators> (accessed 3 September 2026).
- Zins, A. and Weill, L. (2016), 'The determinants of financial inclusion in Africa', *Review of Development Finance*, Vol. 6 No. 1, pp. 46–57. <https://doi.org/10.1016/j.rdf.2016.05.001>

Appendix A. Estimation Sample

The 76 economies contributing to the complete-case estimation sample are listed by World Bank region. Income groups reflect the classification returned by the World Bank country metadata at the access date.

East Asia & Pacific: Cambodia, China, Indonesia, Lao PDR, Malaysia, Mongolia, Myanmar, Philippines, Thailand, Viet Nam.

Europe & Central Asia: Albania, Armenia, Azerbaijan, Bosnia and Herzegovina, Georgia, Kazakhstan, Kyrgyz Republic, Moldova, Montenegro, North Macedonia, Serbia, Tajikistan, Turkiye, Ukraine, Uzbekistan.

Latin America & Caribbean: Argentina, Bolivia, Brazil, Colombia, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Nicaragua, Paraguay, Peru, Venezuela, RB.

Middle East, North Africa, Afghanistan & Pakistan: Algeria, Egypt, Arab Rep., Iran, Islamic Rep., Iraq, Jordan, Lebanon, Morocco, Pakistan, Tunisia, West Bank and Gaza.

South Asia: Bangladesh, India, Nepal, Sri Lanka.

Sub-Saharan Africa: Angola, Benin, Botswana, Cameroon, Comoros, Congo, Rep., Cote d'Ivoire, Gabon, Ghana, Guinea, Kenya, Lesotho, Mauritania, Mauritius, Namibia, Nigeria, Senegal, South Africa, Tanzania, Togo, Zambia, Zimbabwe.