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FINANCIAL INCLUSION INDEX: DEVELOPING A ROBUST FRAMEWORK TO MEASURE BANKING PENETRATION AND ANALYZING BEHAVIORAL IMPACT FINANCIAL INCLUSION INDEX AND BEHAVIORAL IMPACT

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Abstract
Financial inclusion remains a critical development priority, yet comprehensive measurement frameworks integrating multiple dimensions of banking penetration and behavioral outcomes are limited. This study develops and validates a robust Financial Inclusion Index (FII) incorporating three core dimensions: Access (availability of financial infrastructure), Usage (actual utilization of financial services), and Quality (consumer protection, financial literacy, and service quality). Using panel data from 137 countries spanning 2010-2024, we employ a two-stage Principal Component Analysis (PCA) methodology to construct a multidimensional composite index integrating 20 indicators from both supply-side (IMF Financial Access Survey) and demand-side (World Bank Global Findex) sources. The FII demonstrates strong psychometric properties with robust internal consistency and cross-national validity. Empirical analysis reveals significant heterogeneity in financial inclusion across income groups and regions, with developed nations scoring 0.78 ± 0.12 versus 0.42 ± 0.18 for developing countries. Behavioral impact analysis through structural equation modeling demonstrates that financial inclusion significantly influences household financial behaviors including savings rates ($\beta=0.42$, $p<.001$), formal credit usage ($\beta=0.38$, $p<.001$), and financial resilience ($\beta=0.35$, $p<.01$). Incremental validity analysis confirms FII accounts for 16% additional variance in financial well-being beyond income and education. Cross-country analysis identifies digital banking penetration ($r=0.67$, $p<.001$) and mobile money adoption ($r=0.58$, $p<.001$) as primary drivers in developing nations. Policy simulation modeling indicates targeted interventions addressing barriers to access could increase inclusion by 12-18 percentage points within 3-5 years. The validated FII framework provides policymakers, researchers, and practitioners with a comprehensive tool for monitoring progress, identifying gaps, and designing evidence-based financial inclusion strategies.
Keywords: financial inclusion index, banking penetration, behavioral impact, multidimensional measurement, principal component analysis, financial well-being, policy evaluation

1. INTRODUCTION

Financial inclusion—defined as universal access to and usage of affordable, appropriate financial services—has emerged as a cornerstone of global development policy (World Bank, 2017). The United Nations Sustainable Development Goals explicitly recognize financial inclusion as an enabler for poverty reduction (Goal 1), economic growth (Goal 8), and reduced inequalities (Goal 10). Despite remarkable progress, approximately 1.4 billion adults globally remain unbanked, with concentration in Sub-Saharan Africa, South Asia, and Latin America (IMF, 2025). Moreover, account ownership alone does not guarantee meaningful

financial participation; substantial proportions of account holders remain inactive, highlighting the critical distinction between access and genuine inclusion (Demirgüç-Kunt & Klapper, 2013).
Measuring financial inclusion comprehensively presents significant methodological challenges. Early approaches relied on single indicators such as bank account penetration rates or ATM density per capita (Beck et al., 2007). However, financial inclusion is inherently multidimensional, encompassing not merely access to formal financial institutions but also active usage, service quality, and ultimately, behavioral and welfare outcomes (Sarma, 2015; Cámara & Tuesta, 2014). Single-dimension metrics fail to capture this complexity, potentially misleading policymakers regarding actual inclusion status.
Recent scholarly efforts have developed composite indices aggregating multiple indicators into unified frameworks (Sarma, 2008, 2012; Chakravarty & Pal, 2010; Cámara & Tuesta, 2014). However, these indices face three critical limitations. First, most rely exclusively on supply-side data (branch density, ATM numbers) that may not reflect actual population coverage or usage patterns. Second, weight assignment remains arbitrary, raising concerns about subjective bias in index construction. Third, linkages between inclusion indices and behavioral outcomes—the ultimate policy target—remain underexplored empirically.
This study addresses these gaps by developing and validating a comprehensive Financial Inclusion Index integrating supply-side infrastructure data with demand-side utilization indicators across 137 countries. Employing two-stage Principal Component Analysis, we avoid arbitrary weight assignment while constructing a statistically robust composite measure. Critically, we extend beyond index development to empirically examine behavioral impacts, testing whether and how financial inclusion influences household financial behaviors, decision-making patterns, and economic well-being. Our research contributes methodologically through rigorous index validation and substantively by providing evidence on inclusion's causal pathways to improved financial outcomes.
The paper proceeds as follows: Section 2 reviews relevant literature on financial inclusion measurement and behavioral impacts. Section 3 details our methodology including data sources, index construction procedures, and analytical techniques. Section 4 presents empirical results including index validation, cross-country patterns, and behavioral impact analyses. Section 5 discusses policy implications and limitations. Section 6 concludes with recommendations for researchers and policymakers.

2. LITERATURE REVIEW

2.1 Conceptual Foundations: Defining Financial Inclusion

Financial inclusion transcends simple account ownership to encompass comprehensive access, affordability, and meaningful utilization of financial services appropriate to individuals' needs (World Bank, 2017; United Nations, 2016). The concept emerged systematically in academic and policy discourse during the early 2000s, coinciding with recognition that formal financial services could serve as poverty reduction catalysts (Sen, 2000; Yunus, 2007). Successive iterations of definition have progressively broadened to incorporate quality and welfare dimensions. Sarma (2008) pioneered multidimensional conceptualization, proposing inclusion encompasses: (1) banking service penetration across populations, (2) availability and convenience of access, and (3) quality of services provided. This framework represented a departure from crude single-indicator approaches, establishing inclusion as fundamentally multifaceted (Chakravarty & Pal, 2010).
The distinctions among access, usage, and quality prove analytically critical. Access refers to the availability and geographic accessibility of financial infrastructure including branches, ATMs, and digital channels (Beck et al., 2007). Usage encompasses actual behavioral engagement with financial services including account opening rates, transaction volumes, and active account proportions (Demirgüç-Kunt & Klapper, 2013). Quality encompasses consumer protection, service appropriateness, and individual's ability to make informed decisions (World Bank, 2016). This tri-partite framework acknowledges that increased access does not necessarily translate to usage; substantial "access-usage gaps" characterize many developing economies (Johnson, 2013). Similarly, high usage among financially unsophisticated populations absent consumer protections risks exploitation rather than empowerment (Financial Conduct Authority, 2015).

2.2 Measurement Frameworks: From Unidimensional to Composite Indices

Early financial inclusion measurement relied predominantly on supply-side infrastructure metrics: branch density, ATM numbers, and loan portfolio concentrations (Levine, 2005). These measures, though administratively straightforward, poorly captured actual population reach or service utilization. Beck et al. (2007) pioneered systematic construction of financial structure indicators across countries, establishing foundational databases yet acknowledging severe limitations when applied to inclusion measurement. Crucially, infrastructure metrics demonstrate weak correlations with actual banking usage in many contexts (Demirgüç-Kunt & Klapper, 2013), particularly in developing nations where branch proliferation may concentrate in urban areas despite rural population majorities.

Recognition of these limitations prompted development of composite indices. Sarma (2008, 2012) proposed the Financial Inclusion Index (FII), incorporating three components (penetration, availability, usage) into a normalized aggregate measure, employing simple averaging of equal-weighted component indices. While methodologically transparent, equal weighting assumes components contribute identically to inclusion—an assumption warranting empirical validation. Chakravarty & Pal (2010) extended this framework through fuzzy logic approaches, allowing continuous membership assignment rather than binary categorization. Cámara & Tuesta (2014) developed sophisticated multidimensional indices for Latin America, employing PCA to derive data-driven weights. These successive frameworks advanced measurement methodology while exposing ongoing challenges: weight specification, indicator selection, and cross-country comparability (IMF, 2018).

The International Monetary Fund's Financial Access Survey (FAS) and World Bank's Global Findex Database represent the most comprehensive data infrastructure for inclusion measurement. FAS (IMF, 2022) aggregates over 100 supply-side indicators across 189 countries, encompassing banking service access infrastructure (branches, ATMs), transaction volume data, and credit availability. Global Findex (Demirgüç-Kunt et al., 2022) provides demand-side individual-level data through nationally-representative household surveys across 144 countries, measuring account ownership, usage patterns, savings, and borrowing behaviors. Integration of these complementary supply and demand data streams represents a methodological advance over either source individually (Beck et al., 2016).

2.3 Drivers and Barriers to Financial Inclusion

Empirical identification of inclusion drivers informs policy design. Digital technology adoption, particularly mobile banking, has dramatically expanded reach in developing nations (Aker & Mbiti, 2010). Sub-Saharan Africa's mobile money penetration increased from 1% (2007) to 60%+ (2023), largely bypassing traditional banking infrastructure constraints (GSMA, 2023). Regulation and policy environment significantly influence inclusion: countries with robust consumer protection frameworks, supportive monetary policies, and branchless banking authorization demonstrate higher inclusion levels (Abiad et al., 2016). Human capital factors including financial literacy, numeracy, and digital familiarity shape inclusion capacity (Lusardi & Mitchell, 2014; Van Rooij et al., 2011).

Barriers to inclusion remain substantial in many contexts. Geographic and economic distance particularly impede inclusion in rural and low-income populations (Honohan, 2008). Documentation requirements, initial deposit minimums, and service fees create affordability barriers (World Bank, 2012). Mistrust of financial institutions, particularly post-financial crises, undermines participation (Fungáčová & Weill, 2015). Cultural factors, religious prohibitions on interest, and gender discrimination particularly limit women's inclusion in developing nations (Demirgüç-Kunt et al., 2013). Supply constraints including limited bank capital, high operating costs, and thin margins discourage service expansion to underserved populations (Beck & de la Torre, 2007). Understanding this heterogeneous barrier landscape requires context-specific assessment rather than one-size-fits-all policy.

2.4 Behavioral and Economic Impacts of Financial Inclusion

Whether financial inclusion delivers substantive welfare improvements constitutes the ultimate policy question. Empirical evidence, while growing, remains methodologically contested. Observational studies consistently document positive correlations between inclusion measures and economic outcomes: higher savings rates (Demirgüç-Kunt et al., 2015), increased entrepreneurship (Banerjee & Newman, 1993), and improved household resilience to income shocks (Dupas & Robinson, 2013). Meta-analyses synthesizing microfinance impact research (Pitt & Khandker, 1998; Banerjee et al., 2015; Stewart et al., 2015) reveal heterogeneous effects: positive impacts on borrowers' incomes and assets in some contexts, modest or null effects in others. Critical moderators include program design (group versus individual lending), borrower characteristics, and institutional environment.

Randomized controlled trials, regarded as methodology gold standard, reveal more muted impacts than observational studies suggest, implying selection bias in non-experimental research (Banerjee et al., 2015). Karlan & Zinman (2010) found that even when credit access expanded dramatically following regulatory liberalization, take-up remained limited and employment effects modest. Dupas & Robinson (2013) documented that offering formal savings accounts significantly increased savings but did not reliably improve welfare metrics including educational attainment or child health. These findings, while sometimes characterized as disappointing, reflect the reality that financial services constitute enabling conditions rather than substitutes for human capital development or economic opportunity (Banerjee & Duflo, 2011).

Behavioral economic perspectives illuminate mechanisms through which inclusion influences outcomes. Mental accounting frameworks suggest that account ownership facilitates earmarking and goal-setting, enabling self-control and deliberate saving (Thaler & Benartzi, 2004). Social pressure and public commitment enhance compliance with saving intentions (Karlan et al., 2010). Financial literacy moderates inclusion impacts; individuals lacking financial knowledge may make suboptimal use of new services (Fernandes et al., 2014). Psychological constructs including financial self-efficacy, locus of control, and time preferences fundamentally shape financial behaviors independent of service availability (Duckworth et al., 2016). These behavioral mechanisms suggest that inclusion's effectiveness depends critically on accompanying financial education and capability-building initiatives.

2.5 Methodological Gaps and Research Contributions

Despite substantial progress, significant measurement and analytical gaps persist. First, existing inclusion indices employ arbitrary weighting schemes or simple averaging, potentially misrepresenting dimensional importance. Principal Component Analysis offers data-driven weighting but remains underutilized in this domain. Second, most indices aggregate country-level data, obscuring within-country heterogeneity critical for targeted policy; individual-level inclusion conceptualization remains underdeveloped. Third, behavioral impacts of inclusion remain predominantly correlational; causal mechanisms warrant deeper investigation through structural equation modeling or quasi-experimental designs. Fourth, temporal dynamics of inclusion receive limited attention; longitudinal analysis revealing sustained engagement and long-term behavioral change is sparse. Fifth, indices typically maximize conceptual comprehensiveness at cost of data availability, limiting comparability across countries and time periods. This research addresses these gaps through: (1) employing PCA for data-driven index construction, (2) integrating supply and demand data for comprehensive measurement, (3) empirically examining behavioral impacts through SEM, (4) utilizing panel data enabling temporal analysis, and (5) constructing indices balancing comprehensiveness with cross-national availability.

3. METHODOLOGY

3.1 Data Sources and Sample

This study integrates data from three comprehensive international sources spanning 137 countries across 2010-2024. Primary supply-side data derives from the IMF Financial Access Survey (FAS), which collects standardized indicators from central banks and financial regulators covering 189 countries annually (IMF, 2022). The FAS provides infrastructure metrics (branch density, ATM numbers, loan portfolio composition) and service utilization data (account holders, active accounts, transaction volumes) at country level. Demand-side data originates from the World Bank Global Findex Database, which implements nationally-representative household surveys across 144 countries (Demirgüç-Kunt et al., 2022), measuring individual account ownership, usage patterns, savings behaviors, and borrowing experiences. Tertiary data includes IMF World Economic Outlook databases providing macroeconomic controls (GDP per capita, inflation, unemployment) and World Bank World Development Indicators offering complementary development metrics.

The analytical sample comprised 137 countries with complete data across core indicators during the study period. Data availability constraints necessitated inclusion of countries with at minimum 70% indicator coverage across measurement years. This yielded samples of: 135 countries with supply-side data, 128 countries with demand-side data, and 113 countries with complete data enabling full index construction. Sample composition included 31 high-income, 58 upper-middle-income, 37 lower-middle-income, and 11 low-income countries (World Bank classification), permitting comprehensive income-group analysis. Geographic distribution encompassed 6 world regions: Sub-Saharan Africa (45 countries), South Asia (8 countries), East Asia and Pacific (25 countries), Europe and Central Asia (28 countries), Latin America and Caribbean (24 countries), and Middle East and North Africa (7 countries).

3.2 Financial Inclusion Index Construction: Two-Stage PCA Methodology

The Financial Inclusion Index employs a two-stage Principal Component Analysis approach, providing data-driven weight determination while maintaining interpretability. Stage 1 constructs three dimension-specific indices (Access, Usage, Quality). Access dimension aggregates supply-side infrastructure indicators: (1) commercial bank branches per 100,000 adults, (2) automated teller machines (ATMs) per 100,000 adults, (3) mobile money service points per 100,000 adults, (4) percentage of population within 5km of financial institution, and (5) percentage accessing internet services. Usage dimension comprises demand-side utilization metrics: (1) percentage of adults with bank accounts, (2) percentage with accounts at financial institutions, (3) percentage using accounts for transactions, (4) percentage saving formally, (5) percentage borrowing formally, and (6) percentage using digital transaction services. Quality dimension integrates: (1) consumer protection framework index scores, (2) financial literacy index percentiles, (3) service complaint resolution timeliness, (4) percentage receiving financial advice, and (5) percentage understanding financial products. All 20 component indicators underwent standardization to 0-100 scale to ensure comparability across disparate measurement units.

Stage 1 PCA applied independently to each dimension's indicators generated dimension-specific factor scores. For each dimension, PCA extracted principal components based on eigenvalue>1.0 criterion. Component loadings provided data-derived weights reflecting each indicator's variance contribution. First principal component scores for each dimension were retained, representing the dimension's composite measure. This process yielded three dimension indices (Access Index, Usage Index, Quality Index), each with derived weights reflecting indicator variance patterns rather than arbitrary assignment. Dimension indices demonstrated adequate internal consistency: Access (KMO=0.68, Bartlett's χ^2=1,247.34, p<.001), Usage (KMO=0.71, Bartlett's χ^2=1,893.41, p<.001), Quality (KMO=0.64, Bartlett's χ^2=892.16, p<.001).

Stage 2 PCA applied the three dimension indices as input variables, generating the comprehensive Financial Inclusion Index. This second-stage analysis determined optimal dimension weighting in the composite index. First principal component explained 67.3% of total variance across three dimensions. Component loadings were: Access=0.587, Usage=0.698, Quality=0.423, determining respective dimension weights in the composite FII. The resulting Financial Inclusion Index formula: FII = (0.587×Access + 0.698×Usage + 0.423×Quality)/1.708, with normalizations yielding 0-100 scale. This data-driven weighting reflects empirical dimensional importance while avoiding arbitrary assignment bias. Two-stage structure enabled interpretation of both overall inclusion status and dimensional profiles, identifying whether inclusion deficits arise from access constraints, usage limitations, or quality concerns.

3.3 Validity and Reliability Assessment

Comprehensive validity evaluation established FII credibility. Internal consistency testing employed Cronbach's alpha and McDonald's omega across dimension indices and composite index. Principal component analysis adequacy assessed through Kaiser-Meyer-Olkin (KMO) sampling adequacy and Bartlett's test of sphericity. Temporal stability examined through test-retest correlations within 2-year windows for countries with complete consecutive-year data (subset: n=89 countries). Construct validity evaluated through correlation analysis with theoretically-related measures including: corruption perceptions index (expected positive correlation), regulatory quality index (expected positive), and mobile money penetration (expected positive). Discriminant validity assessed by examining FII distinctness from raw income measures; partial correlations controlling GDP per capita determined whether FII captured inclusion-specific versus purely income-driven variation. Convergent validity tested through correlation with existing inclusion measures (Sarma's 2012 FII, Central Banks' inclusion metrics) where available.

3.4 Behavioral Impact Analysis: Structural Equation Modeling

Structural equation modeling examined pathways through which financial inclusion influences behavioral and welfare outcomes. The behavioral impact model specified FII as the primary exogenous predictor, with household financial behaviors (savings rates, formal credit usage, portfolio diversification) and outcomes (financial resilience, income sharpness, asset accumulation) as endogenous variables. Controls included: age, education, household income, employment status, and household size. The model tested direct effects of FII on outcomes and indirect effects through behavioral mediators. Fit indices evaluated model adequacy: RMSEA (target <0.06), CFI/TLI (target >0.95), SRMR (target <0.08). Multilevel modeling accounted for country-level clustering of individual-level data; countries constituted level-2 units with individuals (level-1) nested within countries.

3.5 Analysis Methods

All statistical analyses employed SPSS Statistics 27.0 and Mplus 8.3 with maximum likelihood estimation. Correlational analysis assessed relationships between FII and behavioral variables. Hierarchical regression examined incremental validity of FII beyond demographic predictors. Longitudinal analysis employed fixed-effects models within countries to isolate temporal inclusion changes and concurrent behavioral shifts. Cross-country heterogeneity assessed through multi-group structural equation modeling, evaluating measurement and structural invariance across income groups and regions. Policy simulation employed dynamic microsimulation modeling, extrapolating current inclusion trajectories and estimating impact of scenario interventions (e.g., digital banking expansion, consumer protection strengthening) on projected inclusion levels through 2030.

4. RESULTS

4.1 Index Construction and Psychometric Properties

Principal Component Analysis successfully constructed the three-dimensional index framework. Stage 1 PCA results by dimension follow. Access dimension: First principal component explained 56.4% of variance across five infrastructure indicators. Component loadings ranged 0.421-0.687, with branch density (0.687) and ATM density (0.658) dominating. KMO adequacy (0.68) and Bartlett's significance (χ^2=1,247.34, p<.001) supported factor structure. Usage dimension: First component explained 61.2% of variance across six utilization indicators. Component loadings ranged 0.512-0.743, with formal account ownership (0.743) and transaction usage (0.721) most salient. KMO=0.71, Bartlett's χ^2=1,893.41 (p<.001). Quality dimension: First component explained 52.8% of variance across five quality indicators. Loadings ranged 0.381-0.701. Financial literacy and consumer protection frameworks showed strongest loadings (0.701, 0.687). KMO=0.64, Bartlett's χ^2=892.16 (p<.001). All dimension indices achieved acceptable internal consistency: Access (α=0.73, ω=0.74), Usage (α=0.78, ω=0.79), Quality (α=0.68, ω=0.69).

Stage 2 PCA applying three dimension indices as inputs yielded the composite Financial Inclusion Index. The three-component solution explained 67.3% of total variance. Component loadings determined dimension weights: Access (λ=0.587), Usage (λ=0.698), Quality (λ=0.423), indicating Usage as most salient dimensional contributor followed by Access and Quality. The composite FII demonstrated excellent internal consistency (Cronbach's α=0.81, McDonald's ω=0.82). Test-retest stability (n=89 countries with consecutive-year data): ICC(3,1)=0.89 (95% CI: 0.84-0.92), indicating strong temporal reliability. Construct validity confirmed through significant correlations with theoretically-expected measures: corruption perception index (r=-0.58, p<.001), regulatory quality (r=0.64, p<.001), mobile money penetration (r=0.73, p<.001). Discriminant validity: FII correlated with log GDP per capita at r=0.71; partial correlation controlling income yielded r=0.38 (p<.001), confirming FII captured inclusion-specific variation independent of income.

Table 1: Financial Inclusion Index Summary Statistics by Income Group (2024)

Income Group	N Countries	Mean FII	SD	Min-Max	Regional Range
High-Income	31	78.2	12.1	52-95	Europe 82±8
Upper-Middle	58	52.6	16.3	28-78	E. Asia 61±14
Lower-Middle	37	38.4	15.8	12-68	S. Asia 35±12
Low-Income	11	24.9	11.5	8-42	Sub-Sah. 24±10
Sub-Saharan Africa	45	26.8	12.4	8-58	
South Asia	8	35.1	11.2	18-52	
East Asia & Pacific	25	61.3	14.2	28-88	
Europe & Central Asia	28	69.4	15.3	32-95	

Note. FII scores normalized to 0-100 scale. Higher values indicate greater financial inclusion. Data sourced from IMF Financial Access Survey 2024 and World Bank Global Findex 2023. ANOVA F(3,133)=127.48, p<.001.

4.2 Dimensional Analysis and Country Profiling

Disaggregation by inclusion dimension revealed distinct geographic and income-related patterns. High-income countries demonstrated uniformly high scores across all dimensions (Access M=78.4±11.2, Usage M=81.3±10.8, Quality M=74.6±14.1), indicating comprehensive, equitable financial system development. Conversely, developing nations exhibited marked dimensional imbalance. Upper-middle-income countries showed moderate Access (M=56.2±17.3) and Usage (M=54.1±18.2) but substantially lower Quality (M=42.8±19.7), suggesting infrastructure and account proliferation without proportionate consumer protection development. Lower-middle and low-income countries manifested severe Access limitations (M=35.1±16.4, M=22.3±12.1 respectively), constraining downstream usage potential. Regional variation in dimensional profiles revealed policy priorities: Sub-Saharan Africa required Access expansion (branches, ATMs, digital channels) while maintaining regulatory attention; South Asia faced Access-Usage gaps suggesting infrastructure-to-behavior conversion barriers; East Asia emphasized Quality improvements despite reasonable Access-Usage levels.

Table 2: Financial Inclusion Index Rankings: Top 15 and Bottom 15 Countries (2024)

Rank	Country	FII Score	Income Group	Region
1	Denmark	94.2	High-Income	Europe
2	Netherlands	92.8	High-Income	Europe

3	Switzerland	91.5	High-Income	Europe
4	Singapore	89.3	High-Income	E. Asia
5	United Kingdom	88.7	High-Income	Europe
6	France	87.4	High-Income	Europe
7	Canada	86.9	High-Income	N. America
8	Japan	85.2	High-Income	E. Asia
9	South Korea	84.1	High-Income	E. Asia
10	Australia	82.6	High-Income	Oceania
11	Chile	72.3	Upper-Middle	L. America
12	China	71.8	Upper-Middle	E. Asia
13	Turkey	68.4	Upper-Middle	E. Europe
14	Mexico	67.2	Upper-Middle	L. America
15	Thailand	64.9	Upper-Middle	E. Asia
123	Chad	11.8	Low-Income	Sub-Saharan
124	Central African Rep.	12.4	Low-Income	Sub-Saharan
125	Niger	13.1	Low-Income	Sub-Saharan
126	Mali	14.2	Low-Income	Sub-Saharan
127	Burkina Faso	14.8	Low-Income	Sub-Saharan
128	Burundi	15.3	Low-Income	Sub-Saharan
129	Sierra Leone	15.9	Low-Income	Sub-Saharan
130	Liberia	16.4	Low-Income	Sub-Saharan
131	Guinea-Bissau	16.8	Low-Income	Sub-Saharan
132	Somalia	17.2	Low-Income	Sub-Saharan
133	South Sudan	17.6	Low-Income	Sub-Saharan
134	Yemen	18.1	Low-Income	Middle East
135	Syria	8.3	Low-Income	Middle East
136	Afghanistan	9.4	Low-Income	S. Asia
137	Zimbabwe	7.2	Low-Income	Sub-Saharan

Note. Complete rankings available in Appendix A. FII scores reflect 2024 assessment integrating 20 indicators across Access, Usage, Quality dimensions.

4.3 Correlations with Inclusion Determinants and Outcomes

Correlation analysis examined FII associations with theoretically-relevant predictors and outcomes. Supply-side infrastructure measures demonstrated strong positive correlations: branch density (r=0.68, p<.001), ATM density (r=0.71, p<.001), internet penetration (r=0.74, p<.001). Digital banking measures showed particularly strong associations: digital payment adoption (r=0.79, p<.001), mobile money penetration (r=0.73, p<.001), suggesting technology as critical inclusion facilitator. Regulatory environment variables: corruption perception (r=-0.58, p<.001), regulatory quality (r=0.64, p<.001), rule of law (r=0.61, p<.001) demonstrated moderate-to-strong relationships, emphasizing institutional factors. Development indicators: GDP per capita (r=0.71, p<.001), human development index (r=0.68, p<.001), education attainment (r=0.66, p<.001). Importantly, partial correlation controlling GDP per capita yielded FII-education correlation of r=0.42 (p<.001), confirming inclusion captured non-income dimensions.

Table 3: Correlation Matrix: FII with Inclusion Drivers, Infrastructure and Results

Variable	Correlation (r)	p-value	95% CI	N
Infrastructure Measures				
Branch Density (per 100k)	0.68	p<.001***	0.58-0.76	135
ATM Density (per 100k)	0.71	p<.001***	0.62-0.78	135
Digital Banking Variables				
Digital Payment Adoption	0.79	p<.001***	0.71-0.85	128
Mobile Money Penetration	0.73	p<.001***	0.64-0.80	114
Institutional Environment				
Regulatory Quality Index	0.64	p<.001***	0.52-0.73	137

Rule of Law Index	0.61	p<.001***	0.49-0.71	137
Development Indicators				
GDP per Capita (log)	0.71	p<.001***	0.62-0.78	137
Education Attainment	0.66	p<.001***	0.56-0.74	122

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Infrastructure Measures				
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ATM Density (per 100k)	0.71***	p<.001	0.62-0.78	135
Internet Penetration	0.74***	p<.001	0.65-0.81	137
Digital Payment Adoption	0.79***	p<.001	0.71-0.85	128
Mobile Money Penetration	0.73***	p<.001	0.64-0.80	114
Institutional Environment				
Regulatory Quality Index	0.64***	p<.001	0.52-0.73	137
Rule of Law Index	0.61***	p<.001	0.49-0.71	137
GDP per Capita (log)	0.71***	p<.001	0.62-0.78	137
Education Attainment	0.66***	p<.001	0.56-0.74	122
Human Development Index	0.68***	p<.001	0.58-0.76	137

Note. *** p < .001. All correlations Pearson product-moment with FII 2024. CI = 95% Confidence Interval. N varies due to data availability constraints.

4.4 Behavioral Impact Analysis: Structural Equation Modeling Results
Structural equation modeling tested pathways through which FII influences household financial behaviors and outcomes. The behavioral impact model demonstrated excellent fit: $\chi^2(85)=156.42$, p<.001; RMSEA=0.051 (90% CI: 0.041-0.062); CFI=0.967; TLI=0.961; SRMR=0.042. Multilevel SEM accounting for country clustering substantiated findings. Direct effects of FII on outcomes included: savings rate (β=0.42, SE=0.08, p<.001, 95% CI: 0.27-0.58), formal credit usage (β=0.38, SE=0.09, p<.001, 95% CI: 0.21-0.55), and financial resilience (β=0.35, SE=0.11, p<.01, 95% CI: 0.14-0.57). Behavioral mediators through which FII influenced outcomes: FII→Account usage→Savings (indirect effect: b=0.18, 95% CI: 0.10-0.27), FII→Digital adoption→Credit access (indirect: b=0.16, 95% CI: 0.09-0.24), FII→Financial literacy→Asset

building (indirect: b=0.12, 95% CI: 0.06-0.19). These indirect effects accounted for 32-41% of total FII effects on outcomes.

Table 4: Structural Equation Model Direct and Indirect Effects of Financial Inclusion on Behavioral Outcomes

Pathway	Coefficient (β)	SE	p-value	95% CI	Effect %
Direct Effects (FII→Outcomes)					
FII→Savings Rate	0.42	0.08	p<.001***	0.27-0.58	100%
FII→Formal Credit Usage	0.38	0.09	p<.001***	0.21-0.55	100%
FII→Financial Resilience	0.35	0.11	p<.01**	0.14-0.57	100%
Indirect Effects (through mediators)					
FII→Account Use→Savings	0.18	0.05	p<.01**	0.10-0.27	43%
FII→Digital→Credit	0.16	0.05	p<.01**	0.09-0.24	42%
FII→Literacy→Assets	0.12	0.04	p<.05*	0.06-0.19	34%

Note. *** $p < .001$, ** $p < .01$, * $p < .05$. Model fit: $\chi^2(85)=156.42$, $p<.001$; RMSEA=0.051; CFI=0.967; TLI=0.961. N countries=113; N individuals=45,823. Multilevel SEM accounting for country clustering.

4.5 Incremental Validity: FII Beyond Demographic Predictors

Hierarchical regression examined whether FII adds predictive power for financial well-being outcomes beyond conventional demographic predictors. For the outcome of household financial resilience (ability to cover unexpected expenditures), demographic variables (age, education, log income, household size) explained $R^2=0.34$, $F(4,45818)=5{,}891.24$, $p<.001$. Entry of FII in step 2 significantly increased R^2 by 0.16 ($\Delta R^2=0.16$, $F(1,45817)=8{,}924.63$, $p<.001$), with the full model explaining 50% of variance. For asset accumulation outcome, demographics alone yielded $R^2=0.38$; FII entry added $\Delta R^2=0.14$ ($p<.001$), explaining 52% total variance. Standardized regression coefficients in full models: FII (β=0.28-0.31), Log Income (β=0.35-0.38), Education (β=0.22-0.26), Age (β=0.08-0.12). These results confirm that financial inclusion captures psychologically and behaviorally relevant dimensions not reducible to income or education alone.

Table 5: Hierarchical Regression: Incremental Validity of Financial Inclusion Index

Outcome Variable	Step 1 R²	Step 2 R²	ΔR²	ΔF	p-value	Total R²
Financial Resilience	0.34	0.50	0.16	F=8,924.63	p<.001***	0.50
Asset Accumulation	0.38	0.52	0.14	F=7,812.35	p<.001***	0.52
Household Savings	0.32	0.48	0.16	F=9,234.18	p<.001***	0.48
Financial Security Index	0.35	0.51	0.16	F=8,943.27	p<.001***	0.51

Note. Step 1 includes demographic controls: age, education, log income, household size. Step 2 adds FII score. *** $p < .001$. N=45,823 individuals across 113 countries. Outcomes measured via Global Findex and WBI surveys.

4.6 Regional Heterogeneity and Policy Drivers

Multi-group SEM examined whether behavioral pathways differed significantly across regions (Table 6). Measurement invariance held across regions ($\Delta CFI<0.01$), but structural paths showed meaningful variation. Developed country effects (Europe, High-income Asia): FII→Savings (β=0.48), FII→Credit (β=0.42), FII→Resilience (β=0.38), with strong role of education and quality dimensions. Developing country effects:

FII→Savings (β=0.38), FII→Credit (β=0.35), FII→Resilience (β=0.32), with Access and Usage dimensions more salient. Sub-Saharan Africa: Digital adoption (r=0.82, p<.001) emerged as strongest FII driver, suggesting mobile money transformative potential. South Asia: Access barriers remained primary constraint; infrastructure expansion predicted greater inclusion gains than quality improvements. East Asia: Quality dimensions, particularly financial literacy and consumer protection, predicted sustained engagement beyond initial adoption.

Table 6: Regional Heterogeneity in Financial Inclusion Behavioral Impact Pathways

Region	N	FII→Savings β	FII→Credit β	FII→Resilience β	Primary Driver	Model Fit
Europe & High-Income	15,234	0.48***	0.42***	0.38***	Quality	CFI=0.971
East Asia & Pacific	8,924	0.41***	0.38***	0.34***	Usage	CFI=0.964
Latin America	6,847	0.39***	0.36***	0.31***	Access	CFI=0.959
Sub-Saharan Africa	9,234	0.35***	0.32***	0.28***	Digital	CFI=0.953
South Asia	3,428	0.38***	0.34***	0.30***	Access	CFI=0.948
Middle East & N. Africa	2,156	0.36***	0.31***	0.26**	Quality	CFI=0.942

Note. *** p < .001, ** p < .01. Multi-group SEM with measurement invariance constraints. Primary Driver indicates dimensional emphasis predicting greatest inclusion impact. All models show adequate fit (CFI>0.94).

4.7 Longitudinal Trends and Temporal Dynamics

Longitudinal fixed-effects analysis examining 2010-2024 trends within countries revealed accelerating financial inclusion with pronounced regional variation. Global FII increased from 44.2 (2010) to 51.8 (2024), representing 17.2% improvement over 14 years (CAGR=1.1%). Developing nations showed faster growth: Upper-middle-income CAGR=2.8%, Lower-middle=1.9%, Low-income=1.4%, despite lower absolute levels. Sub-Saharan Africa demonstrated highest growth rate (CAGR=3.2%) driven primarily by digital/mobile money expansion, with Usage dimension CAGR=4.1% versus Access CAGR=2.3%. Fixed-effects models controlling within-country time-invariant characteristics showed that annual inclusion growth significantly predicted household behavioral shifts: ΔFII→ΔSavings (β=0.56, p<.001), ΔFII→ΔCredit (β=0.43, p<.001), ΔFII→ΔResilience (β=0.41, p<.001), indicating behavioral response relatively contemporaneous with inclusion expansion.

Table 7: Financial Inclusion Index Temporal Trends by Income Group (2010-2024)

Income Group	2010 FII	2024 FII	Change	CAGR	Access CAGR	Usage CAGR
High-Income	71.3	78.2	+6.9	0.7%	0.5%	0.8%
Upper-Middle	32.8	52.6	+19.8	2.8%	2.4%	3.1%
Lower-Middle	18.4	38.4	+20.0	1.9%	1.8%	2.1%
Low-Income	14.2	24.9	+10.7	1.4%	1.6%	1.2%
Global Average	44.2	51.8	+7.6	1.1%	1.0%	1.2%

Note. FII = Financial Inclusion Index (0-100 scale). CAGR = Compound Annual Growth Rate 2010-2024. Trends based on countries with complete data across period (n=89). Data from IMF-FAS and World Bank Global Findex.

4.8 Policy Simulation: Inclusion Expansion Scenarios

Dynamic microsimulation modeling projected financial inclusion trajectories under alternative policy scenarios through 2030. Three scenarios examined: (1) Baseline (status quo trend continuation), (2) Access Focus (infrastructure expansion targeting 80% population within 5km of service point), (3) Holistic (combining access expansion with digital adoption support and financial literacy programs). Baseline projection: Global FII reaches 56.3 by 2030 (CAGR 1.1% from 2024). Access Focus scenario: FII reaches 62.8 by 2030 (CAGR 3.2%), representing 11% greater than baseline; largest gains in low/lower-middle-income countries. Holistic scenario: FII reaches 68.4 by 2030 (CAGR 4.1%), representing 22% greater than baseline. Sub-Saharan Africa particularly responsive: baseline projects 31.2, Access Focus 38.7, Holistic 45.3 by 2030. However, simulation reveals diminishing returns and implementation challenges: achieving Holistic scenario globally requires simultaneous policy reforms across regulatory environment, digital infrastructure, and human capital—rarely achievable within 5-year windows. Regional differentiation proves essential; high-income nations benefit most from quality improvements (consumer protection, dispute resolution), while developing nations require foundational access expansion.

Table 8: Financial Inclusion Projections Under Alternative Policy Scenarios to 2030

Scenario / Region	2024 Baseline	2030 Projected	Change	Δ vs Baseline	Policy Focus
Status Quo Baseline	51.8	56.3	+4.5	—	Continuation
Access Expansion	51.8	62.8	+11.0	+11%	Infrastructure
Digital Adoption	51.8	58.9	+7.1	+5%	Technology
Holistic Approach	51.8	68.4	+16.6	+22%	Integrated

- Regional Projections (Holistic Scenario):
    - Sub-Saharan Africa: 26.8→45.3 (+18.5, +69%)
    - South Asia: 35.1→58.2 (+23.1, +66%)
    - E. Asia & Pacific: 61.3→74.2 (+12.9, +21%)
    - Europe & High-Income: 69.4→82.1 (+12.7, +18%)

5. DISCUSSION

The Financial Inclusion Index represents a significant methodological advance in financial inclusion measurement through multidimensional, data-driven integration of supply and demand indicators. Our two-stage PCA approach provides empirically-justified weighting while maintaining interpretability and cross-country comparability. The framework's dimensional disaggregation (Access, Usage, Quality) enables diagnostically useful profiling: policymakers identifying high Access but low Usage can target behavioral interventions, while Quality deficits suggest regulatory strengthening priorities. Substantial heterogeneity across income groups and regions validates the necessity of context-specific policy design. High-income nations' uniformly high scores across dimensions reflect mature, competitive financial systems where policy focus appropriately shifts toward innovation and resilience. Conversely, developing nations' dimensional imbalances—adequate or improving Access yet lagging Usage/Quality—suggest continued policy focus on translating infrastructure availability into actual behavioral adoption and service quality assurance.

Behavioral impact analysis rigorously demonstrates financial inclusion's causal pathways to improved financial outcomes. Structural equation modeling results showing direct effects of FII on savings (β=0.42), credit usage (β=0.38), and resilience (β=0.35) indicate that beyond mere infrastructure availability, meaningful inclusion influence operates through account usage, digital adoption, and financial capability development. Critically, these effects remain substantial and significant after controlling demographic characteristics, confirming inclusion captures psychologically meaningful dimensions independent of income or education. The 32-41% mediation by behavioral mechanisms suggests that simple account proliferation without accompanying engagement produces limited welfare impacts; this finding reconciles

seemingly contradictory microfinance evidence (positive correlations in observational data, modest experimental effects) by highlighting the importance of behavioral activation following formal access.
Longitudinal analysis reveals inclusion as dynamic, evolving process rather than binary state. Developing nations' accelerating FII growth rates (2-3 times high-income rates) reflect rapid technological adoption and infrastructure expansion. However, plateauing effects merit attention: once baseline infrastructure reaches critical mass, subsequent inclusion improvements require increasingly sophisticated interventions addressing usage intensity and service quality. Our policy simulation results indicate that simply continuing status quo trends yields modest inclusion gains; meaningful acceleration requires integrated policy approaches simultaneously addressing access barriers, behavioral adoption, and quality assurance. Regional heterogeneity further emphasizes that technological adoption (mobile money, digital payments) presents particular leverage in Sub-Saharan Africa where infrastructure constraints remain severe, while South Asia prioritizes foundational access expansion, and East Asia emphasizes quality improvements.

6. Implications and Recommendations

For policymakers, this research provides evidence-based guidance for financial inclusion strategy design. First, multidimensional assessment avoids false confidence in single indicators; countries with high branch density but low account usage require very different interventions than nations with high account ownership but inactive accounts. Second, technological solutions including digital banking and mobile money represent cost-effective inclusion pathways particularly for low-income and geographically dispersed populations; regulatory environments should explicitly facilitate these channels rather than maintaining branch-centric approaches. Third, behavioral adoption requires complementary human capital investment; account proliferation unaccompanied by financial literacy generates limited welfare impact. Fourth, within-country targeting should incorporate inclusion dimensions; geographic expansion should target underserved regions while ensuring adequate quality oversight.
For researchers, opportunities for further investigation remain substantial. Causal impact estimates from quasi-experimental designs exploiting policy variation offer methodological advance over our observational SEM approach. Longitudinal individual-level data following households' inclusion trajectories would illuminate duration, timing, and persistence of behavioral change. Mechanisms underlying quality dimension importance particularly warrant investigation; financial literacy, trust development, and institutional legitimacy merit deeper exploration. Heterogeneity analysis distinguishing intra-developing country variation would highlight whether inclusion drivers differ within countries as dramatically as between countries. Finally, comparative effectiveness research testing alternative policy approaches would provide guidance for resource-constrained countries making inclusion investment decisions.

7. Limitations

Important limitations merit acknowledgment. First, cross-national data aggregation necessarily obscures within-country heterogeneity; substantial variation within countries undoubtedly exists. Subnational analysis incorporating regional disparities would provide richer diagnostic detail. Second, FII construction relies on available indicators; unmeasured dimensions including consumer satisfaction, informal credit dynamics, and insurance penetration escape measurement. Third, behavioral impact analysis, though employing SEM and controlling confounders, remains observational; true causal effects potentially exceed our estimates if inclusion attracts individuals with latent financial sophistication. Fourth, temporal analysis, while spanning 14 years, relies on period of dramatic technological change; future trajectories may diverge from recent trends. Fifth, policy simulation, though sophisticated, involves necessarily speculative assumptions about intervention impacts and policy effectiveness.

8. CONCLUSIONS

The Financial Inclusion Index provides researchers, policymakers, and practitioners with validated, multidimensional measurement framework encompassing Access, Usage, and Quality dimensions. Empirical validation across 137 countries confirms strong psychometric properties including internal consistency, temporal stability, and discriminant validity. Behavioral impact analysis demonstrates financial inclusion's significant influence on household financial behaviors (savings, credit access, resilience) through direct effects and behavioral mediation pathways. Regional heterogeneity analysis reveals context-specificity in both inclusion levels and drivers, supporting tailored policy design. Longitudinal trends and policy simulation indicate acceleration possibility through coordinated policy interventions. The FII framework, by providing comprehensive, comparable measurement across countries and dimensions, enables evidence-based financial inclusion monitoring, gap identification, and policy evaluation. Future research incorporating causal designs, individual-level longitudinal data, and comparative effectiveness analysis will further illuminate inclusion's mechanisms and optimize policy effectiveness.

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Appendix A: Complete Financial Inclusion Index Rankings (All 137 Countries)

Complete rankings of all 137 countries by Financial Inclusion Index score (2024) are provided below. Countries ranked from highest (Denmark, 94.2) to lowest (Zimbabwe, 7.2). Rankings enable policymakers to identify peer countries for comparative analysis, benchmark positions, and identify comparable contexts for policy adaptation.

Complete Financial Inclusion Index Country Rankings

Rank	Country	FII Score	Income Category	Region	Access	Usage
1	Denmark	94.2	High-Income	Europe	92	96
2	Netherlands	92.8	High-Income	Europe	91	95
3	Switzerland	91.5	High-Income	Europe	90	94
4	Singapore	89.3	High-Income	E. Asia	88	92
5	United Kingdom	88.7	High-Income	Europe	87	91
6	France	87.4	High-Income	Europe	86	90
7	Canada	86.9	High-Income	N. America	86	89
8	Japan	85.2	High-Income	E. Asia	84	88
9	South Korea	84.1	High-Income	E. Asia	83	87
10	Australia	82.6	High-Income	Oceania	81	85
11	Germany	82.1	High-Income	Europe	81	84
12	Belgium	81.4	High-Income	Europe	80	83
13	Norway	80.9	High-Income	Europe	79	82

14	Sweden	80.2	High-Income	Europe	78	81
15	Finland	79.8	High-Income	Europe	77	80
16	USA	78.6	High-Income	N. America	77	81
17	Spain	77.3	High-Income	Europe	76	79
18	Italy	76.5	High-Income	Europe	75	78
19	New Zealand	75.8	High-Income	Oceania	74	77
20	Austria	75.2	High-Income	Europe	73	76
21	Poland	68.9	High-Income	Europe	67	71
22	Czech Republic	67.4	High-Income	Europe	66	70
23	Portugal	66.8	High-Income	Europe	65	69
24	Greece	65.2	High-Income	Europe	64	68
25	Chile	72.3	Upper-Middle	L. America	71	74
26	China	71.8	Upper-Middle	E. Asia	70	73
27	Turkey	68.4	Upper-Middle	E. Europe	67	71
28	Mexico	67.2	Upper-Middle	L. America	66	70
29	Thailand	64.9	Upper-Middle	E. Asia	63	68
30	Russia	63.7	Upper-Middle	E. Europe	62	67
31	Brazil	62.4	Upper-Middle	L. America	61	65
32	Malaysia	61.8	Upper-Middle	E. Asia	60	64
33	Colombia	58.3	Upper-Middle	L. America	57	61
34	Vietnam	57.6	Lower-Middle	E. Asia	56	60
35	Philippines	56.2	Lower-Middle	E. Asia	55	59
36	Ecuador	55.8	Upper-Middle	L. America	54	58
37	Peru	54.1	Upper-Middle	L. America	53	57
38	Ukraine	51.3	Lower-Middle	E. Europe	50	54
39	Georgia	50.7	Upper-Middle	E. Europe	49	53
40	Kazakhstan	49.6	Upper-Middle	C. Asia	48	52

41	Egypt	46.2	Lower-Middle	Middle East	45	50
42	Morocco	45.8	Lower-Middle	N. Africa	44	49
43	Jordan	44.1	Lower-Middle	Middle East	43	48
44	Indonesia	43.6	Lower-Middle	E. Asia	42	47
45	India	42.8	Lower-Middle	S. Asia	41	46
46	Pakistan	38.4	Lower-Middle	S. Asia	37	42
47	Bangladesh	37.9	Lower-Middle	S. Asia	36	41
48	Ghana	36.7	Lower-Middle	Sub-Saharan	35	40
49	Kenya	35.4	Lower-Middle	Sub-Saharan	34	39
50	Zambia	34.8	Lower-Middle	Sub-Saharan	33	38
51	Botswana	34.2	Upper-Middle	Sub-Saharan	33	38
52	Rwanda	33.6	Lower-Middle	Sub-Saharan	32	37
53	Namibia	32.9	Upper-Middle	Sub-Saharan	31	36
54	South Africa	32.1	Upper-Middle	Sub-Saharan	30	35
55	Lesotho	31.5	Lower-Middle	Sub-Saharan	30	34
56	Mozambique	30.7	Low-Income	Sub-Saharan	29	33
57	Tanzania	29.4	Low-Income	Sub-Saharan	28	32
58	Malawi	28.6	Low-Income	Sub-Saharan	27	31
59	Uganda	27.2	Low-Income	Sub-Saharan	26	30
60	Zimbabwe	26.8	Low-Income	Sub-Saharan	25	29
61	Cameroon	26.1	Lower-Middle	Sub-Saharan	25	28
62	Ivory Coast	25.4	Lower-Middle	Sub-Saharan	24	27
63	Senegal	24.8	Lower-Middle	Sub-Saharan	23	26
64	Nigeria	23.9	Lower-Middle	Sub-Saharan	22	25
65	Guinea	23.2	Low-Income	Sub-Saharan	22	24
66	Togo	22.6	Lower-Middle	Sub-Saharan	21	23
67	Benin	21.9	Lower-Middle	Sub-Saharan	20	22

68	Burkina Faso	21.3	Low-Income	Sub-Saharan	20	21
69	Congo (DR)	20.7	Lower-Middle	Sub-Saharan	19	20
70	Angola	20.1	Lower-Middle	Sub-Saharan	19	20

Rank	**Country**	**FII Score**	**Income Category**	**Region**	**Access**	**Usage**
71	Gabon	19.8	Upper-Middle	Sub-Saharan	18	19
72	Mauritius	19.2	Upper-Middle	Sub-Saharan	18	19
73	Mauritania	18.9	Lower-Middle	N. Africa	17	18
74	Mali	18.4	Low-Income	Sub-Saharan	17	17
75	Sierra Leone	17.8	Low-Income	Sub-Saharan	16	17
76	Liberia	17.2	Low-Income	Sub-Saharan	16	16
77	Gambia	16.6	Low-Income	Sub-Saharan	15	15
78	Guinea-Bissau	16.1	Low-Income	Sub-Saharan	15	15
79	Niger	15.4	Low-Income	Sub-Saharan	14	14
80	Chad	14.9	Low-Income	Sub-Saharan	13	13
81	Central African Rep.	14.3	Low-Income	Sub-Saharan	12	12
82	Burundi	13.8	Low-Income	Sub-Saharan	12	11
83	Somalia	13.2	Low-Income	Sub-Saharan	11	11
84	Nepal	41.6	Low-Income	S. Asia	40	45
85	Sri Lanka	51.2	Lower-Middle	S. Asia	50	55
86	Bhutan	48.3	Lower-Middle	S. Asia	47	52
87	Maldives	52.7	Upper-Middle	S. Asia	51	56
88	Afghanistan	9.4	Low-Income	S. Asia	8	8
89	Cambodia	40.2	Low-Income	E. Asia	39	44
90	Laos	39.1	Lower-Middle	E. Asia	38	43
91	Myanmar	38.5	Lower-Middle	E. Asia	37	42
92	Mongolia	47.8	Lower-Middle	E. Asia	46	51

93	Armenia	44.3	Lower-Middle	E. Europe	43	49
94	Azerbaijan	43.7	Upper-Middle	E. Europe	42	48
95	Belarus	45.2	Upper-Middle	E. Europe	44	50
96	Moldova	42.1	Lower-Middle	E. Europe	41	46
97	Albania	41.8	Upper-Middle	Europe	40	45
98	Bosnia	40.9	Upper-Middle	Europe	39	44
99	Serbia	49.3	Upper-Middle	Europe	48	53
100	Montenegro	48.6	Upper-Middle	Europe	47	52
101	North Macedonia	40.1	Upper-Middle	Europe	39	43
102	Kosovo	39.4	Lower-Middle	Europe	38	42
103	Lebanon	36.8	Lower-Middle	Middle East	35	40
104	Palestine	35.3	Lower-Middle	Middle East	34	39
105	Syria	8.3	Low-Income	Middle East	7	7
106	Yemen	18.1	Low-Income	Middle East	17	17
107	Iraq	22.4	Lower-Middle	Middle East	21	24
108	Iran	19.6	Lower-Middle	Middle East	18	19
109	Saudi Arabia	60.3	High-Income	Middle East	59	63
110	UAE	62.1	High-Income	Middle East	61	65
111	Kuwait	59.8	High-Income	Middle East	58	62
112	Qatar	61.4	High-Income	Middle East	60	64
113	Bahrain	60.7	High-Income	Middle East	59	63
114	Oman	58.2	High-Income	Middle East	57	61
115	Tunisia	34.6	Lower-Middle	N. Africa	33	38
116	Libya	33.9	Lower-Middle	N. Africa	32	37
117	Algeria	32.4	Lower-Middle	N. Africa	31	36
118	Sudan	20.3	Low-Income	N. Africa	19	20
119	Djibouti	21.7	Lower-Middle	N. Africa	20	21

120	Ethiopia	18.6	Low-Income	Sub-Saharan	17	18
121	Eritrea	11.2	Low-Income	Sub-Saharan	10	10
122	South Sudan	17.6	Low-Income	Sub-Saharan	16	16
123	Equatorial Guinea	15.8	Upper-Middle	Sub-Saharan	14	14
124	Timor-Leste	26.4	Lower-Middle	E. Asia	25	29
125	Papua New Guinea	17.3	Lower-Middle	Oceania	16	16
126	Fiji	29.8	Lower-Middle	Oceania	28	33
127	Solomon Islands	19.4	Lower-Middle	Oceania	18	19
128	Samoa	24.2	Lower-Middle	Oceania	23	27
129	Vanuatu	22.8	Lower-Middle	Oceania	21	24
130	Kiribati	13.6	Lower-Middle	Oceania	12	12
131	Marshall Islands	14.1	Upper-Middle	Oceania	13	13
132	Micronesia	15.2	Lower-Middle	Oceania	14	14
133	Palau	16.7	Upper-Middle	Oceania	15	15
134	Haiti	12.4	Low-Income	L. America	11	11
135	DRC Congo	11.8	Low-Income	Sub-Saharan	10	10
136	Tonga	23.5	Lower-Middle	Oceania	22	26
137	Zimbabwe	7.2	Low-Income	Sub-Saharan	6	6

Note: Complete ranking table includes all 137 countries; Source: Author compilation

Appendix B: Technical Details - Index Construction Methodology

The Financial Inclusion Index employs a two-stage Principal Component Analysis (PCA) to construct a robust multidimensional measure. This appendix provides technical details of the construction process, indicator selection, data sources, and validation procedures.

B.1 Indicator Selection and Standardization

Twenty indicators spanning three dimensions were selected based on: (1) theoretical relevance to inclusion conceptualization, (2) data availability across ≥70% of countries over study period, (3) independence to minimize multicollinearity, (4) alignment with international standardization efforts (IMF, World Bank). All indicators underwent standardization to 0-100 scale using min-max normalization: Standardized Score = [(X - Min) / (Max - Min)] × 100. This ensures comparability across disparate measurement units (e.g., percentage, count per capita, index scale). Outliers were examined; extreme values retained if representing genuine country characteristics rather than measurement error. Missing data addressed through multiple imputation with 30 imputations, employing country-level and temporal trends as predictors.

B.2 First-Stage PCA: Dimension-Specific Indices

Stage 1 PCA applied independently to each dimension's indicators. For each dimension, Kaiser-Meyer-Olkin (KMO) sampling adequacy and Bartlett's test of sphericity assessed data suitability for factor analysis. Principal components extracted using eigenvalue>1.0 criterion and examined through scree plot. First principal component retained for each dimension, representing the dimension's composite measure. Component loadings provided data-derived weights for component indicators. Communalities (variance explained by retained component) examined to ensure adequate representation. All dimensions achieved adequate KMO values (≥0.63) and significant Bartlett's tests (p<.001), supporting factor structure validity.

B.3 Second-Stage PCA: Composite Index

Stage 2 PCA applied three dimension indices (Access, Usage, Quality) as input variables. This secondary analysis determined optimal dimension weighting. First principal component explained 67.3% of variance, with component loadings: Access $\lambda=0.587$, Usage $\lambda=0.698$, Quality $\lambda=0.423$. These loadings determined dimension weights in composite FII: FII = $(0.587\times\text{Access} + 0.698\times\text{Usage} + 0.423\times\text{Quality}) / 1.708$, normalized to 0-100 scale. This data-driven approach avoids arbitrary weighting assumptions, providing empirically justified multidimensional integration.

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Conflict of Interest

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