

The Financial Development Data: Methodology for Measuring Financial Development

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Abstract

Financial Development Data (FinData) is a new, annually updated database developed by the World Bank Group to measure financial system development across up to 218 economies from 1980 onwards. Building on Čihák, Demirgüç-Kunt, Feyen, and Levine (2012), FinData adopts an expanded 4×4 conceptual framework that assesses four segments of the financial system — banks, non-bank financial institutions, equity markets, and debt markets — across four dimensions: depth, access, efficiency, and stability. This note describes the methodology underpinning the construction of FinData's composite indices. It details the sample definition and data coverage filters applied to the initial universe of 218 economies, the quality control procedures for source indicators, and the missing-data treatment designed to maximize coverage while minimizing reliance on imputation, with sensitivity analyses confirming that the proposed approach balances external plausibility, temporal stability, coverage, and interpretability relative to alternative missing-data treatments and normalization methods. The database integrates traditional banking and capital market indicators with digital finance and financial inclusion measures, providing a comprehensive and consistent basis for cross-country analysis of financial sector development.



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1 Introduction

Well-developed financial systems are essential for long-term growth, job creation, and economic resilience. By mobilizing savings, allocating capital, facilitating payments, and diversifying risks and sources of finance, they help firms and households invest and expand in normal times and better withstand periods of stress. In a global economy increasingly exposed to overlapping shocks, understanding the depth, accessibility, efficiency, and stability of financial systems has become especially important. Measuring financial development is therefore central to the question of how the financial sector supports private investment, firms, farmers, and households.

Yet a comprehensive, publicly available global financial sector database to support data-driven policy analysis, research, and decision-making is absent. This gap coincides with significant structural changes in financial systems worldwide: the rapid expansion of digital finance and mobile money, the growing role of private equity and venture capital, and increasing attention to sustainable finance. These developments are not adequately captured by existing databases, which were designed around traditional banking and capital market indicators.

Financial Development Data (FinData) is a new, annually updated database created by the World Bank Group to fill this gap and extend the frontier of financial sector measurement. Building on the legacy of more than two decades of research and analytical work at the World Bank, FinData adopts an expanded 4×4 conceptual framework that assesses four segments of the financial system — banks, non-bank financial institutions (NBFIs), equity markets, and debt markets — across four dimensions: depth, access, efficiency, and stability. This integrated framework enables the incorporation of multiple data sources while providing a consistent basis for comparing financial systems across economies and over time. Beyond the underlying indicators, FinData introduces composite indices that summarize financial development across two main pillars — financial institutions and financial markets — and across the core dimensions of depth, access, and efficiency. These indices provide a concise and accessible summary of complex financial sector for policymakers, regulators, and researchers.

By providing granular, cross-country comparable data on the financial sector landscape, FinData serves as a reliable source of evidence for identifying constraints, benchmarking performance, and informing policy reforms aimed at fostering more efficient, inclusive, and resilient financial systems. The database also supports investors, financial intermediaries, and development institutions in assessing investment opportunities and directing capital toward productive uses with the potential to generate greater development impact. In

summary, FinData helps strengthen the information available for policy design and investment decisions, supporting efforts to mobilize private capital, improve resource allocation, and create conditions conducive to long-term economic growth.

This note describes the methodology underpinning FinData's construction, from the conceptual framework and data sources to the quality control procedures, missing-data treatment, index aggregation, and sensitivity analyses.

2 Why finance matters

Decades of research and evidence show that well-functioning financial systems are powerful drivers of economic development. Financial institutions and markets perform key functions that span the mobilization of savings, the allocation of capital to its most productive uses, the monitoring of investment, the diversification of risk, and the execution of transactions — functions that collectively underpin economic growth, poverty reduction, and shared prosperity (Levine, 2005). The empirical evidence linking financial development to growth outcomes is extensive. Levine, Loayza, and Beck (2000) and Beck, Levine, and Loayza (2000) demonstrate, using both cross-country and panel methodologies, that financial intermediation causally promotes economic growth and that differences in financial development across countries explain a non-trivial portion of cross-national income disparities. Levine and Zervos (1998) show that both banking-sector development and stock-market liquidity independently predict subsequent growth in per capita output and total factor productivity. These findings have been replicated and extended across a wide range of institutional settings, income groups, and time periods.

Beyond aggregate growth, the literature has examined specific channels and institutional actors. Abbas and Christensen (2010) highlight the growth-enhancing role of domestic debt markets in low-income countries and emerging economies, provided that public debt remains moderate. Arena (2008) finds that insurance market activity fosters economic growth in both industrialized and developing countries, operating through the channel of financial intermediation and risk pooling. Raddatz and Schmukler (2008) examine the role of pension funds in deepening capital markets, finding that the growth of funded pension systems supports financial market development in a range of country contexts. Together, these strands of research underscore a central proposition: the architecture and performance of financial systems, broadly conceived to include banking, capital markets, insurance, and non-bank financial institutions, matter profoundly for economic outcomes.

3 Analytical Framework and Conceptual Foundations

3.1 Historical background

Systematic, cross-country data collection on financial systems has a history spanning several decades, though the ambition and scope of these efforts have expanded considerably over time. The earliest broad-based efforts to compile financial sector data relied primarily on monetary and banking statistics drawn from the IMF's International Financial Statistics and the balance sheets of central banks. These sources provided basic measures of banking system size — such as the ratio of broad money to GDP and the ratio of credit to the private sector to GDP — but were limited in their coverage of non-bank financial institutions and financial markets, and in their ability to capture dimensions of financial development beyond depth.

A watershed in the systematic measurement of financial development came with Beck, Demirgüç-Kunt, and Levine (2000), who introduced the Database on Financial Development and Structure (FSDS). The FSDS compiled a range of indicators covering the size, activity, and efficiency of banks, non-bank financial intermediaries (including insurance companies and pension funds), and equity and bond markets across a large sample of countries for extended time periods. This database, subsequently updated by Beck, Demirgüç-Kunt, and Levine (2010), became the principal data source for the empirical finance-growth literature over the following decade and a half.

The FSDS was extended and reconceptualized by Čihák, Demirgüç-Kunt, Feyen, and Levine (2012) which introduced the 4x2 framework for measuring financial development and expanded the indicator set to over 70 variables for more than 200 economies on an annual basis from 1960 onwards which were made publicly available through the Global Financial Development Database (GFDD). Since then, the GFDD has been periodically updated by the World Bank through 2022 and has served as the primary reference dataset for analyzing global financial development. The Global Financial Development Report, first published in 2012 (World Bank, 2012), draws extensively on the GFDD to document and analyze financial system characteristics around the world.

Parallel efforts have sought to complement the supply-side, institution-level data of the GFDD with demand-side, household-level data. The World Bank Global Findex database, launched in 2011 and conducted approximately every three years, provides nationally representative surveys of financial behavior among adults in over 140 economies. Successive rounds of the Findex have expanded their coverage of digital financial services, making it an increasingly important source for measuring access to financial services in the era of digitalization (Demirgüç-Kunt et al., 2022). Similarly, the World Bank's Bank Regulation

and Supervision Survey (BRSS) provides comparative data on the regulatory and supervisory frameworks governing financial institutions across jurisdictions, which is particularly relevant as regulators grapple with the challenges posed by fintech and digital finance (Anginer et al., 2019).

FinData builds on and expands these efforts by offering a carefully selected set of core indicators chosen on the basis of their demonstrated relevance for economic growth, methodological robustness, country coverage, data quality, reporting frequency, and time-series length. The database incorporates digital financial indicators drawn from the Global Findex and other World Bank data sources and introduces, on a pilot basis, measures of sustainable finance where sufficient data are available.

3.2 Conceptual Framework: The 4x4 Matrix

The conceptual framework underlying the database builds on and extends the 4×2 structure developed by Čihák, Demirgüç-Kunt, Feyen, and Levine (2012) into a 4x4 framework (Figure 1). It evaluates financial system performance along four **dimensions** across two broad **pillars** of the financial system: *financial institutions* and *financial markets*. These pillars are further disaggregated into four **segments**: *banks* and *non-bank financial institutions* within the financial institutions pillar; and *equity markets* and *debt markets* within the financial markets pillar. The framework conceptually measures each pillar and segment across four **dimensions**: *depth*, *access*, *efficiency*, and *stability*.

To operationalize the measurement of these concepts, FinData provides a set of 34 core indicators selected on the basis of their demonstrated relevance to economic growth, methodological robustness, country and time coverage, and reporting frequency.

The two **pillars** distinguish between the providers of finance and the channels through which finance is delivered. Financial institutions are entities that mobilize funds and invest them in financial assets. Financial markets are the instruments and venues through which funds are raised and traded; they provide price discovery, risk transfer, and liquidity services that complement those of financial institutions, and their relative importance tends to rise with economic development, as firms gain access to capital market financing and institutional investors deepen market liquidity. FinData distinguishes four **segments**, two within each pillar.

Figure 1. FinData's 4x4 conceptual framework and core indicator coverage

	Institutions Pillar		Markets Pillar	
Dimensions	Banks	NBFIs	Equity markets	Debt markets
Depth	3 core indicators	3 core indicators	4 core indicators	3 core indicators
Access	5 core indicators	– No core indicator	3 core indicators	2 core indicators
Efficiency	3 core indicators	– No core indicator	2 core indicators	1 core indicator
Stability	3 core indicators	– No core indicator	1 core indicator	1 core indicator

Note: The figure summarizes the conceptual framework underlying FinData. The database organizes indicators along four dimensions of financial development (depth, access, efficiency, and stability) and four financial system segments (banks, NBFIs, equity markets, and debt markets). Numbers reported in each cell indicate the corresponding count of core indicators. The resulting framework comprises 34 core indicators. FinData further includes 33 supplementary indicators that capture relevant aspects of financial development but are not designated as core indicators due to lower methodological robustness or more limited cross-country and temporal coverage.

Banks remain the dominant providers of finance in most economies, particularly developing ones, and are the segment with the broadest indicator coverage in FinData.

Non-bank financial institutions comprise insurance companies, pension funds, and mutual funds, and other non-bank intermediaries, which play an increasingly important role as financial systems deepen. Comparable cross-country data on NBFIs remain limited, so FinData currently measures only the depth of this segment. Future releases will seek to extend coverage to access, efficiency, and stability.

Equity markets cover listed equity traded on stock exchanges as well as non-listed equity raised through private equity (PE) and venture capital (VC). Because the focus is on transactions in equity claims on firms rather than on the institutions undertaking them, PE and VC deals are classified in this segment rather than under NBFIs.

Debt markets cover government and corporate bonds, with depth measured mainly through internationally issued debt securities and total bond issuance. Derivative markets are not currently covered.

Each segment is assessed along the same four **dimensions**.

Depth refers to the overall size of financial institutions and markets, typically measured as the stock of financial instruments outstanding relative to GDP. Examples include private

credit to GDP (for financial institutions) and stock market capitalization to GDP (for financial markets). Depth measures the extent to which financial activity is occurring in an economy, though it does not capture the quality, efficiency, or distributional character of that activity.

Access refers to the degree to which individuals and firms can obtain and use financial services. Traditional measures of access have focused on supply-side proxies, such as the number of bank branches or ATMs per capita, and on the share of firms reporting access to a line of credit as a constraint. In the digital era, access increasingly must be measured through demand-side indicators — account ownership, use of digital payments, and the availability of mobile money — derived from sources such as the World Bank Global Findex. The distinction between access and use is important: physical or digital availability of financial services does not guarantee their effective utilization, particularly among low-income, rural, female, or elderly populations.

Efficiency refers to the ability of financial institutions and markets to intermediate resources at low cost and with high speed. For financial institutions, efficiency is commonly measured by the net interest margin, overhead costs as a share of total assets, and the return on equity. For financial markets, efficiency indicators include the stock market turnover ratio (trading volume relative to market capitalization) and bid-ask spreads.

Stability refers to the resilience of financial institutions and markets and their ability to withstand adverse shocks. At the institutional level, stability is commonly measured using indicators such as the Z-score (a distance-to-default measure), non-performing loan ratios, capital adequacy ratios, and liquidity ratios. At the market level, stability is assessed through indicators of price volatility and sovereign bond yield fluctuations. The rapid expansion of digital finance has introduced new sources of financial stability risk, including cyber threats, the concentration of critical infrastructure among a small number of technology providers, and the potential for digitally enabled bank runs. However, consistent cross-country data on these risks remain limited, preventing their systematic inclusion in the database at this stage.

Stability is an integral part of the 4×4 framework, and FinData reports stability indicators for banks, equity markets, and debt markets. However, FinData does not construct a stability index, either as a component of the composite indices or as a standalone measure. The main reason is conceptual: stability captures the resilience of a financial system to shocks, which is distinct from its level of financial development. A more developed financial system is not necessarily more stable, nor is a stable system necessarily a developed one, and periods of rapid financial deepening can be associated with a build-up of vulnerabilities (Loayza and Rancière, 2006). Averaging stability with depth, access, and efficiency could therefore obscure meaningful differences between the development of financial intermediation and markets and the resilience of the financial system. Stability indicators are therefore reported

separately, allowing financial development and financial stability to be assessed alongside one another.

3.3 Data Sources and Coverage

FinData draws on a diverse set of primary and secondary data sources to provide broad and internationally comparable coverage of financial system development. The database builds on established data collection efforts by international organizations, market infrastructure providers, commercial data vendors, academic datasets, and World Bank analytical products.

For traditional financial sector indicators, the core sources include the International Monetary Fund's International Financial Statistics (IFS), Financial Soundness Indicators (FSI), and Financial Access Survey (FAS); the Bank for International Settlements' (BIS) credit, debt securities, locational banking, and financial statistics databases; and the World Bank's World Development Indicators (WDI). These sources are complemented by market-based and institution-level data from Fitch, BankFocus, Bloomberg, LSEG, Dealogic, PitchBook, AXCO, Solifi Global Leasing Report, Factors Chain International, and other specialized providers.

The database places particular emphasis on measuring financial inclusion and the digital transformation of financial systems. For household-level access and usage indicators, the primary source is the World Bank's Global Findex Database, drawing on successive survey waves since 2011. For firm-level indicators, FinData relies extensively on the World Bank Enterprise Surveys, which provide internationally comparable measures of firms' access to finance, use of financial services, payment practices, and digital financial adoption. These sources are complemented by the IMF's Financial Access Survey and specialized World Bank datasets, including Remittance Prices Worldwide.

To strengthen coverage of capital markets and emerging areas of financial development, FinData incorporates data on equity, bond, syndicated loan, private equity, venture capital, and sustainable finance markets. These indicators are sourced from the BIS Debt Securities Statistics database, Dealogic's loan and capital market databases, and PitchBook.

Country coverage spans up to 218 economies, though coverage varies by indicator and time period. The temporal coverage extends from 1980 onwards for traditional banking indicators, with digital finance indicators available from approximately 2011 — corresponding to the launch of the Global Findex — and in some cases from earlier years where mobile money data exist.

All indicators are defined, sourced, and documented in the accompanying metadata file, which follows the format established by the GFDD.

4 Data treatment for financial development indicators in FinData

The financial development indicators included in FinData are sourced from a range of external providers. To ensure data integrity, each indicator undergoes a rigorous quality control process designed to detect outliers and unreliable observations. Specifically, the data checks examine country-level growth rates, within-country outliers, and anomalies in the cross-sectional year-country distribution, as well as deviations from overall indicator distributions. Where a suspect value can be verified and corrected against a credible external source, it is revised accordingly. Values that fall beyond acceptable distributional bounds and cannot be substantiated are also adjusted. Data points that remain unresolved after review are set to missing to avoid introducing noise into the analysis. A full record of every modification made to individual data points, including the rationale and supporting reference, is documented in the replicability package.

Table 1 outlines the core indicators that constitute the foundation of the FinData database, structured according to its conceptual framework across Pillars (Financial Institutions and Financial Markets), Financial Segments (Banks, NBFIs, Equity Markets, and Debt Markets), and Dimensions (Depth, Access, Efficiency, and Stability). The indicators presented here represent the key metrics featured directly on the interactive FinData public portal. However, the complete FinData dataset encompasses a broader and more granular set of underlying variables, all systematically organized and classified using the same data collection and mapping architecture.

Table 1. Core indicators in FinData by Pillar, Segment, and Dimension

Pillar	Segment	Dimension	Indicator	Source
Financial Institutions	Banks	Depth	Private credit by deposit money banks to GDP (%)	IMF IFS
		Depth	Deposit money banks' assets to GDP (%)	IMF IFS
		Depth	Consolidated international claims of BIS-reporting banks to GDP (%)	BIS
		Access	Bank or similar financial institution account (% , age 15+)	WB Findex
		Access	Borrowed from a formal bank or similar financial institution (% , age 15+)	WB Findex
		Access	Made or received a digital payment (% , age 15+)	WB Findex
		Access	SMEs with a checking or savings account (% of SMEs)	WB Enterprise Surveys
		Access	SMEs with a line of credit (% of SMEs)	WB Enterprise Surveys
		Efficiency	Bank net interest margin (%)	Fitch

Pillar	Segment	Dimension	Indicator	Source
		Efficiency	Bank cost to income ratio (%)	Fitch
		Efficiency	Bank return on assets (ROA) (%)	Fitch
		Stability	Bank Z-score (# of standard deviations)	Fitch
		Stability	Bank nonperforming loans to gross loans (%)	IMF FSI
		Stability	Tier 1 capital to risk-weighted assets (%)	IMF FSI
	NBFIs	Depth	Insurance company assets to GDP (%)	Multiple sources
		Depth	Pension fund assets to GDP (%)	Multiple sources
		Depth	Mutual fund assets to GDP (%)	Multiple sources
Financial Markets	Equity Markets	Depth	Stock market capitalization to GDP (%)	WB WDI
		Depth	Stock market total value traded to GDP (%)	WB WDI
		Depth	Private equity investment to GDP (%)	PitchBook
		Depth	Venture capital investment to GDP (%)	PitchBook
		Access	Number of listed companies per 10 million adults	WB WDI
		Access	Private equity-backed firms per 10 million adults	PitchBook
		Access	Venture capital-backed firms per 10 million adults	PitchBook
		Efficiency	Stock market turnover ratio (%)	WB WDI
		Efficiency	Free float on equity market (%)	Bloomberg
		Stability	Stock price volatility	Bloomberg
	Debt Markets	Depth	Outstanding international public debt securities to GDP (%)	BIS
		Depth	Outstanding international private debt securities to GDP (%)	BIS
		Depth	Bond issuance to GDP (%)	Dealogic
		Access	Number of issuers of corporate debt per 10 million adults	Dealogic
		Access	Corporate debt issuance outside the top 5 companies to total issuance (%)	Dealogic
		Efficiency	Quoted bid-ask spread on 5-year government bonds (bps)	Bloomberg
		Stability	Total debt in local currency to total debt (%)	Arslanalp and Tsuda (2014)

Note: This table reports the primary indicators featured on the FinData website. The full FinData database contains an expanded set of variables categorized under the same structural framework. Stability indicators are reported but not included in the composite indices.

5 Missing Data Imputation and Aggregation Methodology to Produce FinData Indices

This section describes the methodology to construct the FinData composite indices using core financial development indicators (detailed in Table 1). It first defines the economy-year sample and applies a recent-data-coverage filter to ensure that the indices are based on

sufficiently broad information. It then sets out the treatment of missing observations. Finally, it explains the winsorization and min-max normalization of underlying indicators, their elementary aggregation (segment-dimension indices), and the higher-level aggregation indices, including the overall financial-development indices (OFD).

5.1 Sample definition

Step 1. Time period. The dataset spans 2000–2024. Before 2000, data coverage drops significantly across both indicators and economies. A notable exception involves indicators on bank financial access, which were systematically collected starting in the early 2010s.

Step 2. Initial economy sample. The starting universe consists of the 218 economies that the World Bank classifies annually into four income groups based on the preceding year's Gross National Income (GNI) per capita. From this initial list, economies that are not World Bank member countries are excluded (see Table 2). An exception is made for Hong Kong SAR, China and Taiwan, China given their importance as international financial centers.

Table 2. Economies excluded from the initial sample

American Samoa	French Polynesia	Northern Mariana Islands
Andorra	Gibraltar	Puerto Rico (U.S.)
Aruba	Greenland	Sint Maarten (Dutch part)
Bermuda	Guam	St. Martin (French part)
British Virgin Islands	Isle of Man	Turks and Caicos Islands
Cayman Islands	Korea, Dem. People's Rep.	Virgin Islands (U.S.)
Channel Islands	Liechtenstein	West Bank and Gaza
Cuba	Macao SAR, China	
Curacao	Monaco	
Faroe Islands	New Caledonia	

Step 3. Recent data coverage filter. To compute aggregate indices, we retain only economies for which **at least 25 percent** of economy-year observations across all core FinData indicators are non-missing over the most recent ten-year window (2015–2024). The full list of core FinData indicators is provided in Table 1. The ten-year window serves as a straightforward eligibility screen based on recent data availability, while the 25 percent threshold balances broad economy coverage against the risk that an index is driven disproportionately by sparse source data and subsequent imputation. Applying this criterion retains 147 of the 191 economies (Table 3).

Table 3. Economies excluded in step 3 (recent data coverage filter)

Afghanistan	Equatorial Guinea	Micronesia, Fed. Sts.	St. Vincent and the Grenadines
Antigua and Barbuda	Eritrea	Nauru	Sudan
Belize	Fiji	Niger	Syrian Arab Republic
Brunei Darussalam	Grenada	Palau	Sao Tome and Principe
Burundi	Guinea-Bissau	Samoa	Timor-Leste
Central African Republic	Haiti	San Marino	Tonga
Chad	Kiribati	Solomon Islands	Turkmenistan
Comoros	Liberia	Somalia	Tuvalu
Congo, Dem. Rep.	Maldives	South Sudan	Vanuatu
Djibouti	Marshall Islands	St. Kitts and Nevis	Venezuela, RB
Dominica	Mauritania	St. Lucia	Yemen, Rep.

5.2 Imputation of missing data in economy-level indicators

Approach to missing data

The treatment of missing observations is designed to preserve the contribution of each indicator to the computation of the composite indices while maximizing usable coverage across economies and years. We apply a minimum-necessary-imputation principle, that is we choose the least invasive method that provides a material and documented improvement in coverage, representativeness, temporal stability, or external validity compared to the raw data. Specifically, after treating each indicator to validate its domain, we linearly interpolate internal gaps without imposing a maximum gap length, reflecting the discrete collection frequency of some survey-based series. Remaining gaps are then addressed through peer-growth imputation using other indicators within the same segment-dimension group, followed, where needed, by carry-forward of the last available or reconstructed observation for a maximum of three years. Together, these steps support temporal stability: country values change gradually and continuously over time rather than exhibiting abrupt jumps driven by data gaps.

Pre-imputation domain constraints

Before missing data treatment, indicator values are restricted to economically meaningful values. Indicators that cannot take negative values are bounded below at zero, while percentage and share indicators are constrained to the interval [0, 100]. Bank return on assets (ROA) is allowed to take both positive and negative values and is left unconstrained.

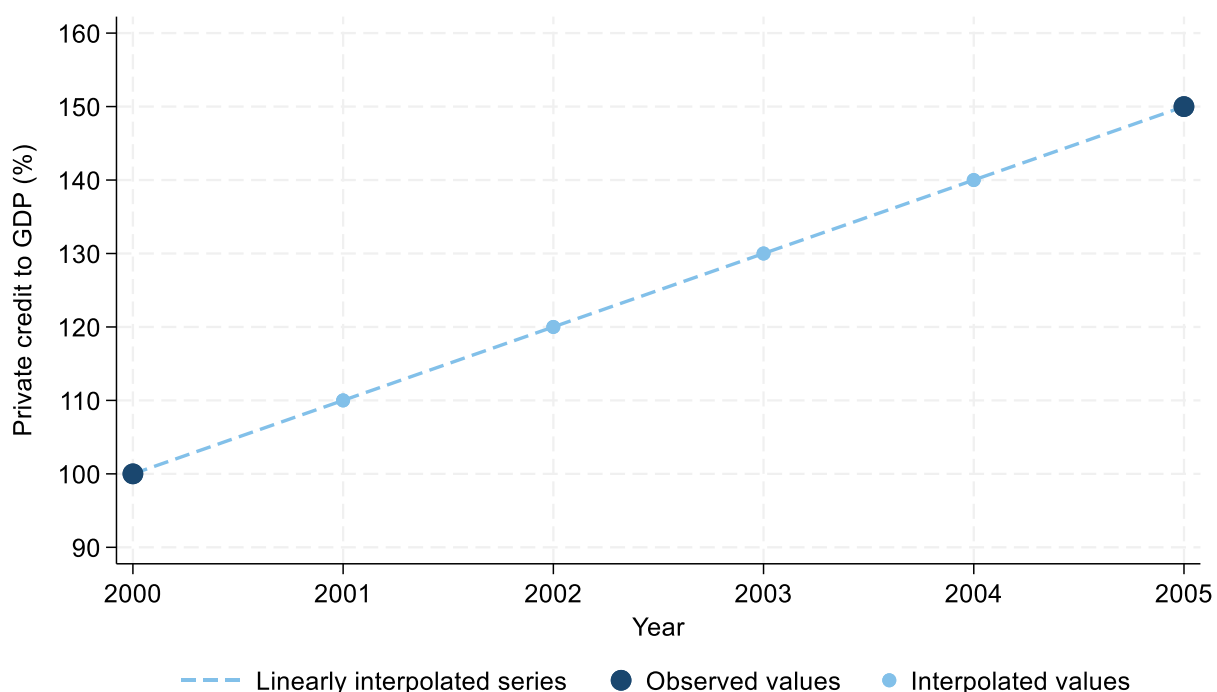
These domain constraints are applied before linear interpolation and before annual growth factors are calculated.

Step 4. Missing data treatment. Missing values are addressed separately for each economy–indicator series. Internal gaps — that is, missing observations situated between available data points (e.g., 2010–2012 or 2018) — are treated first, followed by missing observations at the start (leading gaps, e.g. 2000–2005) and at the end (trailing gaps, e.g. 2023–2024) of each series.

4a. Linear interpolation of internal gaps. When a missing observation falls between two observed values, it is imputed by linear interpolation — that is, by assuming a constant absolute rate of change between the two observed endpoints (Figure 2).

Example: Economy A records private credit to GDP of 100 percent in 2000 and 150 percent in 2005, with no observations for 2001–2004. Linear interpolation implies an increase of 10 percentage points per year, so the missing observations are filled as 110, 120, 130, and 140 percent.

Figure 2. Illustration of linear interpolation of an internal data gap.



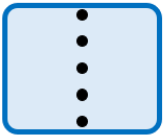
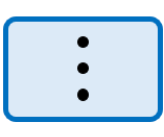
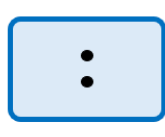
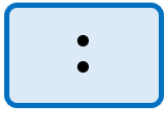
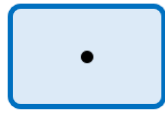
Note: The chart exemplifies the use of linear interpolation between observed endpoints to reconstruct missing values for the private credit-to-GDP ratio from 2001 to 2004. Reconstructed values (shown in blue) reflect an annual increase of 10 percentage points.

4b. Backfill of leading gaps and forward fill of trailing gaps. Missing observations before the first observed value and after the last observed value are reconstructed using a peer-growth procedure. For each target indicator, peer indicators are defined as the most closely related indicators within the same segment/dimension group (Figure 3). Annual peer-growth factors are calculated once, after linear interpolation and before any growth-based reconstruction, and are not recalculated using subsequently reconstructed values. If no usable peer-growth factor is available for a given economy-year, the observation is left as missing, subject to the carry-forward treatment for trailing gaps described below.

Example 1: Missing observations for Bank-Depth indicators are addressed using other available Bank-Depth indicators. If other Bank-Depth indicators are not available, then the value of the Bank-Depth indicator is left as missing.

Example 2: Missing observations for Equity Market-Efficiency indicators are addressed using other available Equity Market-Efficiency indicators.

Figure 3. Backfill and forward fill: computation of peer annual growth factors.

	Financial Institutions		Financial Markets	
	Banks	NBFIs	Equity Markets	Debt Markets
Depth				
Access				
Efficiency				

Note: The figure presents the information set and indicators used for imputation, referred to as “peers” because they belong to the same segment-dimension group, in contrast with broader information sets such as segment or pillar groups. Each dot in Figure 2 represents an indicator classified according to its dimension (Depth, Access, and Efficiency) and segment (Banks, NBFIs, Equity Markets, and Debt Markets). For the NBFIs segment, no suitable indicators were identified for the Access and Efficiency dimensions.

Below we summarize the steps followed to back fill and forward fill missing data for an indicator m for which information is missing at time t :

- a) Using only observed raw data and values obtained through linear interpolation — and excluding any values generated by the subsequent growth-based reconstruction — calculate the annual growth ratio of each eligible indicator k within the same relevant segment/dimension of indicator m .

For indicators where higher values indicate higher financial development, the backward growth factor is calculated as:

$$Growth\ Ratio_{c,k,t} = k_{c,t} / k_{c,t+1}$$

where c stands for an economy, t refers to the year, and k identify an indicator in the same segment-dimension group of indicator m . For indicators where lower values indicate higher financial development (i.e., bank net interest margin, bank cost to income ratio, and quoted bid-ask spreads on 5-year government bonds), the factor is direction-aligned as:

$$Growth\ Ratio_{c,k,t} = k_{c,t+1} / k_{c,t}$$

This ensures that annual changes are expressed in a common higher-is-better orientation before peer growth factors are combined.

Example: Consider a country whose bank cost-to-income ratio increases from 50 percent in 2010 to 60 percent in 2011. This change represents a deterioration in financial intermediation efficiency. The raw backward ratio is 50/60, or approximately 0.833. Because a lower cost-to-income ratio indicates better performance, the ratio is directionally aligned by taking its inverse (60/50 = 1.2). A directional ratio greater than 1.0 consistently signals that 2010 represented better performance than 2011, matching the 'higher-is-better' orientation applied across all indicators.

- b) After direction alignment, cap each growth ratio at [0.80, 1.25], binding out-of-range values to the nearest boundary. These bounds are reciprocal ($0.80 = 1/1.25$), so the same proportional change is treated symmetrically when viewed in opposite directions.

Example: If an indicator takes values of 100 and 125 in two consecutive years, the backward factor is $100/125=0.80$; reversing the values gives $125/100=1.25$.

- c) For each economy-year, we take the geometric mean of all available direction-aligned and truncated growth factors in the same segment-dimension group of indicator m :

$$GM_{c,m,t} = \exp\left(\frac{1}{n} \sum_{k=1}^n \ln(\text{Growth Ratio}_{c,k,t})\right)$$

where n is the number of available growth ratios in the segment-dimension of target indicator m .

- d) For a missing value of target indicator m in economy c at time t , multiply its value in $t+1$ by the geometric mean growth ratio from the applicable segment-dimension. For indicators where higher values indicate higher financial development:

$$m_{c,t} = m_{c,t+1} \times GM_{c,m,t}$$

For indicators where lower values indicate higher financial development:

$$m_{c,t} = m_{c,t+1} / GM_{c,m,t}$$

If peer-growth imputation does not provide a value for a remaining leading gap, the observation remains missing.

- e) Apply the same sequence in steps a) to d) in the opposite direction to fill trailing gaps after the last observed value. When moving forward, the preceding value is divided by the applicable average growth ratio. If peer-growth imputation does not provide a value for a remaining trailing gap, the nearest available or reconstructed value is carried forward for up to three years to retain recent information while limiting reliance on stale observations; any remaining trailing gaps are left missing.

All reconstructed values through the peer-growth reconstruction are subject to the indicator-specific domain constraints before being retained. Bank return on assets (ROA) is excluded from the peer-growth imputation since it can take both positive and negative values, for which multiplicative growth ratios are not well defined. It remains, however, subject to linear interpolation of internal gaps and to a final carry forward of up to three years.

Example: Hypothetical illustration of imputing missing observations

Imagine an economy only has a single observation for private credit to GDP for 2016, a Bank-Depth indicator, as shown in column B of Table 4. The objective is to impute the missing observations in 2015, 2017, and 2018 using the methodology described in step 4 – missing data treatment. Column C shows the methodological details, Column D displays, where relevant, the associated growth factors, and Column E describes the calculation. Column F displays the imputed values. In this example, there was no available data from other eligible

indicators in 2018. Hence simple carry forward is used of the most recent imputed value for 2017 (Table 4).

Table 4. Illustrative data imputation process

Year (A)	Original value (B)	Method (C)	Growth factor (D)	Calculation (E)	Imputed value (F)
2015	-	Peer-growth backfill	0.95	2016 value $\times$ 0.95	85.50
2016	90.00	Observed	-	-	90.00
2017	-	Peer-growth forward fill	0.90	2016 value $\div$ 0.90	100.00
2018	-	Carry forward	-	Use 2017 reconstructed value	100.00

5.3 Winsorization and Normalization

Following imputation, each indicator is winsorized to reduce the influence of outliers and then normalized using a min-max transformation.

Step 5. Winsorization. For each indicator k , values are winsorized at the 5th and 95th percentiles using the pooled distribution across all countries c and years t . As new observations accumulate over time, particularly at the tails of the distribution, these bounds should be periodically revisited, since a meaningful shift in the pooled distribution's boundaries could alter which values are treated as outliers under the current thresholds.

Step 6. Min-Max Normalization. Each winsorized indicator is transformed by min-max normalization to a 0-1 scale using its minimum and maximum values across the pooled sample of all economies and years. For indicators where lower raw values indicate higher financial development, the normalized value is inverted so that, for every indicator, larger values consistently indicate higher financial development.

Example: The Private Credit to GDP index will have higher values for higher Private Credit to GDP values because that typically indicates higher levels of financial development. In contrast, the Bank Net-Interest Margin index will have lower values for higher net-interest margins, since higher margins typically reflect lower levels of financial development.

Table 5. Cases where data is missing in the FinData construction methodology

Rule / Condition	What Remains Missing	Rationale
Economy is not a World Bank member country (with the exception of Hong Kong SAR, China and Taiwan, China)	The entire economy is excluded from the sample (e.g., Bermuda, Puerto Rico — see Table 2)	Non-member economies fall outside the scope of World Bank income classifications
Fewer than 25% of economy-year observations across all core FinData indicators are non-missing over 2015–2024	The entire economy is excluded from index computation (44 of 191 economies — see Table 3)	Prevents indices from being driven disproportionately by sparse data and heavy imputation
Peer-growth imputation fails to yield a usable growth factor for a leading gap	Value is left as missing; if no later value exists at all, it remains missing	Growth-based reconstruction requires at least one adjacent data point in the series
Peer-growth imputation fails to yield a usable growth factor for a trailing gap	Value is filled only via simple carry forward up for a maximum of three years; if no earlier value exists at all, it remains missing	Same as above, applied in the forward direction
Bank Return on Assets (ROA) indicator has an internal or trailing gap	ROA is excluded from peer-growth imputation (multiplicative ratios undefined for signed values); it is only filled via linear interpolation of internal gaps or carry forward	ROA can be positive or negative, so growth ratios are not mathematically well-defined
Access and Efficiency for the NBFi segment	No indicators exist to populate these segment-dimension cells at all (shaded in white in Figure 3)	No suitable indicators were identified for these combinations

5.4 Computation of the Segment-Dimension indices

Step 7. Initial computation of the Segment-Dimension indices. Within each economy-year, the available normalized indicators in a Segment-Dimension cell are averaged to form the corresponding Segment-Dimension index. If information is not available on any of the relevant indicators, the segment-dimension index is left missing. This produces 10 Segment-Dimension indices: three for Banks, one for NBFIs, three for Equity Markets, and three for Debt Markets. Each resulting Segment-Dimension index is then itself min-max normalized across the pooled economy-year distribution to a 0-1 scale.

Table 6. Segment-dimension indices

Segments	Dimensions for which an index is constructed
Banks	Depth; Access; Efficiency
NBFIs	Depth
Equity Markets	Depth; Access; Efficiency
Debt Markets	Depth; Access; Efficiency

The number of underlying indicators contributing to a Segment-Dimension index can differ across economies since the available source data can differ.

Example: One economy may have all five underlying bank-access indicators available, while another economy may have only one. In both cases, the Bank-Access index is the simple average of the normalized indicators that are available.

5.5 Higher-level aggregation and indices outputs

Once the foundational Segment-Dimension indices are fully constructed and min-max normalized—with missing values handled according to the rules detailed in Steps 4 through 7—they serve as building blocks for higher-level aggregation. Building on these normalized values, this section outlines the final stage of index construction: combining lower-level indices upward to generate the core set of composite financial development measures.

Step 8. Hierarchical aggregation using simple averaging of lower-level indices. The objective is to create 16 main financial development indices, expressed on a 0-100 scale and clustered into three conceptually distinct groups (see Table 7). As visualized in Figure 3, higher-level indices are calculated by taking simple averages across the available indices that sit one level below. Higher-level indices are not re-normalized after aggregation, preserving a transparent aggregation structure in which each higher-level index can be directly interpreted as the equal-weight average of its available lower-level components. This use of linear aggregation with equal weights is consistent with common practice in the construction of composite indicators and keeps the weighting structure transparent (OECD/European Union/EC-JRC, 2008).

If information on all underlying sub-indices is missing, the higher-level index is not computed. Otherwise, the index is calculated using the average of all available sub-components at that level.

Table 7. Composition of the main financial sector development indices

Panel A: Overall Financial Development and derivative indices

Index	Computation
Overall Financial Development (OFD)	Average of Financial Institutions and Financial Markets indices
Financial Institutions (FI)	Average of FI-Depth, FI-Access, and FI-Efficiency indices
Financial Markets (FM)	Average of FM-Depth, FM-Access, and FM-Efficiency indices
Financial Institutions-Depth	Average of Bank-Depth and NBFI-Depth indices
Financial Institutions-Access	Equal to Bank-Access index (because NBFI-Access is currently missing)
Financial Institutions-Efficiency	Equal to Bank-Efficiency index (because NBFI-Efficiency is currently missing)
Financial Markets-Depth	Average of Equity Markets-Depth and Debt Markets-Depth indices
Financial Markets-Access	Average of Equity Markets-Access and Debt Markets-Access indices

Index	Computation
Financial Markets-Efficiency	Average of Equity Markets-Efficiency and Debt Markets-Efficiency indices

Panel B: Financial Segment indices

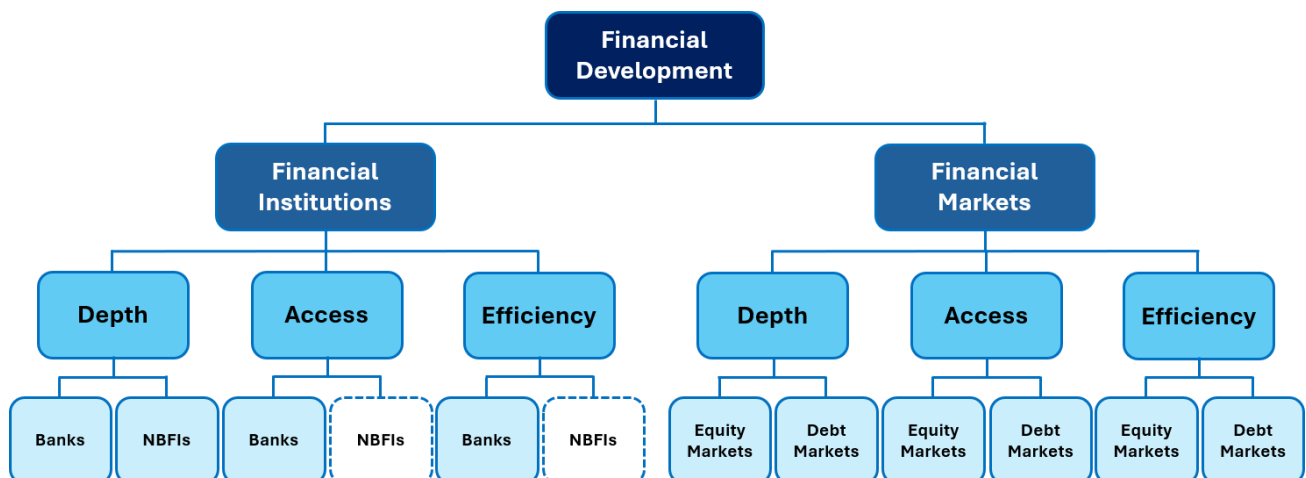
Index	Computation
Banks	Average of Bank-Depth, Bank-Access, and Bank-Efficiency indices
NBFIs	Equal to NBFI-Depth index
Equity Markets	Average of Equity Markets-Depth, Equity Markets-Access, and Equity Markets-Efficiency indices
Debt Markets	Average of Debt Markets-Depth, Debt Markets-Access, and Debt Markets-Efficiency indices

Panel C: Financial Dimension indices

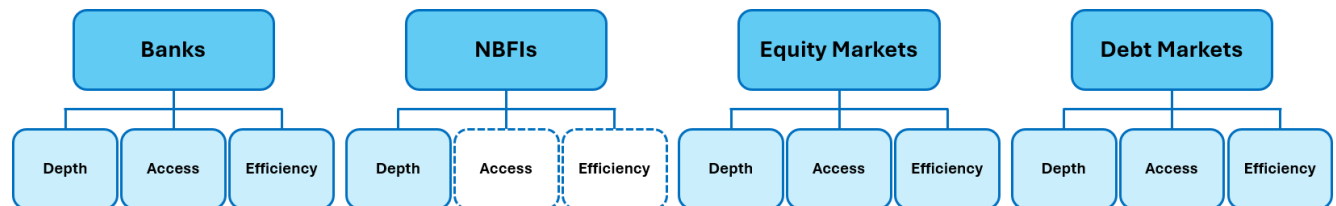
Index	Computation
Depth	Average of Bank-Depth, NBFI-Depth, Equity Markets-Depth, and Debt Markets-Depth indices
Access	Average of Bank-Access, Equity Markets-Access, and Debt Markets-Access indices
Efficiency	Average of Bank-Efficiency, Equity Markets-Efficiency, and Debt Markets-Efficiency indices

Figure 4. Aggregation structure

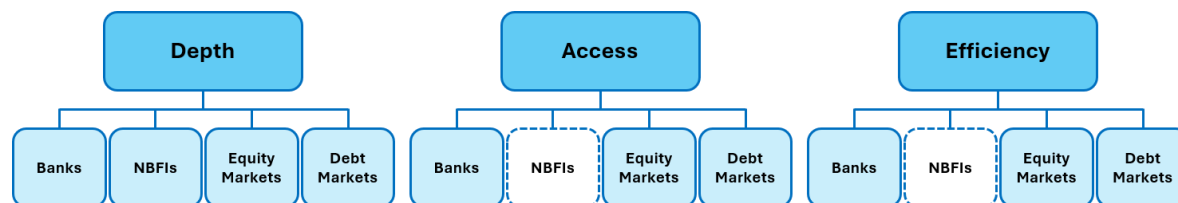
Panel A: Main indices



Panel B: Standalone segment indices



Panel C: Standalone dimension indices



Note: The figures present the aggregation hierarchy for the main indices (Panel A), standalone segment indices (Panel B), and standalone dimension indices (Panel C). Dotted in white appear the components for which no suitable core indicators are available. Stability indicators are excluded from aggregation.

6 Sensitivity analyses

To assess the sensitivity of the financial development indices to methodological choices, we compare five progressively more comprehensive treatments of missing data and one alternative normalization specification. *S1* uses raw data only; *S2* adds linear interpolation of internal gaps; *S3* additionally applies peer-growth reconstruction using information from other indicators within the same segment-dimension groups; *S4* further allows the last available or reconstructed observation to be carried forward for up to three years; and *S5* adds a segment-dimension completion treatment: when two of the three Depth, Access, and Efficiency indices within a segment are available, the missing third is proxied by their average; when only one or none are available, the remaining missing indices are assigned a normalized value of zero, under an assumption of absent or negligible underlying financial activity. Finally, *S6* retains the missing-data treatment of *S4* but replaces min-max normalization with percentile-rank normalization. These specifications allow us to assess the incremental effect of alternative missing-data treatments and the sensitivity of the results to the choice of normalization method. Such sensitivity analysis is particularly

relevant for composite indices, as both missing-data treatment and normalization can affect index values.

Table 8. Alternative approaches to missing data imputation

Specification	Linear Interpolation	Peer-Growth Reconstruction	Carry-Forward (≤ 3 yrs)	Segment-Dimension Completion	Normalization
S1 — Raw data	X	X	X	X	Min-max
S2 — Interpolation	✓	X	X	X	Min-max
S3 — Peer-growth	✓	✓	X	X	Min-max
S4 — Carry-forward (selected)	✓	✓	✓	X	Min-max
S5 — Segment-dimension completion	✓	✓	✓	✓	Min-max
S6 — Percentile-rank normalization	✓	✓	✓	X	Percentile-rank

Note: Each specification adds incrementally to the previous missing-data treatment (S1–S5), except S6, which retains the S4 treatment while varying the normalization method. Segment-dimension completion (S5): if two of three dimension indices (Depth, Access, Efficiency) are available within a segment, the missing third is proxied by their average; if only one or none are available, remaining missing indices are assigned a normalized value of zero.

We do not test principal component analysis (PCA)-based weighting. Although other composite indices use PCA-derived weights (e.g., Svirydzenka, 2016), our framework intentionally retains missing observations and aggregates available components. PCA would therefore require an additional choice about the estimation sample and would generate weights that may change as that sample evolves. We instead retain transparent equal weights throughout aggregation.

We assess each specification along two broad dimensions. External plausibility is measured by the association of the indices with GDP per capita and the Human Development Index (HDI). Temporal stability is assessed using the persistence of economy rankings from year to year, the typical absolute change in rank, and the retention of economies in the top and bottom 25 positions. The comparison below focuses on the Overall Financial Development (OFD), Financial Institutions (FI), and Financial Markets (FM) indices, while the same checks are implemented for the broader set of aggregate indices. The underlying checks calculate annual Spearman correlation using matched economy samples and construct annual index rankings before comparing adjacent years.

The results in Table 9 show that moving beyond raw data materially improves the external plausibility and, particularly, the temporal stability of the indices. Linear interpolation substantially improves results relative to the raw-data specification, while peer-growth reconstruction provides further gains in ranking stability. Adding LOCF under S4 generally yields additional improvement while retaining a relatively parsimonious treatment of missing observations. S5 increases coverage and produces modest further improvements in several

diagnostics but introduces the stronger assumption that unresolved segment-dimension values may be proxied or assigned zero as an indication of absent or negligible financial activity. The alternative percentile-rank normalization in S6 produces mixed results relative to S4: external correlations increase for OFD but are broadly unchanged or lower for FI and FM, while several measures of temporal stability deteriorate, particularly for FI and FM. These diagnostics are not treated as optimization criteria: higher correlations or greater rank stability do not by themselves imply a more appropriate methodology. Rather, they are considered jointly with coverage, transparency, interpretability, and the strength of the assumptions required. On balance, S4 is selected as the preferred specification, with S5 retained as an alternative missing-data sensitivity and S6 as a normalization sensitivity.

Table 9. External plausibility and temporal stability

Index	Specification	Mean GDP per capita correlation	Mean HDI correlation	Mean year-to-year rank correlation	Mean median absolute move	Mean top-25 retention (percent)	Mean bottom-25 retention (percent)
OFD	S1: Raw	0.67	0.67	0.86	8.3	89	60
OFD	S2: Interp	0.72	0.72	0.95	4.8	93	77
OFD	S3: Interp + peer-growth	0.72	0.72	0.96	4.3	93	79
OFD	S4: Interp + peer-growth + LOCF	0.73	0.73	0.96	4.3	94	80
OFD	S5: Interp + peer-growth + LOCF + proxy/zero treatment	0.77	0.79	0.97	3.8	94	81
OFD	S6: Interp + peer-growth + LOCF (percentile-rank)	0.76	0.75	0.96	5.3	89	81
FI	S1: Raw	0.63	0.63	0.82	11.5	76	61
FI	S2: Interp	0.69	0.69	0.93	5.9	85	78
FI	S3: Interp + peer-growth	0.70	0.71	0.95	5.2	89	79
FI	S4: Interp + peer-growth + LOCF	0.71	0.71	0.96	5.0	89	79
FI	S5: Interp + peer-growth + LOCF + proxy/zero treatment	0.71	0.72	0.96	4.7	90	80
FI	S6: Interp + peer-growth + LOCF (percentile-rank)	0.71	0.69	0.94	6.3	83	78
FM	S1: Raw	0.71	0.73	0.93	5.3	87	64
FM	S2: Interp	0.73	0.74	0.96	4.4	91	81
FM	S3: Interp + peer-growth	0.72	0.73	0.97	3.9	93	83
FM	S4: Interp + peer-growth + LOCF	0.72	0.73	0.97	3.8	93	84
FM	S5: Interp + peer-growth + LOCF + proxy/zero treatment	0.74	0.77	0.98	3.3	93	89
FM	S6: Interp + peer-growth + LOCF (percentile-rank)	0.68	0.68	0.96	4.9	90	80

Note: *Interp* denotes linear interpolation of internal gaps; *peer-growth* denotes growth-based reconstruction using other eligible indicators within the same segment-dimension group; *LOCF* denotes last observation carried forward for up to three years; *proxy/zero treatment* denotes the segment-dimension proxy and residual zero-assignment procedure; and *percentile-rank* denotes percentile-rank rather than min-max normalization, while retaining the S4 missing-data treatment. GDP per capita is measured at PPP in constant 2021 international dollars from the World Bank's World Development Indicators, and HDI is from UNDP. Reported GDP per capita and HDI correlation are mean annual Spearman rank correlations, calculated using the matched economy sample available in each year. Mean year-to-year rank correlation is the average Spearman correlation between adjacent-year index rankings; mean median absolute rank change summarizes the typical year-to-year movement in rank; and top- and bottom-25 retention measure the share of economies remaining in the corresponding group from one year to the next. Years with fewer than 50 matched economies are excluded from correlation and rank-movement summaries.

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