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Developing a Multidimensional Financial Inclusion Index: A Comparison Based on Income Groups

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Abstract: The aim of our paper is to construct a multidimensional financial inclusion (FI) index to measure the level of FI in 91 countries across different income groups. In order to address our research problem, we use the principal component analysis method. This approach addresses the criticism of the arbitrary selection of weights and reflects the degree of financial inclusion in depth. The data are drawn from the International Monetary Fund (IMF) Financial Access Survey (FAS), the World Development Indicators (World Bank) and the Global Findex Database during the period of 2004–2020. This paper is the first to consider so many indicators of financial inclusion (13 indicators), belonging to three different dimensions of FI, in order to take into account the maximum number of aspects related to this concept. In addition, unlike previous work, this paper considers both developing and developed countries, which makes it possible to identify differences between them. The proposed index has some advantages. First, it is robust, comparable across countries and has good predictive power in tracking household microeconomic indicators (accounts and savings). It is also well correlated with macroeconomic variables such as literacy rate, poverty, GINI index, real interest rate and employers. Second, our results clearly show that, as a country's income level grows higher, its level of financial inclusion also grows higher.

Keywords: financial inclusion; income level; multidimensional index; principal component analysis

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1. Introduction

> "The test of our progress is not whether we add more to the abundance of those who have much; it is whether we provide enough for those who have too little".
> *Franklin D. Roosevelt*

Because financial exclusion has been identified as a major obstacle to development around the world, governments have made banking services a priority to achieve financial inclusion (FI) (Demirguc-Kunt et al. 2015). The concept of FI emerged at the end of the 20th century, with the aim of making financial services accessible to everyone in society. It reached its popularity in 2010 (Kabakova and Plaksenkov 2018). FI has received a lot of attention in recent years, as one of the seventeenth Sustainable Development Goals, and as a focus for some other goals, such as economic growth (Kithinji 2017; Cull et al. 2014), poverty reduction (Ozili 2020; Bruhn and Love 2014; Ayyagari et al. 2013), equality (Kempson and Collard 2012; The World Bank Annual Report 2008) and education (Jacoby 1994; Demirgüç-Kunt and Levine 2009) to achieve a better and sustainable world. FI is a primary objective for any financial system; it is highly interconnected with other objectives, namely financial stability (Ahamed and Mallick 2019; Siddik et al. 2018; Khan 2011); financial integrity (Financial Action Task Force 2011; Basel Committee on Banking Supervision 2016) and financial protection (Elsayed 2020; Tomilova and Valenzuela 2018). It is recognized as the ease of access to and use of various financial services for all members of the population.

FI refers to the various ways in which individuals and businesses have access to useful and affordable financial products and services that meet their needs, such as transactions, payments, savings, credit and insurance that are provided in a responsible and sustainable manner (The World Bank Annual Report 2008).

There is no consensus in the literature on how to measure financial inclusion, so the question of measurement is the subject of much debate among researchers, governments and policymakers. It is an abstract concept that cannot be directly measured quantitatively. However, it is supposed to be established by the interaction of a number of causal variables. The measurement of financial inclusion has primarily been addressed through the use of and access to formal financial services using aggregate supply-side data (Sarma 2008, 2012; Chakravarty and Pal 2010; Van et al. 2021), but few papers add demand-side data by focusing on individual indicators related to usage and barriers (Demirgüç-Kunt and Klapper 2012; Camara and Tuesta 2014; Avom et al. 2021). We contribute to the literature by using a newly constructed indicator of financial inclusion for 91 countries from different income groups during the period of 2004–2020. Our metric takes into account three dimensions of financial inclusion: availability, accessibility and use. The choice of these dimensions is motivated by the availability of data for many countries and recent developments in the literature. Moreover, these dimensions are considered to have a substantial and significant impact on financial sector inclusion, and they are highly correlated with each other (Ahamed and Mallick 2019). We only deal with data on banks, which is explained by the fact that banks are the point of access to the most basic forms of financial services. In addition, banking inclusion/exclusion is often used as an analog for financial inclusion/exclusion. In fact, according to Leeladhar (2006), "financial inclusion is the provision of affordable banking services to low-income and disadvantaged groups as banking services are in the nature of a public good, it is essential that the availability of banking and payment services to the entire population without any discrimination is the main objective of any public policy". Likewise, the banking sector has played a leading role in promoting financial inclusion (Sarma and Pais 2011).

There are several important aspects to measuring financial inclusion in a multidimensional way. First, an assessment that aggregates multiple indicators into a single index helps to summarize the complex nature of financial inclusion and track its evolution. Second, a good measure of financial inclusion allows us to examine its relationship with other macroeconomic variables of interest. Third, information by dimension helps to better understand the problem of financial inclusion. It can be a useful tool for designing and evaluating development policies.

The implication of our study is that low-income people, the illiterate and the unemployed are not benefiting proportionately from financial inclusion, which is a serious problem. Financial inclusion efforts should therefore be targeted at the most vulnerable in society. In general, without an inclusive financial system, low-income households continue to use their own limited and traditional savings to finance their livelihoods and businesses, deepening inequality and hampering economic growth. Thus, the role of financial inclusion in addressing marginalization can be seen as an opportunity for poor, low-income households that are underserved or financially excluded.

The remainder of this paper is organized as follows. A brief overview of the literature is presented in Section 2. Section 3 describes our research methodology. Section 4 presents the obtained results. Finally, there is a synthetic conclusion highlighting the main findings and policy implications for the countries under study.

2. Prior Literature

Financial inclusion (*FI*) is not only important but also an overarching goal of the highest priority in the world. It has become the focus of economic policies around the world. As mentioned by Sarma (2016), measurement is the first step toward raising awareness about financial inclusion. Indeed, measuring *FI* is necessary to examine the impact of different stakeholder initiatives and to determine future courses of action (Nguyen 2020). *FI* is a

multidimensional measure of the extent of inclusiveness of a given country's financial sector. To date, there is no common and consistent method for measuring the level of *FI* in a country or economy, but there have been several institutional (World Bank, Central banks, ministries, banks, insurance companies, microfinance institutions, Bill and Melinda Gates Foundation and Gallup World Poll) and academic attempts to measure this factor.

A review of the literature reveals two approaches to measuring financial inclusion:

(1). Non-parametric methods assign importance to indicators by selecting weights exogenously, based on the researchers' intuition. Indices have been shown to be sensitive to the subjective assignment of weights, as a simple change in weights can dramatically alter the results. The most popular example of using this method is that of Sarma (2008, 2012).

(2). Parametric methods are based on the premise that there is a latent structure behind the variation in a set of correlated indicators so that the importance of the indicators (weights) in the overall index can be determined endogenously by the covariation between the indicators on each dimension of the structure. There are two commonly used parametric techniques: principal component analysis (PCA) and Common Factor Analysis. Furthermore, there are global databases such as the Financial Access Survey (FAS—IMF) and the Global Findex Survey (Findex—World Bank) that measure financial inclusion using different types of financial access indicators, such as the number of bank branches, the number of ATMs, the number of deposit accounts, and outstanding deposits or loans. From these databases, it is possible to construct a composite index called the "*FI* Index" that measures the degree of financial inclusion. Several studies have followed this approach to measure the level of financial inclusion (Gupte et al. 2012; Park and Mercado 2015; Nguyen 2020; Jungo et al. 2022).

The literature review shows that efforts have been made to develop a composite index to measure the level of financial inclusion. Each approach to developing the IF index has its advantages and disadvantages. As a result, there is no consensus on how to measure the level of financial inclusion. Indeed, studies differ not only in their approach, but also in the indicators selected to calculate the *FI* index. Table 1 classifies previous work on the development of a financial inclusion index according to the used measurement approach.

Table 1. Classification of previous work.

Measurement Methods	Author(s)	Dimensions	Measures
Principal component analysis	Jungo et al. (2022)	Access	- Commercial banks per 1000 km^2 - Commercial banks per 100,000 adults - ATMs per 1000 km^2 - ATMs per 100,000 adults
		Usage	- Depositors in commercial banks per 100,000 adults - Deposit accounts in commercial banks per 100,000 adults - Borrowers in commercial banks per 100,000 adults - Demand deposits in commercial banks as a percentage of GDP
Principal component analysis	Nguyen (2020)	Availability	- Branches - ATMs - Mobile money agents
		Access	- Deposit accounts - Mobile money accounts
		Usage	- Deposits - Loans - Mobile money transactions

Table 1. *Cont.*

Measurement Methods	Author(s)	Dimensions	Measures
Principal component analysis	Avom et al. (2021)	Availability	- Proportion of adults with an account in a formal institution - Ownership of a bank card - Proportion of adults with a mobile account
		Access	- ATMs per 100,000 people - Commercial banks per 100,000 people - Number of commercial banks and ATMs per 1000 km^2
		Usage	- Saving in a formal institution - Withdrawals and loans from a formal financial institution - Use of digital payments - Life and non-life insurance policies
Three panel cointegration methods: the mean group (MG) estimator; the fixed-effects (FE) approach of the generalized method of moments; and the pooled mean group (PMG) estimator	Huang and Zhang (2019)	Availability	- Number of bank employees and bank branches per 10,000 members of the population
		Access	- Number of bank employees and bank branches per 10,000 km^2
		Usage	- Deposits and credit per capita relative to GDP per capita
Sarma's methodology (Sarma 2008)	Park and Mercado (2015, 2018)	Availability	- ATMs per 100,000 adults - Commercial bank branches per 100,000 adults
		Usage	- Commercial bank borrowers per 1000 adults - Commercial bank depositors per 1000 adults - Household credit/GDP ratio
Principal component analysis	Camara and Tuesta (2014)	Access	- ATMs and commercial bank branches per 100,000 adults - ATMs and commercial bank branches per 1000 km^2
		Usage	- Accounts - Loans - Savings
		Barriers	- Distance - Affordability - Documentation - Lack of trust
Combining the approaches of Sarma (2008) and Park and Mercado (2015)	Van et al. (2021)	Availability	- Number of commercial bank branches and ATMs per 100,000 adults
		Usage	- Ratio of bank credit of the private sector to GDP
Multidimensional approach of dimensions similar to the implemented human development index	Sarma (2008, 2012, 2015, 2016)	Availability	- Number of bank branches and ATMs per 100,000 adults
		Access	- Number of bank deposit accounts per 1000 adults
		Usage	- Volume of credit and deposits to adults as a proportion of GDP

Source: Elaborated by authors.

3. Materials and Methods

3.1. Sample and Data Sources

Our sample is limited to 91 developed and less-developed countries (the list is given in Table A1 in Appendix A), over the period from 2004 to 2020. It is a sample observed over 17 years (i.e., a total of 91 × 17 = 1547 observations) in order to ensure the most complete and consistent collection of data on representative variables over time.

We use annual data collected from the International Monetary Fund's (IMF) Financial Access Survey (FAS); Global Findex Database; and the World Bank Group's World Development Indicators database. Thus, the ability to calculate combined or composite measures of financial inclusion using survey data has several advantages, including global coverage and cross-country comparisons (Van et al. 2021).

3.2. Definitions and Measures of Variables

We develop a multidimensional *FI* index based on three dimensions: availability, access (financial services penetration) and usage.

(1) Availability is used to account for the widespread presence of the financial sector in terms of physical bank outlets, as distance to the physical point of financial services is considered a barrier to financial inclusion (Allen et al. 2014). Therefore, following Sarma (2016), who states that in an inclusive financial system, banking transaction points such as offices, branches and ATMs must be readily available to users, we use measures of the demographic and geographic availability of physical branches and ATMs presented by the number of branches and ATMs per 100,000 adults and per 1000 km^2.

(2) Access refers to the ability to access financial services and products. An inclusive financial system should have as many users as possible, which means that it should be widely available to those who use it (Nguyen 2020). We use data on deposit and loan accounts and the number of credit and debit cards per 1000 adults.

Access remains biased in favor of those living in urban areas (Atellu 2021), and the ability of rural people to access global financial, trade and labor markets is generally very limited. Rural populations are outside the reach of the formal financial system, where they lack access to basic services such as savings accounts, credit transfers and insurance. Physical access to financial institutions is often hampered by long distances and the lack of infrastructure in rural areas. Thus, geographic access is one of the financial inclusion challenges that need to be addressed. In this context, we argue that being part of an urban population is a key determinant of access to financial services, and we add the geographical aspects of financial inclusion measured by urban population (% of total).

(3) Usage identifies how customers use financial services, in terms of the regularity and duration of the use of the financial product and service over time. This dimension is based on the concept of "underbanking", in which people who have a bank account make little use of the services offered (Kempson et al. 2006). This population undermines the inclusiveness of the financial system. Therefore, having a bank account is not enough for the system to be inclusive, but adequate and regular use of banking services is also essential (Sarma 2012). Therefore, we use outstanding loans (% of GDP), the number of bank depositors with commercial banks per 1000 adults and the number of bank borrowers with commercial banks per 1000 adults. We are very aware of the importance of this dimension to avoid the risk of obtaining a potentially unrepresentative index.

We use the parametric method and develop an index of FIs using the principal component analysis (PCA) method. The *FI* is a latent variable determined linearly, as follows:

$$FII_i = w_1 Y_i^{av} + w_2 Y_i^{ac} + w_3 Y_i^{u} + \varepsilon_i \quad (1)$$

where FII_i is the composite *FI* index of a country i; w_1, w_2 and w_3 present the relative weights of each dimension; Y^{av}, Y^{ac} and Y^{u} are the dimensions of availability, access and utilization, respectively; and ε_i denotes the error term. Table 2 below shows the variables used in this study. The dimensions are calculated as follows:

$$Y_i^{av} = \alpha_1 Bradlt_i + \alpha_2 ATMsadlt_i + \alpha_3 Brkmsq_i + \alpha_4 ATMskmsq_i + \varepsilon_i \quad (2)$$

$$Y_i^{ac} = \beta_1 depacct_i + \beta_2 loanacct_i + \beta_3 debcard_i + \beta_4 credcard_i + \beta_5 urban_i + \varepsilon_i \quad (3)$$

$$Y_i^{u} = \lambda_1 Ostdep_i + \lambda_2 Ostloan_i + \lambda_3 depositors_i + \lambda_4 borrowers_i + \varepsilon_i \quad (4)$$

This paper is the first to consider so many indicators of financial inclusion (13 indicators), belonging to 3 different dimensions of *FI*, in order to take into account the maximum number of aspects related to this concept. In addition, unlike previous work, this paper considers both developing and developed countries, which makes it possible to identify differences between them.

Table 2. Study variable definitions.

	Acronym	Definitions
Availability	*Bradlt*	Number of bank branches per 100,000 adults
	ATMsadlt	Number of automated teller machines (ATMs) per 100,000 adults
	BrKmsq	Number of bank branches per 1000 km^2
	ATMsKmsq	Number of ATMs per 1000 km^2
Access	*depacct*	Number of deposit accounts at commercial banks per 1000 adults
	loanacct	Number of loans accounts at commercial banks per 1000 adults
	debcard	Number of debit cards per 1000 adults
	credcard	Number of credit cards per 1000 adults
	Urban	Urban population as a percentage of the total population
Usage	*Ostdep*	Outstanding number of deposits with commercial banks as a % of GDP
	Ostloan	Outstanding loans from commercial banks as a percentage of GDP
	depositors	Number of depositors at commercial banks per 1000 adults
	borrowres	Number of borrowers at commercial banks per 1000 adults
	α, β, λ and ε_i	Parameters to be estimated and the error term

Source: Developed by authors.

4. Results and Discussion

4.1. PCA Application Conditions

Principal component analysis (PCA) is the most commonly used data extraction method in factor analysis. PCA synthesizes data by constructing a smaller number of variables called the "principal components".

First, we need to make sure that the items are minimally correlated with each other. The correlation matrix should be observed. If several variables are correlated, factoring is possible. If not, factoring is pointless and therefore not recommended. The correlation matrix for the causal variables is shown in Table 3.

Table 3. Correlation matrix.

	1	2	3	4	5	6	7	8	9	10	11	12	13
Brchkmsq	1.0000												
bradults	0.8419	1.0000											
ATMskmsq	0.9304	0.7200	1.0000										
ATMsadults	0.4262	0.6204	0.4513	1.0000									
depositors	0.2419	0.4332	0.2998	0.6396	1.0000								
depacct	0.2812	0.4588	0.3439	0.6454	0.8709	1.0000							
borrowers	0.2574	0.4629	0.3168	0.7131	0.6706	0.6938	1.0000						
loanacct	0.1829	0.3921	0.2275	0.6552	0.5147	0.6277	0.8103	1.0000					
Ostdep	0.4585	0.4295	0.4805	0.3199	0.2473	0.3533	0.3516	0.2877	1.0000				
Ostloan	0.2126	0.3098	0.2496	0.3779	0.2867	0.4408	0.4984	0.4534	0.8081	1.0000			
creditcards	0.1288	0.2095	0.1553	0.4907	0.3791	0.4147	0.5556	0.6016	0.0438	0.1359	1.0000		
debitcards	0.1609	0.3187	0.2496	0.6480	0.6332	0.7186	0.7099	0.7100	0.1393	0.2847	0.5839	1.0000	
Urban	0.2798	0.3012	0.2933	0.4957	0.3909	0.4232	0.5068	0.5390	0.3169	0.2949	0.4856	0.4701	1.0000

Source: Calculated by authors in STATA 15.

Reliability is the degree to which the used instruments consistently measure the construct under study (Pras et al. 2003). In our study, the Cronbach's alpha calculated for the 13-item scale (Table 4) is 0.8993 > 0.7. Therefore, the alpha value is good, indicating the reliability of the data.

Table 4. Data reliability statistics.

Average inter-item covariance	0.0090072
Number of items in the scale	13
Scale reliability coefficient	0.8993

Source: Calculated by authors in STATA 15.

In the second step, we test the KMO (Kaiser–Meyer–Olkin) index. Based on Table 5, the value of the KMO measure is 0.7903, which satisfies KMO > 0.5 (if this is not the case, factorization is not recommended) (Hair 2009). Therefore, the analysis factor is consistent with the data.

Table 5. KMO index.

Variable	KMO Index
Zbrchkm^2	0.6196
Zbrchadults	0.7338
ZATMskm^2	0.6973
ZATMsad	0.9243
Zdepositors	0.7420
Zdepaccts	0.7926
Zborrowers	0.8660
Zloanaccts	0.8301
Zoutsdepo	0.7605
Zoutstloans	0.7782
Zcreditcards	0.8644
Zdebcards	0.8177
Zurban	0.8816
Overall	**0.7903**

Source: Calculated by authors in STATA 15.

4.2. Results of the First Stage of PCA

Prior to PCA, the indicators for each dimension are normalized to take values of 0 and 1, so that the scale on which they are measured is irrelevant. In this case, 0 indicates financial exclusion, and 1 indicates *FI*.

$$Z_{variable} = \frac{(Actual\ value - Min)}{Max - Min} \quad (5)$$

As PCA produces "spurious" results for non-stationary variables (Casin et al. 2011), we assess the stationarity of the variables before proceeding with the analysis. Three different tests are applied: the augmented Dickey–Fuller (ADF) test, the Phillips–Perron (PP) test and the Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test.

Table 6 shows the results. For the ADF and PP tests, because the calculated *p*-value is lower than the significance level alpha = 0.05, we reject the null hypothesis H0 and retain the alternative hypothesis H1, so the series is stationary. For the KPSS test, as the *p*-value is higher than the significance level of 0.05, we accept the null hypothesis H0, so the variables are stationary. All variables are stationary in level, and only the variable "ZATMkmsq" is stationary in the first difference.

Table 6. Stationarity tests.

		Augmented Dickey–Fuller		Phillips–Perron		KPSS
		T-Statistic	***p*-Value**	**Adj. t-Stat**	**Prob.**	**LM-Stat**
Levels	*ZBradlt*	−5.269391	0.0000 ***	−7.589819	0.0000 ***	0.173505 ***
	ZATMsadlt	−5.548075	0.0000 ***	−6.617165	0.0000 ***	0.096288 **
	ZBrkmsq	−5.183138	0.0000 ***	−6.746831	0.0000 ***	0.250556 ***
	ZATMKmsq	−1.88891	0.3378	−3.918081	0.0020 ***	0.246573 ***
	Zdepaccts	−7.976820	0.0000 ***	−7.916892	0.0000 ***	0.096703 **
	Zloanaccts	−7.401598	0.0000 ***	−7.414708	0.0000 ***	0.332711 ***
	Zdebcards	−10.11128	0.0000 ***	−10.26076	0.0000 ***	0.139693 ***
	Zcredcards	−8.165019	0.0000 ***	−8.781089	0.0000 ***	0.092385 **
	Zurban	−6.610992	0.0000 ***	−8.304249	0.0000 ***	0.141241 ***
	Zostdeps	−6.998931	0.0000 ***	−7.582518	0.0000 ***	0.335466 ***
	Zostloans	−6.290706	0.0000 ***	−7.106409	0.0000 ***	0.274875 ***
	Zdepositors	−4.615369	0.0001 ***	−4.625274	0.0001 ***	0.180918 ***
	Zborrowres	−4.680450	0.0001 ***	−5.058596	0.0000 ***	0.071047 **
1st diff	*DZATMKmsq*	−33.26622	0.0000 ***	-	-	-

*** and ** denote a significance of 1% and 5%, respectively; Source: Calculated by authors in STATA 15.

Using the PCA method, we calculate the eigenvalues of each sub-index, and we estimate the following latent variables: availability (Y^{av}), access (Y^{ac}) and use (Y^{u}). The results of the first stage of PCA shown in Table 7 indicate that the eigenvalues of the principal components for the three dimensions are 2.65, 0.69, 0.58 and 0.07 (for availability); 3.24, 0.78, 0.52, 0.25 and 0.20 (for accessibility); and 2.57, 0.92, 0.32 and 0.18 (for use). The determination of the factors is based on the Kaiser criteria, i.e., factors with an eigenvalue greater than 1 are included as the dominant indicator. In this case, with the exception of the first three principal components (PC) of the three dimensions, no other PC has an eigenvalue greater than 1. Thus, the first three components with eigenvalues of 2.65, 3.24 and 2.57 are considered for the analysis. The weights obtained from the PCA are assigned to the first principal component of each dimension. Then, the dimensions of availability, access and use are estimated.

Table 7. Principal component estimates for sub-indices.

Component	Eigenvalue	Difference	Proportion	Cumulative
		Availability—Estimate Y^{av}		
Comp1	2.65242	1.96284	0.6631	0.6631
Comp2	0.689578	0.10835	0.1724	0.8355
Comp3	0.581226	0.50445	0.1453	0.9808
Comp4	0.076776	.	0.0192	1.0000
		Accessibility—Estimate Y^{ac}		
Comp1	3.23939	2.45449	0.6479	0.6479
Comp2	0.78489	0.260911	0.1570	0.8049
Comp3	0.52398	0.27444	0.1048	0.9097
Comp4	0.24954	0.047335	0.0499	0.9596
Comp5	0.202205	.	0.0404	1.0000
		Usage—Estimate Y^{u}		
Comp1	2.57587	1.65649	0.6440	0.6440
Comp2	0.919381	0.596009	0.2298	0.8738
Comp3	0.323372	0.141992	0.0808	0.9547
Comp4	0.18138	.	0.0453	1.0000

Source: Calculated by authors in STATA 15.

Except for the first three PCs, none of the others have an eigenvalue greater than 1. According to Kaiser (1960), the highest eigenvalue of the components retains more normalized variance among the others, and an eigenvalue greater than 1 is considered for the analysis.

Therefore, in our analysis, we keep only the first three components and estimate the dimensions based on the weights assigned to these PCs.

4.3. Results of the Second Stage of PCA

In the second step, we apply the same procedure as described in the first step, i.e., the PCA method, to the three sub-indices in order to calculate their weights in the overall *FI* index. The eigenvalues of the three PCs in Table 8 are 1.82, 0.61 and 0.55, respectively. This shows that only the first component has an eigenvalue greater than 1, so we simply take it to find the weights assigned to the PCs.

Table 8. Principal component estimates for the overall IF index.

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1	1.82752	1.20887	0.6092	0.6092
Comp2	0.618649	0.0648187	0.2062	0.8154
Comp3	0.55383		0.1846	1.0000

Source: Calculated by authors in STATA 15.

Regarding the structure of the principal components, we observe that the first component, which accounts for 60.9% of the total variation in the data, is fed by all three dimensions. This indicates that the three dimensions measuring the same latent structure are taken as the *FI* level.

The total variance that is extracted is 60.92%. This shows that only 39.08% of the variation is lost; so, it is a good extraction. It is able to save on the number of factors selected, i.e., out of three factors, there is one factor with an eigenvalue greater than 1, and we keep it to construct our financial inclusion index.

In order to adequately check the number of components to be retained, we use the Scree diagram proposed by Cattell (1966). In Figure 1 below, we retain the components associated with the high part of the scree diagram and drop the components associated with the low, flat part of the scree diagram. Thus, we select only the first principal component.

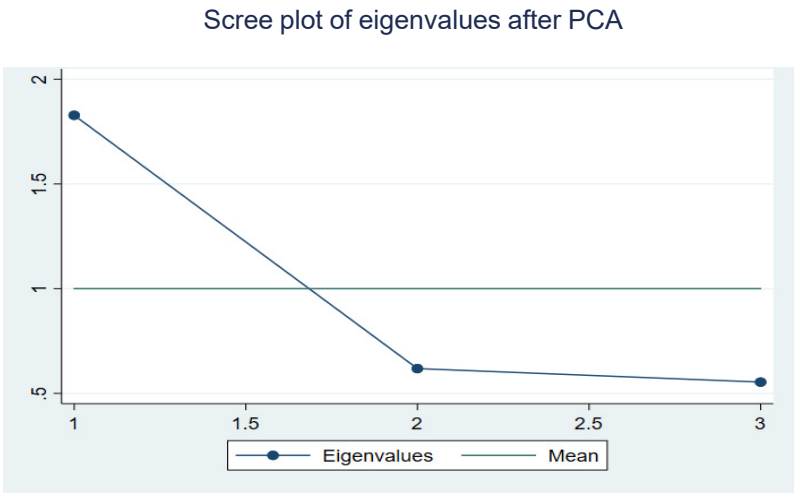

Figure 1. Eigen value graph after PCA. Source: Drawn by the authors on STATA 15.

Table 9 indicates that the KMO value (0.6636) satisfies KMO > 0.5 (Hair 2009). As a result, the analysis factor is consistent with the data.

Table 9. KMO test (second step of PCA).

Variable	KMO Index
Zavailability	0.6474
Zaccessibility	0.6638
Zusage	0.6830
Overall	**0.6636**

Source: Calculated by authors in STATA 15.

Following the method used in the first step, we also calculate the weights for the three dimensions. Table 10 shows that PCA assigns the highest weight to availability (0.5903), followed by accessibility with a weight of 0.5772 and use with 0.5642. Thus, the overall *FI* index is a combination of the three dimensions.

Table 10. Scoring coefficients (weights assigned to zY^{av}, zY^{ac} and zY^{u}).

Variable	Comp1
Zavailability	0.5903
Zaccessibility	0.5772
Zusage	0.5642

Source: Calculated by authors in STATA 15.

We construct our multidimensional index using the weights of each dimension derived from the principal component analysis:

$$FII_i = 0.590Y_i^{av} + 0.577Y_i^{ac} + 0.564Y_i^{u} + \varepsilon_i \quad (6)$$

Equation (6) indicates that the Financial Inclusion Index (*FII*) has a slightly higher weight on the availability dimension, making the availability of financial services the most important dimension contributing to the construction of the overall financial inclusion index of financial inclusion in the studied countries. All three dimensions are mandatory, and each of them alone is not sufficient to determine the inclusiveness of the financial system. In this way, we estimate the overall *FI* index for our sample. Due to the lack of comprehensive data on financial inclusion, we take advantage of available data and use a seventeen-year average (from 2004 to 2020) to calculate our financial inclusion index. In order to make analysis and interpretation easier, we further normalize this index assigned to each country on a scale of 0 to 1, where 0 indicates complete financial exclusion and 1 indicates complete financial inclusion in an economy. As the number comes closer to 1, the level of financial inclusion becomes higher, and vice versa. An index is therefore calculated for each country, as follows:

$$d_i = \frac{A_i - m_i}{M_i - m_i} \quad (7)$$

where A_i = actual index value for country i; m_i = lower bound for the index, given by the observed minimum for the country set; and M_i = upper bound for the index, given by the last empirical quantile for the country set.

The different measures of *FI* in the literature have different variables, and each step in the measurement has a different method, which can affect the result. Therefore, it is not surprising that an *FI* index differs from one study to another. The results of the country rankings by *FI* index in Table 11 show that the economies with the highest level of *FI* among the countries in the sample are San Marino and Japan, whereas the lowest is Madagascar. It is clear that, as the income level of the country becomes higher, the level of financial inclusion also becomes higher. Thus, in line with our expectations, countries in the high-income group and the upper-middle-income group have the most inclusive financial systems. Low- and lower-middle-income countries generally have gaps

in financial development and financial inclusion compared to other countries. In this context, it is important to pursue financial inclusion policies as a national strategy in each country to share prosperity.

Table 11. Estimation of the *FI* index.

Countries	FIIndex	Ranks	Countries	FIIndex	Ranks
San Marino	0.51712754	1	Trinidad and Tobago	0.17707082	47
Japan	0.50633249	2	Suriname	0.17267126	48
Malta	0.4011762	3	Republic of Kosova	0.16972084	49
Poland	0.36079909	4	Philippines	0.16956373	50
Republic of Korea	0.3607197	5	El Salvador	0.16826297	51
Spain	0.35807149	6	Dominican Republic	0.16805977	52
Belgium	0.32684518	7	Jamaica	0.16413421	53
Estonia	0.31840065	8	Jordan	0.16389441	54
Portugal	0.3150422	9	Honduras	0.16361695	55
Italy	0.30004884	10	Bolivia	0.16278091	56
Lebanon	0.29977184	11	West Bank and Gaza	0.16246099	57
The Netherlands	0.28214496	12	Peru	0.16228444	58
Croatia	0.2762500	13	Namibia	0.15579956	59
Cyprus	0.27401804	14	Mozambique	0.1546327	60
Turkey	0.2631012	15	Indonesia	0.14936201	61
Iceland	0.26175415	16	Nepal	0.14759658	62
Bulgaria	0.25818204	17	Botswana	0.14423108	63
Brunei Darussalam	0.25547694	18	Azerbaijan	0.14314418	64
Costa Rica	0.25171711	19	India	0.14054968	65
China: Mainland	0.25097494	20	Lao People's Democratic Republic	0.14009326	66
Chile	0.25089021	21	Paraguay	0.13942224	67
Greece	0.25040516	22	Kenya	0.13610072	68
Latvia	0.24859421	23	Nicaragua	0.13436375	69
Malaysia	0.24839941	24	Ghana	0.13204394	70
Mauritius	0.24659766	25	Samoa	0.13131248	71
United Arab Emirates	0.24266296	26	Ecuador	0.13103669	72
Seychelles	0.2416201	27	Egypt	0.1264063	73
Thailand	0.24125155	28	Bangladesh	0.1151103	74
Brazil	0.22401967	29	Tajikistan	0.11341355	75
North Macedonia	0.22296472	30	Cambodia	0.11300767	76
Hungary	0.21935949	31	Chad	0.08407547	77
Georgia	0.21875586	32	Solomon Islands	0.07220478	78
Montenegro	0.2118795	33	Uganda	0.07177104	79
Colombia	0.20719921	34	Haiti	0.06889847	80
Mauritania	0.20487232	35	Zimbabwe	0.06788513	81
Mongolia	0.20179991	36	Islamic Republic of Afghanistan	0.06530299	82
Argentina	0.19388903	37	Democratic Republic of the Congo	0.06520064	83
Maldives	0.19083875	38	Pakistan	0.0621416	84
Panama	0.18801858	39	Lesotho	0.05976429	85
Bosnia and Herzegovina	0.18573008	40	Zambia	0.05675106	86
Saudi Arabia	0.18394895	41	Cameroon	0.05528427	87
Moldova	0.18200412	42	Myanmar	0.04928665	88
Ukraine	0.18167949	43	Comoros	0.03677993	89
Belize	0.18148433	44	Rwanda	0.02435577	90
Armenia	0.18094603	45	Madagascar	0.02074834	91
Albania	0.1789745	46			

Source: Calculated by authors in STATA 15.

Our result is a stronger magnitude of the relationship between financial inclusion and income levels. It confirms the work of Fungáčová and Weill (2015); Camara and Tuesta (2014); and Demirgüç-Kunt and Klapper (2012) who showed that income increases the level of financial inclusion in China. Similarly, Efobi et al. (2014) showed that income is a significant factor influencing the use of banking services. Kempson and Collard (2012)

reported that the level of income inequality, as measured by the Gini coefficients, negatively influence financial inclusion.

Our findings support the "financial growth theory", which states that the lack of access to finance is a factor responsible for income disparities and slower development. Thus, access to safe, simple and attractive finance is considered to be a necessary condition for development and reductions in income disparities and poverty, which should further ensure equal opportunities; empower the vulnerable and socially disadvantaged to better participate in the economy and contribute effectively to development; and protect themselves from economic shocks (Serrao et al. 2012).

Differences in income levels are more likely to lead to disproportionate benefits for financial inclusion across a population. Demirgüç-Kunt and Klapper (2013) showed that income differences between countries and between individuals within countries influence the level of financial inclusion. Similarly, Allen et al. (2016) found that higher income levels are positively associated with greater financial inclusion.

San Marino ranks as the most financially inclusive country in our sample, with an index value of 0.517. Our result is in agreement with that of Saha and Dutta (2022), who found San Marino to be the most financially inclusive country with an average index value of 0.96 and 1, respectively. According to the financial access survey (FAS) portal (International Monetary Fund 2019), the indicator of bank branches shows that San Marino has little overbanking; thus, its number of branches per 100,000 adults is the highest in Europe.

Japan is ranked the second most financially inclusive country with an index of 0.506. This result is not surprising, as Japan is a major financial center in terms of financial assets; about 24 trillion euros of gross financial assets, which is six times the country's GDP. The banking sector covers 65% of the total assets (Direction Générale du Trésor 2019). This is also due to the support of the development of reliable financial services by the Bank of Japan, including improving financial literacy through CCFSI[1] activities, so that everyone can use financial services with confidence. Referring to our database, Japan has the highest number of deposit accounts (7,987,978 accounts per 1000 adults in 2004 and 7,086,588 in 2020), with an excessive reliance on deposits, which is explained by the saving behavior of Japanese households that are characterized by risk aversion and preference for bank liquidity, which multiply deposits with banks.

Madagascar is the least financially included country with an average FI index of 0.02074. Thus, according to Demirgüç-Kunt et al. 2021, in the latest World Bank Global Findex surveys, only 17.9 percent of adults have an account with a formal financial institution. Most Malagasy manage their financial lives outside the financial system due to difficult socio-economic conditions. Low literacy levels and a limited ability to use formal financial services, as well as severe infrastructural constraints and a weak payment system, prevent formal financial service providers from reaching the majority of consumers. As a result, the majority of Malagasy do not use financial services; they either turn to community members for financial assistance or use other arrangements rather than the formal financial system for savings, loans and risk management. All of these factors explain why Madagascar is positioned at the bottom of the financial inclusion table compared to other countries, even compared to its peers in the region.

The problem of financial inclusion is much more severe in Africa than it is elsewhere, with banking groups suffering from a lack of adequate collateral and high default rates. Therefore, these banking sectors still have a long way to go in terms of density, dynamism and sophistication. Although its financial system is underdeveloped and suffers from several shortcomings, such as the use of financial services having not grown as fast as the rate of account ownership, sub-Saharan Africa has the highest deployment rate of mobile payment services in the world. Thus, an introduction of these in our measure certainly affects the value of the *FI*.

Our result is a stronger magnitude of the relationship between financial inclusion and income level. Given that differences between income groups result in financial inclusion inequality, and that financial inclusion improves incomes and reduces the gap between different income groups, it is recommended that authorities encourage financial institutions to operate in low-income areas and promote financial education. Digital technologies should also be considered to ensure better access to financial services and alleviate the problems associated with income inequality.

4.4. Evaluation of the Index's Robustness

Drawing on the studies of Beck et al. (2007), Ahamed and Mallick (2019) and Nguyen (2020), we conduct a robustness test to examine whether our *FI* index is valid and robust relative to other financial inclusion indices; thus, we conduct a validity test of our newly developed *FI* index to verify its reliability. This test is carried out in two steps.

Step 1: We assess the correlation between the household-based *FI* indicators of the share of household accounts (% age 15+) and people with savings (from the Global Findex Database) and our newly developed *FI* index. Thus, a higher level of *FI* is positively associated with more households having accounts in financial institutions and benefiting from banking products, namely savings.

"Account" (% of population aged 15 and over): the share of respondents who report having an account at a bank or other financial institution (by themselves or with someone else).

"Savings" (% of people aged 15 and over): the percentage of respondents who report having saved or put money aside in the past year in a bank or other type of financial institution.

The regression results presented in Table 12 show *p*-values of 0.000 and 0.000, respectively, indicating that the correlations are statistically significant at the 1% level (0.777 for Account) and (0.621 for Savings). These results therefore demonstrate the robustness of our newly created index.

Table 12. Correlation between FIIndex and household-based *FI* indicators.

		ZFIIndex
ZFIIndex	Pearson Correlation	1
Account	Pearson Correlation Sig. (bilateral)	0.777 ** 0.000
Savings	Pearson Correlation Sig. (bilateral)	0.621 ** 0.000

Correlation is significant at the 0.01 ** level. Source: Calculated by authors in STATA 15.

Step 2: We carry out a second verification of our *FI* index to ensure its power. We test its correlation with the variables of interest, namely the following.

Literacy rate: the percentage of people aged 15 and over whom can both read and write while understanding a short, simple statement about their daily lives. The previous literature shows a positive and significant relationship between financial inclusion and literacy rates [Yangdol and Sarma (2019); Sanderson et al. (2018); Uddin et al. (2017); Zins and Weill (2016); Chithra and Selvam (2013)]. Indeed, more educated people are more likely to use a bank account and understand how to manage it. People with low levels of education find it difficult to access financial services. They find it difficult to analyze the credit risk and benefits of a loan or savings project, more difficult to provide the necessary documents and information (e.g., a business plan) to access the loan and more difficult to understand the terms and contracts. Thus, financial literacy plays an important role in promoting financial inclusion. Similarly, illiteracy is the main barrier to *FI* in sub-Saharan Africa (Chikalipah 2017).

Multidimensional poverty index (0–1 scale): the proportion of the population that is multidimensionally poor, adjusted by the intensity of deprivation. The financially excluded poor generally tend to keep their money in cash and rely on their personal networks to meet their most basic financial needs, which marginalize and put them at risk of loss, theft and exploitation, perpetuating the cycle of poverty.

Several studies have focused on the impact of financial inclusion on poverty, such as those by Allen et al. (2014) for Kenya, Brune et al. (2011) for Malawi, Neaime and Gaysset (2018) for countries in the Middle East and North Africa, and Park and Mercado (2018) for 37 developing Asian economies and 176 global economies. *FI* is seen as a major tool for poverty reduction.

Real interest rate (%): the lending rate adjusted for inflation as measured by the GDP deflator. High interest rates are one of the main factors that have hampered joint government and World Bank initiatives to achieve universal financial access (Uddin et al. 2017).

Employers, total (% of total employment): those who, working on their own account or with one or a few partners, hold the type of jobs defined as "self-employment", i.e., jobs whose remuneration is directly linked to the profits from the goods and services produced, and who, as such, have hired one or more persons to work for them as employees on a continuous basis. An increase in the rate of financial inclusion is associated with a decrease in unemployment, and vice versa. For example, financial inclusion is associated with a high rate of investment, which leads to a much lower rate of unemployment (Leeladhar 2006).

GINI index: the extent to which the distribution of income (or, in some cases, consumption expenditures) among individuals or households in an economy deviates from a perfectly equal distribution. A GINI index of 0 therefore represents perfect equality, whereas an index of 100 implies perfect inequality. Levels of income inequality, as measured by GINI coefficients, are negatively correlated with levels of financial inclusion. For example, developing countries with high levels of income inequality, such as those in Africa, have high levels of financial exclusion and therefore low levels of financial inclusion.

For this reason, we use these variables as a robustness test, and we expect the literacy rate, poverty rate, real interest rate, employer rate and GINI index to be positively, negatively, negatively, positively and negatively correlated with the level of *FI*, respectively.

The results in Table 13 are in line with our expectations. Thus, the financial inclusion index is positively correlated with the literacy rate (0.573) and the employment rate (0.280) but is negatively correlated with poverty (−0.729), the GINI index (−0.372) and the real interest rate (−0.132).

Table 13. Correlation between FIIndex and some variables of interest.

		ZFIIndex
ZFIIndex	Pearson Correlation	1
Literacy rate	Pearson Correlation Sig. (bilateral)	0.573 ** **0.000**
POV	Pearson Correlation Sig. (bilateral)	−0.729 ** **0.000**
RIRR	Pearson Correlation Sig. (bilateral)	−0.132 ** **0.000**
GINI	Corrélation de Pearson Sig. (bilatérale)	−0.372 ** **0.000**
EMP	Corrélation de Pearson Sig. (bilatérale)	0.280 ** **0.000**

The correlation is significant at the 0.01 ** level. Source: Calculated by authors in STATA 15.

5. Conclusions

Fostering financial inclusion is an emerging issue of primary financial and social necessity for shared prosperity and sustainability. Financial inclusion is one of the 17 goals of the United Nations Sustainable Development Agenda. More than 50 countries have set a target to promote FI. Recognizing the importance of what has been proposed, we contribute to this debate by addressing the most important issue surrounding the topic, namely the measurement of FI. Using a sample of 91 countries for the period of 2004–2020, we propose a new composite index of FI at the country level using the principal component analysis method, and we proceed to classify countries according to the obtained scores.

Each measure in the literature has different variables, and each measurement step has a different method, which can affect the result. Therefore, it is not surprising that a composite FI index differs from one study to another. Because our index is robust and easy to calculate, it can be used by financial professionals and researchers to track the progress of FI measures in the studied countries. Moreover, it can be used as a reference for policymakers to make strategic decisions to improve current policies and achieve better FI outcomes.

In-depth knowledge of financial inclusion, as well as the need for it, leads to other studies, namely the study of tools to promote financial inclusion in a world of constant change, namely digital technologies. It is also recommended that the sample be divided into three panels (high-, middle- and low-income) to confirm or refute the previous studies by taking advantage of the financial inclusion index created for each country.

Our research highlights the importance of FI for the development of countries. In addition, given the gap between low- and high-income countries, developing country governments need to focus on the following. First, financial infrastructure should be improved to increase opportunities for access to and use of financial services. Second, strategies should be implemented to accelerate the digitalization of banks and welcome new innovative players. Third, financial instruments that are adapted to the needs of the population and to perceived developments, namely digital financial services, including FinTech and big data, should be implemented. Fourth, more cooperation should be developed with communication technology operators, in particular cell phones, which are catalysts for FI. Finally, measures should be instituted to improve financial literacy, trust and depositor protection.

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Appendix A

Table A1. List of countries selected in the sample[2].

Low income	Lower-Middle Income	Upper-Middle Income	High Income
South Asia	**Europe and Central Asia**	**Europe and Central Asia**	**Europe and Central Asia**
Afghanistan	Tajikistan	Armenia	Belgaum
Sub-Saharan Africa	Ukraine	Georgia	Croatia
Chad	**Latin America and**	Kosovo	Cypris
Congo	**Caribbean**	Moldova	Estonia
Madagascar	Belize	Albania	Greece
Mozambique	Bolivia	Azerbaijan	Hungary
Rwanda	El Salvador	Bosnia and Herzegovina (BH)	Italy
Uganda	Honduras	Bulgaria	Netherlands
	Haiti	Macedonia	Latvia
	Nicaragua	Montenegro	Poland
	East Asia and Pacific	Turkish	Portugal
	Cambodia	**Sub-Saharan Africa**	Spain
	Indonesia	Botswana	Iceland
	Lao PDR	Namibia	San Marino
	Myanmar	**Middle East and North**	**East Asia and Pacific**
	Mongolia	**Africa**	Japan
	Philippines	Jordan	Korea
	Solomon Islands (SI)	Lebanon	**Middle East and North**
	Samoa	**East Asia and Pacific**	**Africa**
	Sub-Saharan Africa	China, PR.: Mainland	Malta
	Cameroon	Malaysia	Saudia Arabia
	Comoros	Thailand	United Arab Emirates (UAE)
	Ghana	**Latin America and**	**Latin America and**
	Lesotho	**Caribbean**	**Caribbean**
	Mauritania	Argentina	Chile
	Kenya	Brazil	Trinidad and Tobago (TT)
	Zambia	Colombia	**Sub-Saharan Africa**
	Zimbabwe	Costa Rica	Mauritius
	Middle East and North	Dominican Republic	Seychelles
	Africa	Ecuador	**South Asia**
	Egypt	Jamaica	Brunei Darussalam (BD)
	West Bank and Gaza	Panama	
	South Asia	Paraguay	
	Bangladesh	Peru	
	India	Suriname	
	Nepal	**South Asia**	
	Pakistan	Maldives	

Source: Prepared by authors.

Notes

1 The Central Council for Financial Services Information is an organization that conducts financial services information activities in Japan. Its main objective is to enlighten the public on the importance of basic financial and economic knowledge related to daily life.

2 We take into consideration the classification of the World Bank. This classification, updated every year on 1 July, is based on the GNI per capita of the previous year (2019 in our case) in current dollars.

References

Ahamed, M. Mostak, and Sushanta K. Mallick. 2019. Is financial inclusion good for bank stability? International evidence. *Journal of Economic Behavior and Organization* 157: 403–27. [CrossRef]

Allen, Franklin, Elena Carletti, Robert Cull, Jun Qian, Lemma Senbet, and Patricio Valenzuela. 2014. The African financial development and financial inclusion gaps. *Journal of African Economies* 23: 614–42. [CrossRef]

Allen, Franklin, Asli Demirgüç-Kunt, Leora Klapper, and Maria Soledad Martinez Peria. 2016. The foundations of financial inclusion: Understanding ownership and use of formal accounts. *Journal of Financial Intermediation* 27: 1–30. [CrossRef]

Atellu, Antony R. 2021. Inclusive Finance, Bank Regulation, Concentration and Financial Stability in Kenya. Doctoral dissertation, University of Nairobi, Nairobi, Kenya.
Avom, Désiré, Chrysost Bangaké, and Hermann Ndoya. 2021. Measuring financial inclusion in African countries. *Economics Bulletin* 41: 848–66.
Ayyagari, Meghana, Thorsten Beck, and Mohammad Hoseini. 2013. Finance and Poverty: Evidence from India, CEPR Discussion Paper No. DP9497. Available online: https://ssrn.com/abstract=2275150 (accessed on 25 October 2022).
Basel Committee on Banking Supervision. 2016. *Recommendations for the Application of the Core Principles for Effective Banking Supervision to the Regulation and Supervision of Institutions Engaged in Financial Inclusion*. Geneva: Bank for International Settlements. Available online: http://www.bis.org/bcbs/publ/d383.pdf (accessed on 20 June 2022).
Beck, Thorsten, Asli Demirguc-Kunt, and Maria Soledad Martine Peria. 2007. Reaching out: Access to and use of banking services across countries. *Journal of Financial Economics* 85: 234–66. [CrossRef]
Bruhn, Miriam, and Inessa Love. 2014. The real impact of improved access to finance: Evidence from Mexico. *The Journal of Finance* 69: 1347–76. [CrossRef]
Brune, Lasse, Xavier Giné, Jessica Goldberg, and Dean Yang. 2011. Commitments to Save: A Field Experiment in Rural Malawi. World Bank Policy Research Working Paper, No. 5748. Available online: https://ssrn.com/abstract=1904244 (accessed on 3 December 2021).
Camara, Noelia, and David Tuesta. 2014. Measuring Financial Inclusion: A Multidimensional Index. Working Paper, N 14/26, BBVA Bank, Economic Research Department, Madrid, September. Available online: https://www.bbvaresearch.com/wp-content/uploads/2014/09/WP1426.Financial (accessed on 18 August 2021).
Casin, Philippe, Christine Stachowiak, and François Marque. 2011. L'analyse en composantes principales de variables non stationnaires. *Mathématiques et Sciences Humaines. Mathematics and Social Sciences* 196: 27–40. [CrossRef]
Cattell, Raymond B. 1966. The Scree Test for The Number Of Factors. *Multivariate Behavioral Research* 1: 245–76. [CrossRef]
Chakravarty, Satya R., and Rupayan Pal. 2010. *Measuring Financial Inclusion: An Axiomatic Approach*. Mumbai: Indira Gandhi Institute of Development Research. Available online: http://www.igidr.ac.in/pdf/publication/WP-2010-003.pdf (accessed on 5 October 2021).
Chikalipah, Sydney. 2017. What determines financial inclusion in Sub-Saharan Africa? *African Journal of Economic and Management Studies* 8: 8–18. [CrossRef]
Chithra, Natarajan, and Murugesan Selvam. 2013. Determinants of Financial Inclusion: An Empirical Study on the Inter-State Variations in India. Available online: https://ssrn.com/abstract=2296096 (accessed on 12 November 2021).
Cull, Robert, Tilman Ehrbeck, and Nina Holle. 2014. *Financial Inclusion and Development: Recent Impact Evidence (No. 88169)*. Washington, DC: The World Bank, pp. 1–12.
Demirgüç-Kunt, Asli, and Leora F. Klapper. 2012. Measuring Financial Inclusion: The Global Findex Database (No. 6025). The World Bank. Available online: https://www.bbvaresearch.com/wp-content/uploads/2014/09/WP14-26_Financial-Inclusion.pdf (accessed on 22 December 2020).
Demirgüç-Kunt, Asli, and Leora Klapper. 2013. Measuring financial inclusion: Explaining variation in use of financial services across and within countries. *Brookings Papers on Economic Activity* 2013: 279–340. [CrossRef]
Demirgüç-Kunt, Asli, and Ross Levine. 2009. Finance and inequality: Theory and evidence. *Annual Review of Financial Economics* 1: 287–318. [CrossRef]
Demirguc-Kunt, Asli, Leora Klapper, Dorothe Singer, and Peter Van Oudheusden. 2015. *The Global Findex Database 2014: Measuring Financial Inclusion around the World*. Policy Research Working Paper No. 7255. Washington, DC: World Bank. Available online: https://openknowledge.worldbank.org/handle/10986/21865 (accessed on 22 December 2021).
Demirgüç-Kunt, Asli, Leora Klapper, Dorothe Singer, and Ansar Saniya. 2021. The Global Findex Database 2021: Financial Inclusion, Digital Payments, and Resilience in the Age of COVID-19. Available online: https://www.worldbank.org/en/publication/globalfindex (accessed on 22 December 2021).
Direction Générale du Trésor. 2019. Panorama du système financier japonais, évolutions, enjeux et vulnérabilités. Ministère de l'économie, des finances et de la souveraineté industrielle et numérique. Available online: https://www.tresor.economie.gouv.fr/Articles/2019/01/24/panorama-du-systeme-financier-japonais-evolutions-enjeux-et-vulnerabilites (accessed on 16 February 2021).
Efobi, Uchenna, Ibukun Beecroft, and Evans Osabuohien. 2014. Access to and use of bank services in Nigeria: Micro-econometric evidence. *Review of Development Finance* 4: 104–14. [CrossRef]
Elsayed, Abdullah. 2020. The Interrelationship between Financial Inclusion, Financial Stability, Financial Integrity and Consumer Protection (I-SIP Theory). Available online: http://dx.doi.org/10.2139/ssrn.3745874 (accessed on 12 February 2021).
Financial Action Task Force. 2011. Annual Report 2011–2012. Available online: file:///C:/Users/MDPI/Downloads/FATF%20annual%20report%202011%202012%20website.pdf (accessed on 12 February 2021).
Fungáčová, Zuzana, and Laurent Weill. 2015. *Understanding Financial Inclusion in China*. BOFIT Discussion Papers, No. 10/2014. Helsinki: Bank of Finland, Institute for Economies in Transition (BOFIT). ISBN 978-952-6699-80-6. Available online: https://nbn-resolving.de/urn:NBN:fi:bof-201408072217 (accessed on 8 April 2021).
Gupte, Rajani, Bhama Venkataramani, and Deepa Gupta. 2012. Computation of financial inclusion index for India. *Procedia—Social and Behavioral Sciences* 37: 133–49. [CrossRef]

Hair, Joseph F. 2009. *Multivariate Data Analysis*. Edited by Joseph F. Hair. Hoboken: Prentice Hall.
Huang, Youxing, and Yan Zhang. 2019. Financial inclusion and urban–rural income inequality: Long-run and short-run relationships. *Emerging Markets Finance and Trade* 56: 457–71. [CrossRef]
International Monetary Fund. 2019. *Financial Access Survey Portal*. Washington, DC: IMF Data.
Jacoby, Hanan G. 1994. Borrowing Constraints and Progress through School: Evidence from Peru. *The Review of Economics and Statistics* 76: 151–60. [CrossRef]
Jungo, João, Mara Madaleno, and Anabela Botelho. 2022. The Effect of Financial Inclusion and Competitiveness on Financial Stability: Why Financial Regulation Matters in Developing Countries? *Journal of Risk and Financial Management* 15: 122. [CrossRef]
Kabakova, Oksana, and Evgeny Plaksenkov. 2018. Analysis of factors affecting financial inclusion: Ecosystem view. *Journal of Business Research* 89: 198–205. [CrossRef]
Kaiser, Henry F. 1960. The application of electronic computers to factor analysis. *Educational and Psychological Measurement* 20: 141–51. [CrossRef]
Kempson, Elaine, and Sharon Collard. 2012. *Developing a Vision for Financial Inclusion*. Bristol: University of Bristol for Friends Provident Foundation. Available online: https://www.bristol.ac.uk/media-library/sites/geography/migrated/documents/pfrc1205.pdf (accessed on 12 February 2021).
Kempson, Elaine, Adele Atkinson, and Odile Pilley. 2006. Policy Level Response to Financial Exclusion in Developed Economies. Report of Personal Finance Research Centre, University of Bristol. Available online: http://www.bristol.ac.uk/media-library/sites/geography/migrated/documents/pfrc0410.pdf (accessed on 6 November 2021).
Khan, H. R. 2011. *Financial Inclusion and Financial Stability: Are They Two Sides of the Same Coin*. Address by Shri HR Khan, Deputy Governor of the Reserve Bank of India, at BANCON, RBI Monthly Bulletin March 2012. pp. 553–63. Available online: https://rbidocs.rbi.org.in/rdocs/Bulletin/PDFs/06SPBUL120312.pdf (accessed on 12 February 2021).
Kithinji, Emily. 2017. Effects of Digital Banking Strategy on Financial Inclusion among Commercial Banks in Kenya. Project Presented in Partial Fulfillment of the Requirements for the Award of the Degree of Master Business Administration. Doctoral dissertation, University of Nairobi, Nairobi, Kenya.
Leeladhar, Vivek. 2006. Taking banking services to the common man-financial inclusion. *Reserve Bank of India Bulletin* 60: 73–77.
Neaime, Simon, and Isabelle Gaysset. 2018. Financial inclusion and stability in MENA: Evidence from poverty and inequality. *Finance Research Letters* 24: 230–37. [CrossRef]
Nguyen, Thi Truc Huong. 2020. Measuring financial inclusion: A composite FI index for the developing countries. *Journal of Economics and Development* 23: 77–99. [CrossRef]
Ozili, Peterson K. 2020. Theories of Financial Inclusion. In *Uncertainty and Challenges in Contemporary Economic Behaviour (Emerald Studies in Finance, Insurance, and Risk Management)*. Edited by Ercan Özen and Simon Grima. Bingley: Emerald Publishing Limited, pp. 89–115. [CrossRef]
Park, Cyn-Young, and Rogelio Mercado. 2015. Financial Inclusion, Poverty, and Income Inequality in Developing Asia. Asian Development Bank Economics Working Paper Series, No. 426. Available online: https://ssrn.com/abstract=2558936 (accessed on 26 January 2021).
Park, Cyn-Young, and Rogelio Mercado Jr. 2018. Financial inclusion, poverty, and income inequality. *The Singapore Economic Review* 63: 185–206. [CrossRef]
Pras, Bernard, Yves Evrard, and Elyette Roux. 2003. *MARKET: Etudes et Recherches en Marketing, Fondements, Méthodes*, 3rd ed. Paris: Dunod, p. 699.
Saha, Mallika, and Kumar Debasis Dutta. 2022. Revisiting financial inclusion-stability nexus: Cross-country heterogeneity. *Journal of Financial Economic Policy* 14: 713–42. [CrossRef]
Sanderson, Abel, Learnmore Mutandwa, and Pierre Le Roux. 2018. A review of determinants of financial inclusion. *International Journal of Economics and Financial Issues* 8: 1–8.
Sarma, Mandira. 2008. Index of Financial Inclusion. Working Paper No. 215, Indian Council for Research on International Economic Relations (ICRIER), New Delhi. Available online: http://hdl.handle.net/10419/176233 (accessed on 3 March 2021).
Sarma, Mandira. 2012. *Index of Financial Inclusion—A Measure of Financial Sector Inclusiveness*. Working Paper No. 07. Delhi: Centre for International Trade and Development, School of International Studies Jawaharlal Nehru University, June.
Sarma, Mandira. 2015. Measuring financial inclusion. *Economics Bulletin* 35: 604–11.
Sarma, Mandira. 2016. Measuring financial inclusion for Asian economies. In *Financial Inclusion in Asia*. London: Palgrave Macmillan, pp. 3–34.
Sarma, Mandira, and Jesim Pais. 2011. Financial inclusion and development. *Journal of International Development* 23: 613–28. [CrossRef]
Serrao, Manohar Vincent, Aloysius Henry Sequeira, and Basil Hans. 2012. Designing a Methodology to Investigate Accessibility and Impact of Financial Inclusion. Household finance e-journal-CMBO. Available online: https://ssrn.com/abstract=2025521 (accessed on 27 November 2020).
Siddik, Md, Nur Alam, and Sajal Kabiraj. 2018. Does financial inclusion induce financial stability? Evidence from cross-country analysis. *Australasian Accounting, Business and Finance Journal* 12: 34–46.
The World Bank Annual Report. 2008. Year in Review, World Bank Document. Available online: http://hdl.handle.net/10986/7524 (accessed on 27 December 2020).

Tomilova, Olga, and Myra Valenzuela. 2018. *Financial Inclusion + Stability, Integrity, and Protection (ISIP). Policy Making for an Inclusive Financial System. Technical Guide*. Washington, DC: CGAP, April. Available online: https://www.cgap.org/sites/default/files/publications/Technical-Guide-ISIP-Policy-Making-Nov-2018.pdf (accessed on 22 December 2021).

Uddin, Ajim, Mohammad Ashraful Ferdous Chowdhury, and Md Nazrul Islam. 2017. Determinants of financial inclusion in Bangladesh: Dynamic GMM & quantile regression approach. *The Journal of Developing Areas* 51: 221–37.

Van, Loan Thi-Hong, Anh The Vo, Nhan Thien Nguyen, and Duc Hong Vo. 2021. Financial inclusion and economic growth: An international evidence. *Emerging Markets Finance and Trade* 57: 239–63. [CrossRef]

Yangdol, Rigzin, and Mandira Sarma. 2019. Demand-side factors for financial inclusion: A cross-country empirical analysis. *International Studies* 56: 163–85. [CrossRef]

Zins, Alexandra, and Laurent Weill. 2016. The determinants of financial inclusion in Africa. *Review of Development Finance* 6: 46–57. [CrossRef]