FINANCIAL INCLUSION: NEW MEASUREMENT AND CROSS-COUNTRY IMPACT ASSESSMENT

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ABSTRACT

This paper introduces a new index of financial inclusion for 151 economies using principal component analysis to compute weights for aggregating nine indicators of access, availability, and usage. It then assesses the impact of financial inclusion on poverty and income inequality. The results provide evidence that high- and middle-high-income economies with high financial inclusion have significantly lower poverty, while no such relation exists for middle-low and low-income economies. The nonlinearities in the cross-country determinants and impacts of financial inclusion on poverty and income inequality across income groups are important to choosing the appropriate policies for achieving inclusive growth in different development stages.

Key words: financial inclusion, income inequality, poverty

JEL codes: G18, O11, O16

I.   INTRODUCTION

Financial inclusion aids inclusive growth, economic development, and financial deepening. More practically, it can increase poor people's access to financial services, reducing poverty and lowering income inequality. The empirical evidence supports this view. Indeed, simply having a bank account increases savings, empowers women, boosts household consumption, and raises productive investment (Allen et al. 2012; Beck, Demirgüç-Kunt, and Honohan 2009). As such, policy makers around the world have pursued financial inclusion as a major policy goal, with G20 leaders recognizing it as one of the main pillars of the global development agenda.

Recent policy initiatives vary in scope and purpose. For instance, the World Bank has recently made available the Global Financial Inclusion (Global Findex) database to measure and track the progress of financial inclusion across member countries. And to help improve financial inclusion policy in developing and emerging market economies, the Alliance for Financial Inclusion was established in 2008 as a network of financial inclusion policy makers. It would now be useful, with these and other initiatives in place, to have a tool to track progress, assess impact, identify challenges, and suggest policy direction.

The literature on financial inclusion falls broadly into two categories. The first strand considers individual and household impacts and determinants of financial inclusion using field experiments. Burgess and Pande (2005), for example, report that state-led expansion of rural bank branches in India has helped reduce poverty. Specifically, the authors find robust evidence that opening bank branches in rural unbanked locations in India is associated with lower poverty in those areas. Similarly, Brune et al. (2011) show that increased financial access through commitment-savings accounts in rural Malawi improves the well-being of poor households, which were able to keep their savings for agricultural inputs, creating an access to funds for lean periods. Allen et al. (2013) illustrate that by tapping underprivileged households, commercial banks can help improve the financial access of the poor in Kenya.

The second strand focuses more on cross-country aggregate trends and impacts of financial inclusion. Honohan (2008) finds that a set of country-specific structural variables matter for financial access. For example, more aid as percent of gross domestic product (GDP), higher age-dependency ratio, and higher population density significantly reduce financial access; while more mobile phone subscriptions and higher quality of institutions significantly increase financial access. Aid dependency suggests more poverty and age dependency implies more children who many not have access to financial services. Negative correlation between population density and financial access is rather counterintuitive, but its significance disappears when the two largest outliers, Hong Kong, China and Lebanon, are excluded from the data set. Looking at the cross-country link between poverty and financial access, his results show that financial access significantly reduces poverty, but the result is valid only when financial access is the sole regressor. In an earlier version of his paper, Honohan (2007) tested the significance of financial access in reducing income equality. His results show that higher financial access significantly reduces income inequality. However, the link between the two variables depends on which specification is used.

Rojas-Suarez (2010) used the same indicator constructed by Honohan (2008) to test the significance of various macroeconomic and country characteristics for financial access among a group of emerging economies. The results show that economic volatility, weak rule of law, higher income inequality, and social underdevelopment and regulatory constraints significantly lower financial inclusion. Park and Mercado (2016, 2018) later confirmed these earlier findings, showing that per

capita income, rule of law, and demographic characteristics are significantly positively correlated with financial inclusion for both global and Asian samples. They also find that financial inclusion is significantly correlated with lower poverty for both global and developing Asia samples. Although their results point to a significant covariation between income inequality and financial inclusion in their full sample, no such covariance is found in the developing Asia sample.

Both strands of empirical literature are equally relevant to policy making. While the experimental literature for financial inclusion is growing rapidly, with new papers focusing on more specific evidence from randomized control trials or quasi-randomized impact evaluations, macroeconomic level studies use country panel data comparisons to establish the general relationship between financial inclusion and economic growth/employment. This paper follows the second approach by investigating the aggregate impact of financial inclusion on overall poverty, income inequality, entrepreneurship, and female empowerment.

We construct a new index of financial inclusion (IFI) for 151 economies with indicators based on the World Bank's Global Findex database to assess cross-country variation in the impact of financial inclusion on key development objectives. We ask two questions. First, what factors are relevant in explaining cross-country differences in the recent change in financial inclusion? Second, does financial inclusion lower poverty and income inequality, and improve entrepreneurship and female empowerment?

This paper contributes to the literature in several ways. First, the new financial inclusion measure combines Sarma's (2008) multidimension approach with the normalized weights from the principal component analysis of Camara and Tuesta (2014) to address the well-known weaknesses of each methodology. The new index shows that the indicators and dimension weights from the principal component analysis are relatively stable between two survey periods, 2011 and 2014.

Second, our estimates provide robust evidence using best available cross-country data that economies with high financial inclusion have significantly lower poverty rates. This validates the causal inverse relation between financial access and poverty at the individual and household level on a cross-country setting.

Third, splitting the sample by country income groups, we find higher financial inclusion significantly covaries with higher output growth and lower poverty rates for high and middle-high-income economies. However, for middle-low and low-income economies, these significant relationships lose their significance. This suggests that there may be nonlinearities in country-specific factors that may influence the relationship between financial inclusion and economic growth/poverty.

The paper proceeds as follows. Section II discusses conceptual and measurement issues on financial inclusion. Section III explains the methodology in constructing a new financial inclusion index and provides stylized facts. Section IV presents the empirical approach and discusses the results. Section V concludes.

II.   FINANCIAL INCLUSION CONCEPTS AND MEASUREMENT

Definitions of financial inclusion vary. Several studies define the concept within the broader context of social inclusion. For example, Leyshon and Thrift (1995) highlight the exclusion of some groups and individuals from access to formal financial systems, while Sinclair (2001) focuses on the inability to access necessary financial services in an appropriate form. Amidžić, Massara, and Mialou (2014) and

Sarma (2008) directly define financial inclusion as an economic state in which individuals and firms are not denied access to basic financial services. Sarma (2008) defines financial inclusion as a process that ensures ease of access, availability, and usage of formal financial systems for all members of an economy. In contrast, Camara and Tuesta (2014) define an inclusive financial system as one that maximizes usage and access while minimizing involuntary exclusions. Hence, they focus more on usage, access, and barriers, which capture both the supply- and demand-side of financial access.

It is also important to distinguish between voluntary and involuntary financial exclusion. The World Bank (2014) defines voluntary exclusion as a condition in which a segment of the population or firms chooses not to use financial services, either because they have no need for them or for cultural or religious reasons.

In contrast, involuntary exclusion arises from insufficient income, a high-risk profile due to discrimination, and financial market failures and imperfections. This involuntary element, which is viewed as a barrier to financial inclusion, requires policy and research initiatives, as it can be addressed with appropriate economic programs and policies to increase income and correct market failures and imperfections.

This paper follows the definition of financial inclusion of Sarma (2008), who views it as a process that ensures ease of access, availability, and usage of financial services for all members of society. The advantage in this definition is that it builds the concept of financial inclusion based on several dimensions, including accessibility, availability, and usage, which can be assessed separately. More importantly, Sarma (2008) strictly delineates financial inclusion dimensions focusing on the financial access of a segment of the population included in the financial system. Defining financial inclusion to include barriers or ease of financial access, a la Camara and Tuesta (2014), confuses the conceptual clarity of financial inclusion, as it combines the reasons for having and not having financial access in a financial inclusion measure.[1]

And just as no single conceptual definition of financial inclusion exists, no standard measure of the concept is universally accepted. Consequently, measures of financial inclusion often vary across studies. For instance, Honohan (2007, 2008) constructed a financial access indicator that captures the fraction of the adult population in each economy with access to formal financial intermediaries—which captures only one dimension of financial inclusion. This composite financial access indicator was constructed using household survey data for economies with available data on financial access. For those without a household survey on financial access, the indicator was derived using information on bank account numbers and GDP per capita. The data set was constructed as a cross-section series using the most recent data as the reference year, which varies across economies.

Amidžić, Massara, and Mialou (2014) constructed a financial inclusion indicator as a composite of variables pertaining to multiple dimensions: outreach (geographic and demographic penetration); usage (deposit and lending); and quality (disclosure requirement, dispute resolution, and cost of usage).[2] Each measure is normalized, statistically identified for each dimension, and then aggregated using statistical weights, the aggregation following a weighted geometric mean. One

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[1] Camara and Tuesta (2014) argued that barriers to financial access must be included as a dimension of financial inclusion as they reflect demand-side measures of financial services. However, demand-side indicators could also be included in a multidimensional approach of Sarma (2008). In other words, the lack of demand-side measures in existing financial inclusion measures does not fully justify the inclusion of barriers dimension in the aggregate financial inclusion measure.

[2] Although Amidžić, Massara, and Mialou (2014) defined proxies for a quality measure, they did not include it in their composite indicator due to a lack of reliable and available data.

drawback of this approach is that it uses a factor analysis method to reduce a set of variables down to a smaller number of factors and, therefore, not fully utilizing all available data for each country. Furthermore, it assigns different weights to each dimension, which may imply the importance of one dimension over another.

Sarma (2008) followed a different approach to construct the indicator. She first computed a subindex for each dimension of financial inclusion (access, availability, and usage) and then aggregated each index as the normalized inverse of Euclidean distance, where the distance is computed from a reference ideal point and then normalized by the number of dimensions included in the aggregate index. The advantage of this approach is that it is easy to compute and does not impose varying weights for each dimension. In Sarma (2015), dimensional weights are set at arbitrary values due to the lack of available data to fully characterize availability and usage dimensions. For example, the weights for access, availability, and usage are 1, 0.5, and 0.5, respectively.

Camara and Tuesta (2014) use two-stage principal component analysis, wherein, in the first stage, they estimate three subindices—usage, access, and barriers—which define their financial inclusion measure. In the second stage, they estimate the dimension weights and the overall financial inclusion index by using the dimension subindices in the first stage as explanatory variables. In effect, their financial inclusion measure is a weighted average of three dimensions, where the weights are derived from principal component analysis. While their methodology suffers from weaknesses of its own, the weights are drawn from available data, rather than relying on the researcher's discretion and potential biases.

III. INDEX OF FINANCIAL INCLUSION

Before investigating what influences the change in financial inclusion and assessing the impact of financial inclusion in reducing poverty and lowering income inequality across different samples of countries, we first construct our own financial inclusion indicator. The motivation for constructing our own financial inclusion indicator are as follows: (i) we aim to include as many economies in our sample, as using a previously computed indicator will limit our sample size, which could bias results for a cross-country setting; (ii) need exists to develop a consistent and robust measure of financial inclusion for a large sample of economies, which helps standardize the measure for all countries in our sample; and (iii) we can use this consistent and robust financial inclusion index to validate earlier findings.

In computing our index of financial inclusion, we combine the approaches of Sarma (2008) and Camara and Tuesta (2014). Like Sarma (2008), we use access, availability, and usage as dimensions of our financial inclusion index.[3] We compute each indictor for each dimension as:

$$X_{i,d} = \frac{x_i - m_i}{M_i - m_i} \tag{1}$$

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[3] We classify the percentage of the adult population with bank accounts as access and not as usage, in line with existing studies on financial access (Beck, Demirgüç-Kunt, and Honohan 2009; Honohan 2007, 2008; Park and Mercado 2016, 2018; and Sarma 2008, 2015).

where x_i is the actual value of indicator i, mi is the minimum value of indicator i, M_i is the maximum value of dimension i.[4] X_i, d is the standardized value of indicator i of dimension d. In aggregating each indicator to a dimension index, we use principal component analysis, like Camara and Tuesta (2014). We denote λ_j (j = 1, ..., p) as the jth eigenvalue, subscript j refers to the number of principal components that also coincides with the number of standardized indicators p. We assume that $\lambda_1 > \lambda_2 > ...> \lambda p$ and denote P_k (k = 1, ... , p) as the kth principal component. We derive each dimension index according to the weighted averages:

$$D_d = \frac{\sum_{j,k=1}^{p} \lambda_j P_k}{\sum_{j=1}^{p} \lambda_j} \tag{2}$$

where D_d is dimension d index and P_k = $X\lambda_j$. λ_j represents the variance of the kth principal component (weights) and X is the indicators matrix. The weights given to each component are decreasing, so that the larger proportion of the variation in each dimension is explained by the first principal component and so on. Following Camara and Tuesta (2014), we also account for 100% of the total variation in our dimension indices to avoid discarding information that could accurately estimate the overall country financial inclusion index.

Once we have the dimension indices, we run another principal component analysis to derive the dimension weights for the overall financial inclusion. As in Equation 2,

$$IFI_i = \frac{\sum_{j=1}^{p} \lambda_j P_{ki}}{\sum_{j=1}^{p} \lambda_j} \tag{3}$$

where IFI_i is the aggregate financial inclusion index for country i. P_k = $X\lambda_j$. λ_j represents the variance of the kth principal component (weights of each dimension) and X is the dimensions matrix. The weights given to each component are also decreasing; and we account for 100% of the total variation in our IFI. We can also represent Equation 3 as:

$$IFI_i = \omega_1 D_{1,i} + \omega_2 D_{2,i} + \omega_3 D_{3,i} \tag{4}$$

where ω are the weights derived from principal component analysis and D_i are the dimensions. Equation 4 states that our index of financial inclusion for our sample of 151 advanced and emerging economies is a weighted average of individual dimensions.

While we follow Sarma's (2008) definition of financial inclusion, we use better and more indicators for each dimension of our financial inclusion index. For access, the indicators include the percentage of the adult population with financial accounts to total population. This indicator is a better measure of the segment of the adult population with bank accounts compared to the number of deposit accounts per adult population. We also include the proportion of the adult population with credit and debit cards as these measures complement those who have a bank account; that is, one must have a bank account before a debit and/or a credit card is issued. Our primary data source is the World Bank's Global Findex database, which is based on individual and household survey data for 2011

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[4]   Following Sarma (2015), we set the minimum value for each indicator to zero.

and 2014, which are aggregated to a country level. For our 2014 data on access, we also include the percentage share of the adult population with a mobile money account.[5]

For the availability dimension, we include the number of commercial bank branches and of ATMs per 100,000 adults, also taken from the Global Findex database. For the usage dimension, we include the share of the adult population who borrowed and saved from a financial institution, taken from the same database. We also include the domestic credit-to-GDP ratio, sourced from the World Bank's World Development Indicators.[6]

Table 1 presents the computed normalized weights for each indicator. Several observations are notable. First, changing the number of indicators in a dimension index significantly alters the resulting weights. For the access dimension, the inclusion of a mobile money account has altered the weights for 2014 for countries with available mobile account data. For those without mobile account data, the weights are like 2011. Second, the weight of commercial bank branches is significantly larger than the weight of ATMs per adult population for the availability dimension. Third, the share of those who borrow from a financial institution is far greater than the share of those who saved and for the credit-to-GDP ratio. Fourth, weights appear to be stable in both survey periods. This offers support for using principal component analysis to generate indicator and dimension weights in aggregating a financial inclusion index. Lastly, dimensional weights appear stable across the sample periods. Among the dimensions, availability appears to have greater importance than access and usage. This validates the findings of Demirgüç-Kunt and Klapper (2012), in which they find that distance or the lack of available bank branches in remote areas are primary reasons that survey respondents are involuntarily excluded from financial services.[7]

Applying equations 1 to 4 on the list of indicators, Table 2 presents our cross-country IFI ordered from highest to lowest in 2014.[8] In principle, the IFI index could reach 100, suggesting a very high level of financial inclusion. But our computed index reaches only up to 73.22 for Luxembourg in 2014. This could be attributed to the use of weighted averages for our indicators and dimensions, as weighted averages make it less likely for a country to score high points on each weight. Nonetheless, the ordering of economies based on IFI appears robust such that economies like Japan, Luxembourg, Spain, and the United States always score high on previous IFI rankings, as in Sarma (2008) and Park and Mercado (2018).

Figure 1 compares our new index with Sarma's (2015) index.[9] Based on the figure, our new measure is positively correlated with Sarma's index, suggesting that those economies that score high on our measure also have high financial inclusion in Sarma's (2015) index.

Figure 2 illustrates IFI median values by country income groupings. As expected, high-income countries (as classified by the World Bank) score high on our IFI measure, while low-income countries score the lowest. It also shows that financial inclusion has increased overall across income groups between the sample periods.

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[5] The appendix lists data definitions and sources.

[6] We explored the option of including point-of-sales data from the Global Findex database. Data is available for 78 economies and the survey period is not specified.

[7] Table 1 also presents the weights of each indicator and dimension using country income-group samples. Note that similar patterns hold as in the full sample weights.

[8] We tested for the significance of each indicator on each dimension as well as the significance of each dimension on overall financial inclusion index. The regression results show all indicators and dimensions indices are significant. The estimates imply that all the indicators are relevant for each of the dimensions and that dimensions are significant for the aggregate financial inclusion index.

[9] The financial inclusion index of Camara and Tuesta (2014) is unavailable.

Table 1: Principal Component Analysis of Indicators for Each Index of Financial Inclusion Dimension

	Full Sample			HIC			MHI			MLI			LIC	
	2011	2014		2011	2014		2011	2014		2011	2014		2011	2014
Account (% age 15+)	0.314	0.321	0.263	0.312	0.290	0.290	0.284	0.292	0.336	0.276	0.282	0.217	0.337	0.281
Credit card (% age 15+)	0.367	0.363	0.250	0.488	0.433	0.181	0.412	0.407	0.065	0.444	0.429	0.359	0.371	0.225
Debit card (% age 15+)	0.318	0.316	0.273	0.200	0.277	0.297	0.304	0.301	0.324	0.280	0.290	0.224	0.292	0.262
Mobile money (% age 15+)			0.215			0.231			0.275			0.200		0.232
Branches per 100,000 pop.	0.626	0.649		0.767	0.794		0.647	0.710		0.758	0.687		0.609	
ATMs per 100,000 pop.	0.374	0.351		0.233	0.206		0.353	0.290		0.242	0.313		0.391	
Borrower (% age 15+)	0.437	0.447		0.305	0.149		0.444	0.443		0.135	0.246		0.257	
Saver (% age 15+)	0.247	0.268		0.209	0.393		0.323	0.291		0.278	0.553		0.313	
Credit (% GDP)	0.315	0.285		0.487	0.458		0.233	0.266		0.587	0.201		0.430	
Dimension 1 (Access)	0.300	0.292		0.302	0.269		0.237	0.231		0.269	0.193		0.305	
Dimension 2 (Availability)	0.402	0.395		0.434	0.415		0.229	0.483		0.261	0.452		0.487	
Dimension 3 (Usage)	0.298	0.313		0.264	0.316		0.534	0.286		0.470	0.354		0.208	

GDP = gross domestic product, HIC = high-income countries, LIC = low-income countries, MHI = middle–high-income countries, MLI = middle–low-income countries.
Notes: Weights are normalized. Refer to the appendix for data definition and sources.
Source: Authors' calculations.

IV. EMPIRICAL METHODOLOGY AND RESULTS

To address the research questions of the paper, we ran two regression models. First, we tested the covariation between the change or increase in IFI between 2011 and 2014 with average GDP growth in 2011 to 2013, average domestic credit provided by the financial sector to GDP in 2011 to 2013 as proxy for financial sector development, and average level of technology in 2011 to 2013.[10] Specifically, we run the regression equation:

$$\Delta IFI_{2014-11,i} = \alpha + \beta' X_{2011-13,i} + \phi D_i + \varepsilon_i \qquad (5)$$

Table 2: Index of Financial Inclusion Ranking, 2014

Rank	Economy	Code	Income Group	Geographic Group	IFI 2011	IFI 2014
1	Luxembourg	LUX	HIC	EUR	71.81	73.22
2	Spain	SPA	HIC	EUR	68.15	68.66
3	United States	USA	HIC	NAM	63.24	66.33
4	Canada	CAN	HIC	NAM	62.33	66.31
5	New Zealand	NZL	HIC	EAP	62.39	63.15
6	Australia	AUS	HIC	EAP	61.20	62.21
7	Japan	JPN	HIC	EAP	49.83	59.21
8	United Kingdom	UKG	HIC	EUR	54.06	59.07
9	Korea, Republic of	KOR	HIC	EAP	59.16	59.03
10	Switzerland	SWI	HIC	EUR	59.40	59.01
11	Mongolia	MON	MIL	EAP	48.31	56.98
12	Israel	ISR	HIC	MENA	45.99	56.80
13	Norway	NOR	HIC	EUR	58.95	56.09
14	Sweden	SWE	HIC	EUR	55.38	55.77
15	Denmark	DEN	HIC	EUR	59.14	55.50
16	Portugal	POR	HIC	EUR	58.70	54.82
17	France	FRA	HIC	EUR	54.96	54.43
18	Italy	ITA	HIC	EUR	43.30	51.57
19	Hong Kong, China	HKG	HIC	EAP	48.33	50.54
20	Germany	GER	HIC	EUR	47.54	50.37
21	Croatia	HRV	MIH	CEE	46.48	49.99
22	Ireland	IRE	HIC	EUR	51.69	49.72
23	Finland	FIN	HIC	EUR	52.02	49.61
24	Malta	MLT	HIC	EUR	51.08	48.34
25	Slovenia	SVN	HIC	CEE	51.25	47.47
26	Austria	AUT	HIC	EUR	45.38	47.05
27	Cyprus	CYP	HIC	EUR	62.16	46.05

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[10] The larger the domestic credit provided by the financial sector, the deeper the financial system, as it captures not only credit to households and nonfinancial corporations, but also credit to other financial corporations and government. Technology, such as the internet, smart cards, and the use of mobile phones, can help broaden financial access, but it does not necessarily address the underlying distortions limiting access (Claessens 2006).

Rank	Economy	Code	Income Group	Geographic Group	IFI 2011	IFI 2014
28	The Netherlands	NET	HIC	EUR	48.80	45.38
29	Bulgaria	BGR	MIH	CEE	39.19	45.11
30	Belgium	BEL	HIC	EUR	43.45	44.59
31	Russian Federation	RUS	MIH	FSU	32.07	41.54
32	Iran	IRN	MIH	MENA	43.08	41.38
33	Estonia	EST	HIC	CEE	40.85	40.71
34	Slovakia	SVK	HIC	CEE	37.26	40.69
35	Latvia	LVA	HIC	CEE	38.86	39.39
36	Singapore	SIN	HIC	EAP	37.17	39.06
37	Poland	POL	HIC	CEE	32.59	38.58
38	Montenegro	MNE	MIH	EUR	35.54	38.38
39	Czech Republic	CZE	HIC	CEE	35.38	37.76
40	Greece	GRC	HIC	EUR	38.07	35.96
41	Mauritius	MUS	MIH	SSA	35.32	35.72
42	United Arab Emirates	ARE	HIC	MENA	30.38	35.70
43	Thailand	THA	MIH	EAP	36.84	35.45
44	Colombia	COL	MIH	LAC	20.02	34.64
45	Kuwait	KWT	HIC	MENA	46.50	34.49
46	Brazil	BRA	MIH	LAC	30.73	33.38
47	Macedonia	MKD	MIH	CEE	29.33	33.11
48	Costa Rica	CRI	MIH	LAC	27.97	33.05
49	Serbia	SRB	MIH	CEE	34.50	32.89
50	South Africa	ZAF	MIH	SSA	27.78	32.49
51	Malaysia	MAL	MIH	EAP	28.45	32.35
52	China, People's Republic of	PRC	MIH	EAP	25.75	32.08
53	Chile	CHL	HIC	LAC	26.50	31.50
54	Turkey	TUR	MIH	MENA	29.71	31.28
55	Qatar	QAT	HIC	MENA	31.14	31.26
56	Lithuania	LTU	HIC	CEE	29.09	30.57
57	Trinidad and Tobago	TTO	HIC	LAC	29.84	30.28
58	Bosnia and Herzegovina	BIH	MIH	CEE	29.63	30.24
59	Oman	OMN	HIC	MENA	31.06	29.62
60	Georgia	GEO	MIL	FSU	21.58	29.39
61	Romania	ROU	MIH	CEE	27.88	29.24
62	Hungary	HUN	HIC	CEE	30.63	28.44
63	Lebanon	LBN	MIH	MENA	27.16	28.31
64	Saudi Arabia	SAU	HIC	MENA	20.15	27.62
65	Kenya	KEN	MIL	SSA	17.15	27.09
66	Belize	BLZ	MIH	LAC	27.50	26.86
67	Uruguay	URY	HIC	LAC	21.25	26.50
68	Panama	PAN	MIH	LAC	22.30	26.48
69	Sri Lanka	SRI	MIL	SAS	25.22	26.24
70	Guatemala	GTM	MIL	LAC	23.12	25.11

Rank	Economy	Code	Income Group	Geographic Group	IFI 2011	IFI 2014
71	Namibia	NAM	MIH	SSA	25.02	24.22
72	Ukraine	UKR	MIL	FSU	21.47	23.74
73	Bolivia	BOL	MIL	LAC	18.67	23.66
74	Kosovo	UVK	MIL	CEE	21.04	23.06
75	Belarus	BLR	MIH	FSU	23.20	22.74
76	Dominican Republic	DOM	MIH	LAC	20.29	22.71
77	Botswana	BWA	MIH	SSA	14.63	22.63
78	Venezuela	VEN	MIH	LAC	18.69	22.37
79	Jamaica	JAM	MIH	LAC	22.00	22.21
80	Kazakhstan	KAZ	MIH	FSU	20.14	22.01
81	Indonesia	INO	MIL	EAP	14.24	21.95
82	Armenia	ARM	MIL	FSU	19.96	21.69
83	Ecuador	ECU	MIH	LAC	19.51	20.98
84	Argentina	ARG	MIH	LAC	18.99	20.91
85	Albania	ALB	MIH	CEE	20.45	20.83
86	Mexico	MEX	MIH	LAC	17.72	20.62
87	Morocco	MAR	MIL	MENA	19.49	20.56
88	El Salvador	SLV	MIL	LAC	12.34	20.24
89	Uzbekistan	UZB	MIL	FSU	17.10	20.20
90	Honduras	HND	MIL	LAC	16.03	19.40
91	Azerbaijan	AZE	MIH	FSU	15.51	18.82
92	Viet Nam	VIE	MIL	EAP	17.20	18.64
93	Cambodia	CAM	MIL	EAP	11.64	18.07
94	Tunisia	TUN	MIL	MENA	17.97	17.81
95	Uganda	UGA	LIC	SSA	9.92	17.63
96	Jordan	JOR	MIL	MENA	15.89	17.54
97	India	IND	MIL	SAS	14.18	17.12
98	Peru	PER	MIH	LAC	15.60	16.74
99	Swaziland	SWZ	MIL	SSA	16.95	16.49
100	Bhutan	BHU	MIL	SAS	15.94	16.26
101	Paraguay	PRY	MIH	LAC	16.00	16.25
102	Philippines	PHI	MIL	EAP	14.38	15.79
103	Lao People's Democratic Rep.	LAO	MIL	EAP	15.54	15.14
104	Nigeria	NGA	MIL	SSA	10.74	14.62
105	Nepal	NEP	LIC	SAS	12.85	14.41
106	Rwanda	RWA	LIC	SSA	11.56	14.10
107	Moldova	MDA	MIL	CEE	12.76	14.02
108	Ghana	GHA	MIL	SSA	10.48	13.23
109	Nicaragua	NIC	MIL	LAC	9.91	13.12
110	Zimbabwe	ZWE	LIC	SSA	13.55	13.08
111	Angola	AGO	MIL	SSA	17.45	12.92
112	Gabon	GAB	MIH	SSA	7.19	12.82
113	Algeria	DZA	MIH	MENA	7.97	12.50

Rank	Economy	Code	Income Group	Geographic Group	IFI 2011	IFI 2014
114	Kyrgyz Republic	KGZ	MIL	FSU	8.64	12.42
115	Tanzania	TZA	LIC	SSA	8.55	12.28
116	Zambia	ZMB	MIL	SSA	9.80	11.81
117	Bangladesh	BAN	MIL	SAS	18.85	11.80
118	West Bank and Gaza	PSE	MIL	MENA	10.51	11.03
119	Mauritania	MRT	MIL	SSA	8.72	10.86
120	Syria	SYR	MIL	MENA	11.43	10.63
121	Myanmar	MYA	MIL	EAP	10.87	10.38
122	Cote d'Ivoire	CIV	MIL	SSA	7.85	10.03
123	Comoros	COM	LIC	SSA	8.57	8.44
124	Liberia	LBR	LIC	SSA	8.30	8.12
125	Egypt	EGY	MIL	MENA	6.19	7.72
126	Lesotho	LSO	MIL	SSA	7.42	7.66
127	Benin	BEN	LIC	SSA	5.50	7.54
128	Djibouti	DJI	MIL	MENA	7.42	7.49
129	Malawi	MWI	LIC	SSA	8.38	7.38
130	Senegal	SEN	LIC	SSA	5.27	7.25
131	Mali	MLI	LIC	SSA	5.04	7.22
132	Ethiopia	ETH	LIC	SSA	7.63	7.18
133	Congo Republic	COG	MIL	SSA	5.02	7.03
134	Pakistan	PAK	MIL	SAS	5.61	6.77
135	Togo	TGO	LIC	SSA	5.66	6.77
136	Haiti	HTI	LIC	LAC	9.16	6.74
137	Burkina Faso	BFA	LIC	SSA	4.97	6.68
138	Sudan	SDN	MIL	SSA	3.59	6.23
139	Tajikistan	TAJ	MIL	FSU	5.24	6.13
140	Sierra Leone	SLE	LIC	SSA	7.19	5.76
141	Iraq	IRQ	MIH	MENA	7.19	5.52
142	Congo Democratic Republic	COD	LIC	SSA	1.89	4.68
143	Cameroon	CMR	MIL	SSA	5.85	4.55
144	Chad	TCD	LIC	SSA	5.78	3.86
145	Afghanistan	AFG	LIC	SAS	5.69	3.62
146	Madagascar	MDG	LIC	SSA	2.65	3.46
147	Guinea	GIN	LIC	SSA	2.79	3.41
148	Burundi	BDI	LIC	SSA	3.40	3.39
149	Niger	NER	LIC	SSA	1.78	2.79
150	Yemen	YEM	MIL	MENA	2.00	2.12
151	Central African Republic	CAF	LIC	SSA	1.81	1.96

HIC = high-income countries, LIC = low-income countries, MHI = middle-high-income countries, MLI = middle-low- income countries.
Notes: Ranking based on 2014 Index of Financial Inclusion (IFI) values. Refer to section II for the discussion of the construction of the IFI. Hong Kong, China, which is a special administrative region of the People's Republic of China, is classified as a high-income country for purposes of this research.
Source: Authors' calculations.

Figure 1: Index of Financial Inclusion and Sarma Measure (2015)

IFI = Index of Financial Inclusion.
Notes: Level_IFI1114 pertains to the average IFI for 2011 and 2014. Sarma (2015) values refer to the average values for 2011 and 2014. Refer to Table 2 for the definition of the codes.
Source: Authors' calculations.
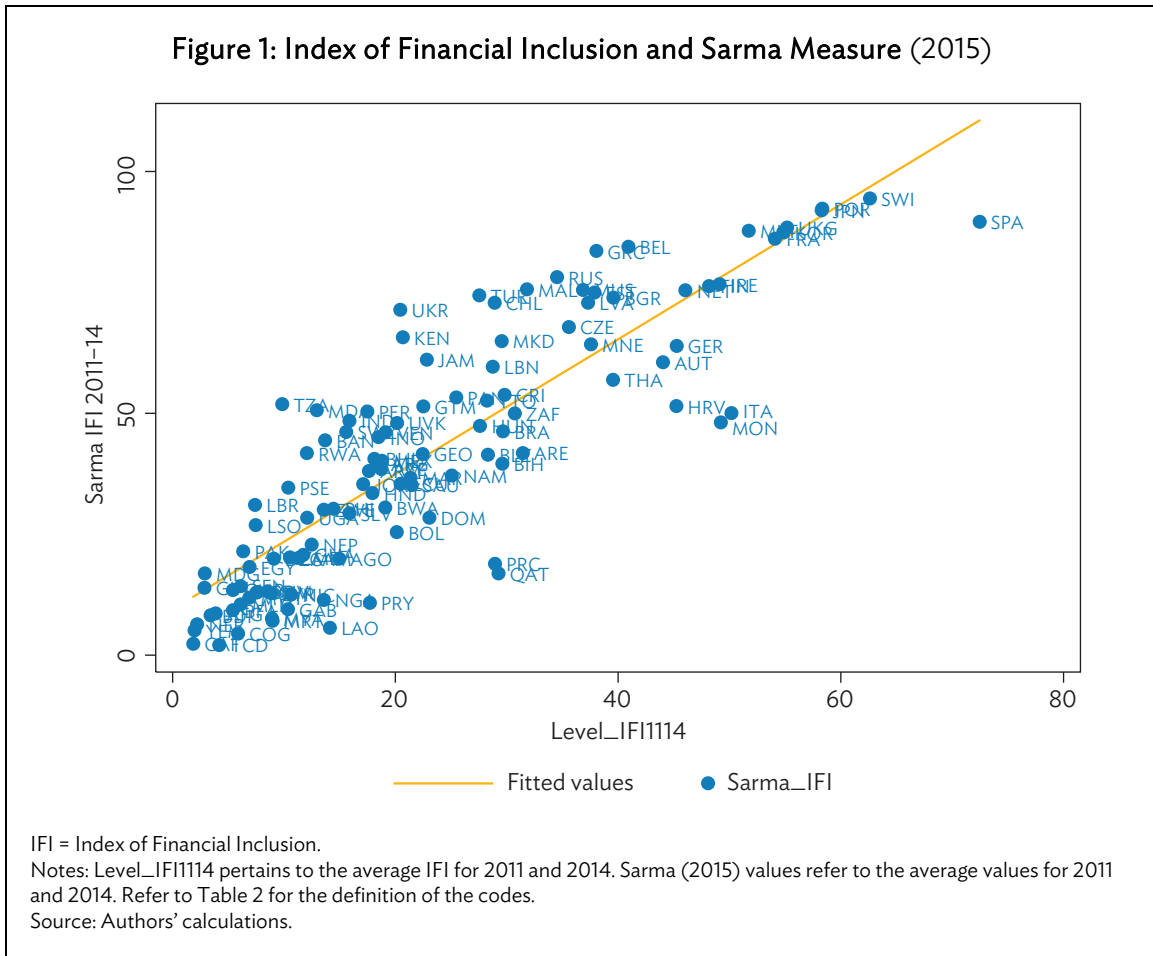
where X_i is the row vector of regressors and D_i is a dummy variable for membership in the Alliance for Financial Inclusion.[11] We estimate Equation 5 to determine whether growth rate, technology, size of financial market (proxied by domestic credit provided by the financial sector), and membership in the financial inclusion alliance significantly covary with the change of financial inclusion for the full sample and individual country income groups.[12] This allows us to assess whether the determinants remain relevant in explaining covariation with the change in financial inclusion across income groups.

Figure 3 illustrates the relationship between the GDP growth rate in 2011–2013 and the change in financial inclusion between sample periods. We observe an upward sloping scatter plot line, implying that economies with high average growth rates in 2011–2013 tend to have increased financial access.

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[11] For the Alliance for Financial Inclusion member central banks and monetary authorities, see https://www.afi-global.org/members/.

[12] We use the proportion of population that accessed the internet in the past 3 months as our technology measure, since it reflects information and communication technology, which aids financial access, following the discussion of Claessens (2006).

Figure 2: Index of Financial Inclusion by Income Group (Median)

HIC = high-income economies, IFI = Index of Financial Inclusion, LIC = low-income economies, MIH = middle-income high economies, MIL = middle-income low economies.
Note: Median values based on the Index of Financial Inclusion presented in Table 3.
Source: Authors' calculations.
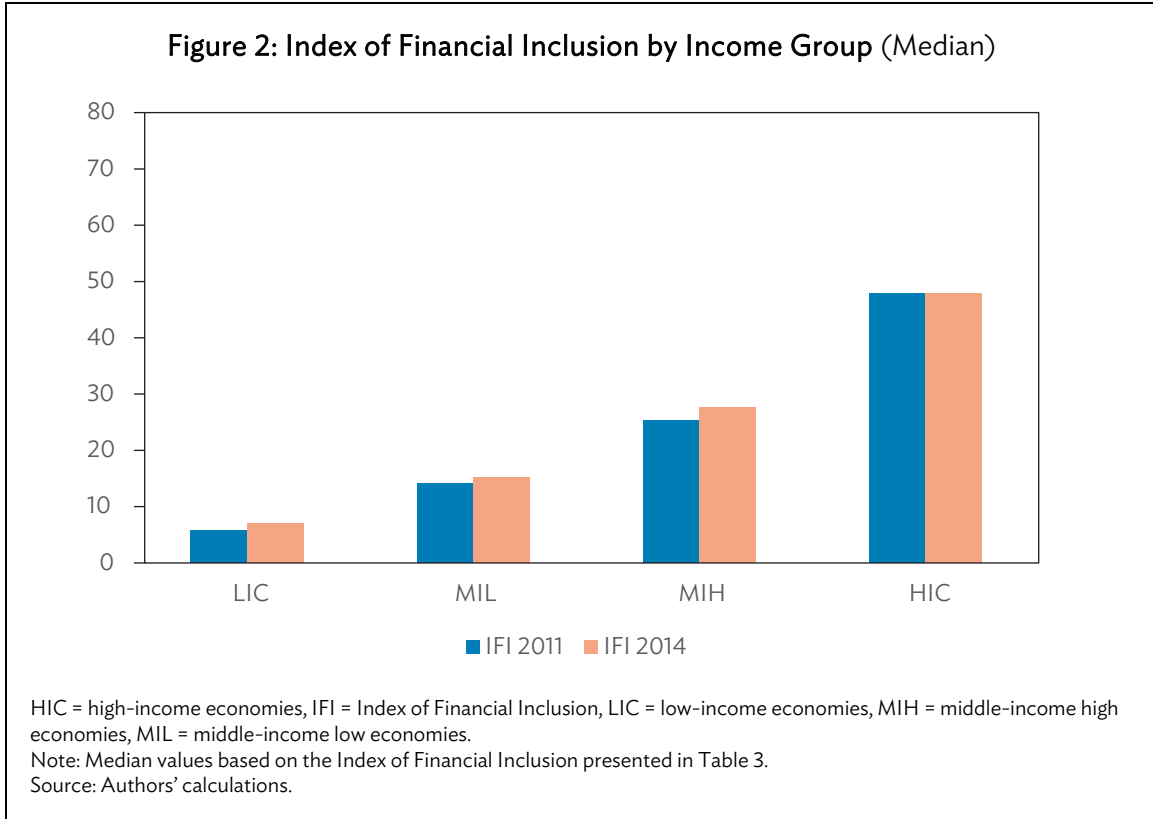
Second, we test the covariation between the average level of financial inclusion in 2011–2014 and the level of poverty, income inequality, entrepreneurship, and female empowerment in 2014–2016. We expect economies with higher financial inclusion would have lower poverty rates and income inequality and higher entrepreneurship (Dupas and Robinson 2009) and female empowerment (Ashraf, Karlan, and Yin 2010). Figure 4 demonstrates this negative relationship between the average level of IFI in 2011–2014 and headline poverty rates in 2014–2016. Figure 5 also exhibits this pattern for income inequality. Figure 6 shows a strong positive correlation between our financial inclusion measure and rule of law, although the correlation may be spurious.

To formally test the covariation, we estimate the regression equation:

$$Y_{2014-16,i} = \alpha + \beta_1 IFI_{2011-14,i} + \beta' X_{2011-13,i} + \phi' D_i + \varphi' D_i * IFI_{2011-14,i} + \varepsilon_i \tag{6}$$

where Y pertains to the average values of poverty, income inequality, entrepreneurship, and female empowerment for 2014–2016. IFI is the average value for financial inclusion in 2011 and 2014. X is a row vector of regressors which includes the average values of secondary education completion and GDP growth rates for 2011–2013.[13] D is a dummy variable for country income groupings. $D*IFI$ is the interaction term between the country income group and financial inclusion.[14] The interaction term in Equation 6 will indicate whether financial inclusion for a specific income group exerts more or less significant impact on poverty and income inequality than other income groups.

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[13] We considered including productivity as one of our explanatory variables. However, any changes in productivity are captured by the average GDP growth rate.

[14] Refer to Table 3 for the country income groups, and the appendix for the full list of data notes and sources.

Figure 3: Change in Financial Inclusion on Gross Domestic Product Growth

Notes: Change refers to the difference of IFI log values in 2011 and 2014. Growth refers to the average gross domestic product growth rate for 2011 to 2013. Refer to Table 2 for the definition of the codes.
Source: Authors' calculations.

Figure 4: Poverty on Index of Financial Inclusion

Notes: Level_IFI1114 pertains to the average IFI for 2011 and 2014. Poverty refers to the average value of poverty headcount ratio for 2014 to 2016. Refer to Table 2 for the definition of the codes.
Source: Authors' calculations.

Figure 5: Income Inequality on Index of Financial Inclusion

Notes: Level_IFI1114 pertains to the average IFI for 2011 and 2014. Income inequality refers to the average value of GINI coefficient for 2014 to 2016. Refer to Table 2 for the definition of the codes.
Source: Authors' calculations.

For both Equations 5 and 6, we limit the number of regressors included to avoid multicollinearity among regressors.[15] We also use robust standard errors to address potential heteroskedasticity. In addition, regressing the dependent and independent variables in two different time periods reduces endogeneity, that is, the explanatory variables are lagged. This empirical approach is recommended to address endogeneity in a cross-section regression without the need to use an instrument variable. Finally, we estimated Equations 5 and 6 using ordinary least squares estimation. We do not use an instrument variable with two-stage least squares estimation because a valid instrument variable is lacking. Using a weak instrument variable would lead to inefficient estimation, as the standard errors in the second-stage regression will be higher, yielding inconsistent results.[16]

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[15]   We run similar estimation including rule of law. However, we find that it is highly correlated with financial inclusion, such that the unconditional correlation between rule of law and financial inclusion is significant at 0.83. This leads to multicollinearity when both rule of law and financial inclusion are included in the empirical specification. Hence, we opted to drop rule of law in our current specification.

[16]   We considered applying a randomized experiment approach using membership in the Alliance for Financial Inclusion as treatment. But given that our sample is a highly heterogeneous group with varying income levels, and the sample is small, we could not apply it.

Figure 6: Rule of Law on Index of Financial Inclusion

Notes: Level_IFI1114 pertains to the average IFI for 2011 and 2014. Rule of law is the average values of the percentile ranking for 2014–16. Data on rule of law are taken from the World Governance Indicators. Refer to Table 2 for the definition of the codes.
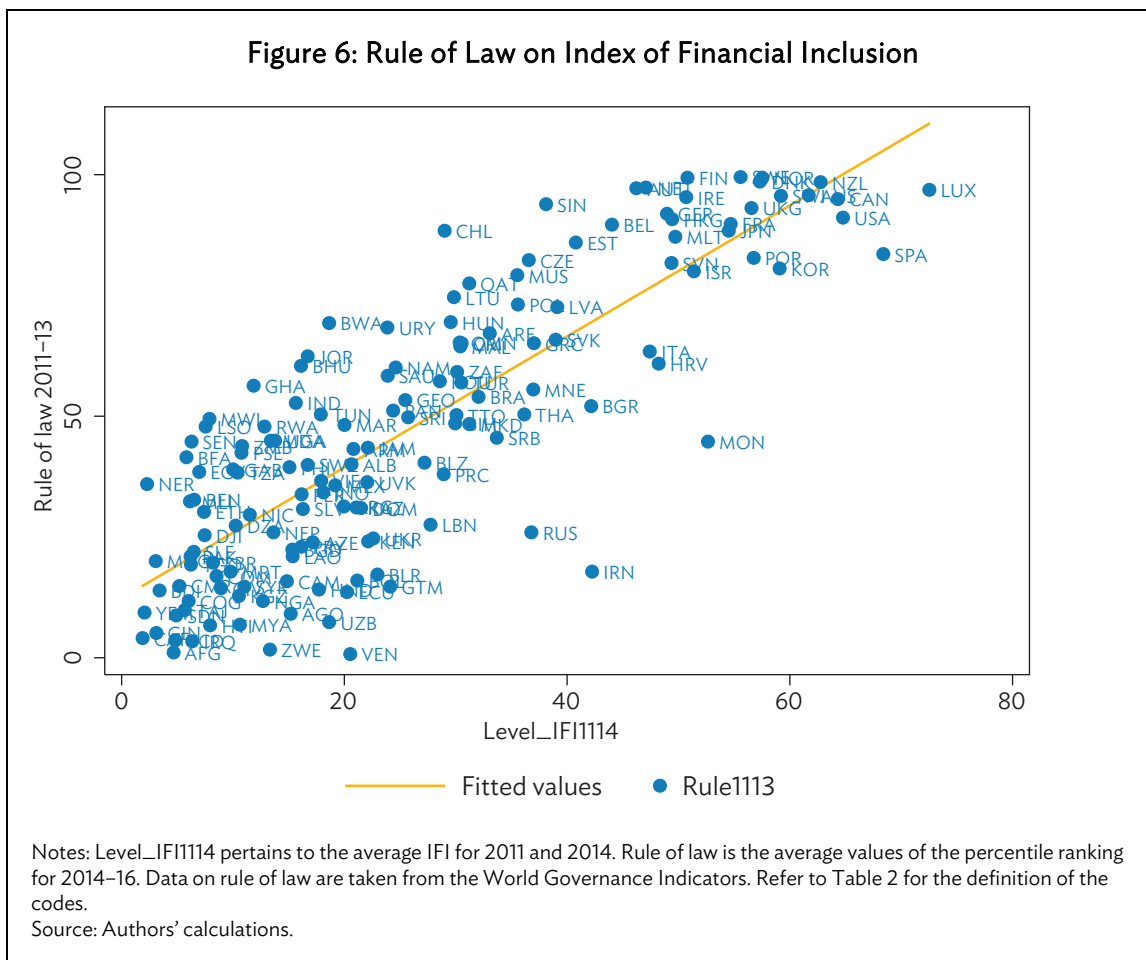Source: Authors' calculations.

Table 3 presents the estimates for Equation 5 on the covariation between the change in financial inclusion and growth, credit, financial sector development, and technology. We do not find significant cross-country covariation between the change in financial inclusion and growth, credit, financial sector development, and technology for the full sample estimates in column (1). But splitting the country income groups into high, middle-high, middle-low, and low-income countries as classified by the World Bank yields some interesting results. The results show that, for high- (column 2) and middle-high (column 3) income economies, higher output growth significantly covaries with higher financial inclusion. However, we do not see the same results for middle-low (column 4) and low-income (column 5) economies. In fact, for both groups, output growth has a negative sign, albeit insignificant. The results indicate that greater financial inclusion significantly covaries with higher output growth only for high- and middle-high-income economies and not for middle-low and low-income economies. This implies the presence of nonlinear effects of economic growth on financial inclusion. In low-income economies, economic growth has no significant effect on financial inclusion. But economic growth can positively influence the degree of financial inclusion in higher-income economies, which might reflect better institutional quality in these economies to allow better access to finance.

Tables 4–8 assess the impact of financial inclusion on poverty, income inequality, entrepreneurship, and female empowerment. Apart from poverty and inequality, we added entrepreneurship and female empowerment, as financial inclusion is often discussed as a key driver for

these two important economic variables in micro-level studies using individual and household survey data. Table 4 presents evidence that economies with higher financial inclusion have significantly lower poverty. However, we do not find similar results for income inequality, entrepreneurship, and female empowerment. We also find that educational attainment significantly covaries with lower poverty, less income inequality, but with less entrepreneurship; and higher output growth significantly covaries with higher income inequality and entrepreneurship.

Table 3: Estimates on the Change in Index of Financial Inclusion, by Income Group

Variables	(1)	(2)	(3)	(4)	(5)
			Change in $IFI_{2011-14}$		
Countries	All Countries	High Income	Middle-High Income	Middle-Low Income	Low Income
$Growth_{2011-13}$	0.005	0.016***	0.018**	−0.001	−0.006
	[1.000]	[3.089]	[2.497]	[−0.083]	[−0.483]
Financial Sector Development$_{2011-13}$	−0.033	0.038	−0.081*	−0.002	0.039
	[−1.114]	[1.271]	[−1.886]	[−0.040]	[0.247]
Technology$_{2011-13}$	0.013	−0.177	0.047	0.041	0.091
	[0.581]	[−1.611]	[0.793]	[0.590]	[0.756]
AFI Member	0.048	0.067	0.002	−0.024	0.193
	[1.461]	[1.208]	[0.038]	[−0.372]	[1.324]
Constant	0.143	0.582	0.185	0.057	−0.267
	[1.198]	[1.309]	[0.579]	[0.279]	[−0.402]
Observations	135	40	35	40	20
R-squared	0.070	0.301	0.321	0.023	0.085

AFI = Alliance for Financial Inclusion, IFI = Index of Financial Inclusion.
Notes: Dependent variable is the change in IFI from 2011 to 2014. Refer to the appendix for definition and data sources of Growth, Credit, Technology, and AFI membership. Refer to Table 2 for the list of economies included in each income group. t-stats are reported in brackets.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors are used.
Source: Authors' estimates.

Tables 5 and 6 present the results when we split the sample into high- and middle-high and middle-low and low-income economies[17]. For high- and middle-high-income economies, in Table 5, we find that higher financial access significantly covaries with lower poverty rates, while educational attainment significantly covaries with lower poverty rates, income inequality, but lower entrepreneurship. In contrast, in Table 6, we do not find financial inclusion to be significant for middle-low and low-income economies. Nonetheless, we find higher educational attainment to significantly covary with lower poverty rates for the subset of economies. Tables 5 and 6 provide evidence from high- and middle-high-income economies that financial inclusion significantly lowers poverty. It could suggest that middle-low and low-income economies may have other features that impede the effect of financial inclusion on poverty and income inequality.[18] Exploring interaction effects between financial inclusion and other factors might be worthwhile in assessing whether financial inclusion alone is a sufficient factor in lowering poverty and income inequality. This is because, as suggested by Beck,

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[17] We combined high-and middle-high-income and middle-low and low-income economies in both regressions to have sufficient sample size to assume normality of both samples.
[18] Kenya would be a case in point. It has relatively high financial inclusion given the widespread use of mobile money. However, poverty remains high, perhaps due to other factors, or the impact of financial inclusion on poverty might take time to be reflected on an aggregate level.

Demirgüç-Kunt, and Honohan (2009), financial access may lower poverty and income inequality, not through the direct provision of financial services to low-income groups, but through higher wages and higher participation in the formal sector of the economy. For middle-low and low-income economies, such indirect effects may dominate the direct effects due to inefficient financial systems and ineffective provision of financial services to the poor.

Table 4: Estimates on Poverty, Income Inequality, Entrepreneurship, and Female Empowerment, Full Sample

Variables	Poverty$_{14-16}$	Income Inequality$_{14-16}$	Entrepre$_{14-16}$	Female Empower$_{14-16}$
Financial Inclusion$_{2011-14}$	−0.300***	−0.027	−0.032	−0.074
	[−3.379]	[−0.525]	[−1.124]	[−0.777]
Education Completion$_{2011-13}$	−0.228***	−0.118***	−0.086***	−0.084
	[−3.019]	[−2.919]	[−3.914]	[−1.357]
Growth$_{2011-13}$	−0.308	0.423*	0.424***	0.345
	[−0.711]	[1.857]	[4.463]	[0.764]
Constant	47.706***	44.324***	11.240***	48.002***
	[9.658]	[17.810]	[8.582]	[10.521]
Observations	91	86	118	118
R-squared	0.433	0.298	0.448	0.075

Notes: Dependent variables are average values of poverty, income inequality, entrepreneurship, and female empowerment for 2014 to 2016. The regressors are average values of financial inclusion for 2011 and 2014; and education completion and gross domestic product growth rates for 2011 to 2013. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors are used for t-stats reported in brackets.
Source: Authors' estimates.

Table 5: Estimates on Poverty, Income Inequality, Entrepreneurship, and Female Empowerment, High- and Middle-High-Income Economies

Variables	Poverty$_{14-16}$	Income Inequality$_{14-16}$	Entrepre$_{14-16}$	Female Empower$_{14-16}$
Financial Inclusion$_{2011-14}$	−0.192*	−0.066	−0.009	−0.017
	[−1.887]	[−1.201]	[−0.377]	[−0.150]
Education Completion$_{2011-13}$	−0.151**	−0.238***	−0.057**	0.021
	[−2.035]	[−5.193]	[−2.340]	[0.238]
Growth$_{2011-13}$	−0.316	0.670***	0.220**	0.261
	[−0.761]	[3.008]	[2.122]	[0.367]
Constant	35.933***	55.885***	8.048***	36.860***
	[5.054]	[17.856]	[4.414]	[4.147]
Observations	55	55	70	70
R-squared	0.194	0.634	0.291	0.003

Notes: Dependent variables are average values of poverty, income inequality, entrepreneurship, and female empowerment for 2014 to 2016. The regressors are average values of financial inclusion for 2011 and 2014; and education completion and gross domestic product growth rates for 2011 to 2013. Refer to Table 2 for the list of economies included in the high- (HIC) and middle-high (MIH) income groups. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors are used for t-stats reported in brackets.
Source: Authors' estimates.

Table 6: Estimates on Poverty, Income Inequality, Entrepreneurship, and
Female Empowerment, Middle-Low and Low-Income Economies

Variables	$Poverty_{14-16}$	Income Inequality$_{14-16}$	$Entrepre_{14-16}$	Female Empower$_{14-16}$
Financial Inclusion$_{2011-14}$	−0.321	0.145	−0.041	−0.134
	[−0.846]	[0.788]	[−0.398]	[−0.444]
Education Completion$_{2011-13}$	−0.225*	−0.072	−0.083**	−0.092
	[−1.981]	[−1.173]	[−2.319]	[−0.954]
Growth$_{2011-13}$	−0.407	−0.583	0.540***	0.422
	[−0.370]	[−1.042]	[2.708]	[0.617]
Constant	50.408***	43.157***	11.324***	50.223***
	[7.524]	[13.931]	[6.825]	[9.292]
Observations	36	31	48	48
R-squared	0.274	0.091	0.202	0.048

Notes: Dependent variables are average values of poverty, Income inequality, entrepreneurship and female empowerment for 2014 to 2016. The regressors are average values of financial inclusion for 2011 and 2014; and education completion and gross domestic product growth rates for 2011 to 2013. Refer to Table 2 for the list of economies included in the middle-low (MIL) and low-income (LIC) groups. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors are used for t-stats reported in brackets.
Source: Authors' estimates.

Tables 7a–7d present the results when we control for different income groups and their interaction effects with financial inclusion to assess whether belonging to a specific income group has significantly different impact on our parameters of interest, as compared to other groups. Table 7a validates that higher financial inclusion significantly covaries with lower poverty rates, while we do not see the same effect for income inequality, entrepreneurship, and female empowerment. More importantly, the estimates indicate that, for high-income economies, a one-unit increase in financial inclusion is significantly correlated with lower poverty rates by around 0.04%, whereas the decline for other income groups would be around 0.44%. This implies that the significant impact of financial inclusion on poverty for high-income economies is considerably less than those for other income groups. This finding is intuitive given that high-income economies have significantly lower poverty rates than other income groups, and so the decline in poverty would be smaller given an increase in financial inclusion.

Tables 7b and 7c also show that higher financial inclusion significantly covaries with lower poverty rates. However, we do not find significant effects of financial inclusion on income inequality, entrepreneurship, and female empowerment in any income group. In addition, the interaction terms between middle-income groups and financial inclusion are insignificant, implying that belonging to middle-high and middle-low-income economies do not make the impact of financial inclusion on poverty greater or weaker compared to other income groups. Table 7d presents the results on the interaction term between financial inclusion and low-income economies, which is insignificant. We find that the effect of financial inclusion is significant for poverty. In addition, educational attainment significantly covaries with lower poverty, income inequality, and entrepreneurship, consistent with previous studies on poverty. What the interaction effects tell us is that it is only for high-income economies, that the impact of financial inclusion on poverty is considerably less, given that poverty rates are lower in these economies.

Table 7a: Estimates on Poverty, Income Inequality, Entrepreneurship, and Female Empowerment, with High-Income Interaction Effects

Variables	Poverty$_{14-16}$	Income Inequality$_{14-16}$	Entrepre$_{14-16}$	Female Empower$_{14-16}$
Financial Inclusion$_{2011-14}$	−0.442**	0.134	−0.068	−0.050
	[−2.376]	[1.260]	[−1.289]	[−0.262]
Education Completion$_{2011-13}$	−0.195**	−0.125***	−0.076***	−0.057
	[−2.396]	[−2.901]	[−3.206]	[−0.858]
Growth$_{2011-13}$	−0.392	0.267	0.406***	0.219
	[−0.782]	[0.938]	[4.007]	[0.479]
HIC	−17.850**	2.971	−6.153***	−19.859***
	[−2.512]	[0.575]	[−3.656]	[−2.910]
HIC*Financial Inclusion$_{2011-14}$	0.403**	−0.195	0.132**	0.300
	[2.051]	[−1.573]	[2.544]	[1.364]
Constant	49.312***	42.802***	11.607***	47.860***
	[9.556]	[15.167]	[8.385]	[10.928]
Observations	91	86	118	118
R-squared	0.455	0.354	0.471	0.118

HIC = high-income economies.
Notes: Dependent variables are average values of poverty, income inequality, entrepreneurship and female empowerment for 2014 to 2016. The regressors are average values of financial inclusion for 2011 and 2014; and education completion and gross domestic product growth rates for 2011 to 2013. Refer to Table 2 for the list of economies included in each income group. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors are used for t-stats reported in brackets.
Source: Authors' estimates.

Table 7b: Estimates on Poverty, Income Inequality, Entrepreneurship, and Female Empowerment, with Middle-High-Income Interaction Effects

Variables	Poverty$_{14-16}$	Income Inequality$_{14-16}$	Entrepre$_{14-16}$	Female Empower$_{14-16}$
Financial Inclusion$_{2011-14}$	−0.317***	−0.011	−0.044	−0.107
	[−3.791]	[−0.206]	[−1.451]	[−1.059]
Education Completion$_{2011-13}$	−0.221***	−0.124***	−0.081***	−0.075
	[−3.025]	[−3.039]	[−3.581]	[−1.176]
Growth$_{2011-13}$	−0.268	0.363*	0.419***	0.438
	[−0.620]	[1.833]	[4.286]	[1.044]
MHI	−6.970	8.180*	−3.241*	−12.065
	[−0.860]	[1.956]	[−1.868]	[−1.155]
MHI*Financial Inclusion$_{2011-14}$	0.136	−0.095	0.077	0.469
	[0.513]	[−0.837]	[1.406]	[1.278]
Constant	48.405***	43.032***	11.570***	47.848***
	[9.715]	[18.340]	[8.414]	[10.793]
Observations	91	86	118	118
R-squared	0.443	0.403	0.461	0.097

MHI = middle-high-income countries.
Notes: Dependent variables are average values of poverty, income inequality, entrepreneurship and female empowerment for 2014 to 2016. The regressors are average values of financial inclusion for 2011 and 2014; and education completion and gross domestic product growth rates for 2011 to 2013. Refer to Table 2 for the list of economies included in each income group. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors are used for t-stats reported in brackets.
Source: Authors' estimates.

Table 7c: Estimates on Poverty, Income Inequality, Entrepreneurship, and Female Empowerment, with Middle-Low-Income Interaction Effects

Variables	$Poverty_{14-16}$	Income Inequality$_{14-16}$	$Entrepre_{14-16}$	Female Empower$_{14-16}$
Financial Inclusion$_{2011-14}$	−0.357***	−0.052	−0.020	−0.066
	[−3.292]	[−0.949]	[−0.661]	[−0.606]
Education Completion$_{2011-13}$	−0.225***	−0.119***	−0.089***	−0.085
	[−2.933]	[−2.866]	[−4.086]	[−1.332]
Growth$_{2011-13}$	−0.611	0.451*	0.407***	0.375
	[−1.085]	[1.677]	[3.343]	[0.773]
MLI	−5.621	−2.301	1.131	0.827
	[−0.917]	[−0.583]	[0.560]	[0.138]
MLI*Financial Inclusion$_{2011-14}$	0.311	0.023	−0.006	−0.046
	[1.064]	[0.137]	[−0.073]	[−0.160]
Constant	50.432***	45.590***	10.876***	47.715***
	[8.449]	[13.252]	[6.679]	[9.375]
Observations	91	86	118	118
R-squared	0.440	0.308	0.454	0.075

MLI = middle-low-income countries.
Notes: Dependent variables are average values of poverty, income inequality, entrepreneurship and female empowerment for 2014 to 2016. The regressors are average values of financial inclusion for 2011 and 2014; and education completion and gross domestic product growth rates for 2011 to 2013. Refer to Table 2 for the list of economies included in each income group. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors are used for t-stats reported in brackets.
Source: Authors' estimates.

Table 7d: Estimates on Poverty, Income Inequality, Entrepreneurship, and Female Empowerment, with Low-Income Interaction Effects

Variables	$Poverty_{14-16}$	Income Inequality$_{14-16}$	$Entrepre_{14-16}$	Female Empower$_{14-16}$
Financial Inclusion$_{2011-14}$	−0.275***	−0.042	−0.031	−0.068
	[−3.123]	[−0.779]	[−1.111]	[−0.713]
Education Completion$_{2011-13}$	−0.170**	−0.138***	−0.075***	−0.041
	[−2.097]	[−3.192]	[−3.078]	[−0.551]
Growth$_{2011-13}$	−0.401	0.443*	0.378***	0.190
	[−0.920]	[1.918]	[3.698]	[0.403]
LIC	14.548	−8.622	−0.636	−0.369
	[1.636]	[−1.509]	[−0.189]	[−0.038]
LIC*Financial Inclusion$_{2011-14}$	−0.214	0.290	0.344	1.031
	[−0.183]	[0.593]	[0.895]	[1.116]
Constant	42.093***	46.542***	10.388***	44.580***
	[7.211]	[16.901]	[6.842]	[7.739]
Observations	91	86	118	118
R-squared	0.479	0.341	0.468	0.107

LIC = low-income countries.
Notes: Dependent variables are average values of poverty, income inequality, entrepreneurship and female empowerment for 2014 to 2016. The regressors are average values of financial inclusion for 2011 and 2014; and education completion and gross domestic product growth rates for 2011 to 2013. Refer to Table 2 for the list of economies included in each income group. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors are used for t-stats reported in brackets.
Source: Authors' estimates.

The estimates also show that educational attainment covaries strongly with lower poverty and income inequality, in line with previous studies. However, educational attainment has a negative relationship with entrepreneurship, which shows up consistently across Tables 4–7. A possible explanation for this is that those without higher educational attainment have higher likelihood of starting their own business as they might have insufficient qualifications to be employed in the formal sector and, hence, they become more entrepreneurial. The estimates also indicate that financial inclusion does not increase women's empowerment. Buvinić and Furst-Nichols (2016) find that interventions through small cash loans or grants have varying outcomes on female empowerment depending on women's characteristics, such as income group, skills, and income source. Likewise, Calderon, Iacovone, and Juarez (2016) find heterogeneity across female entrepreneurship in Mexico. In contrast, Ghosh and Vinod (2017) and Swamy (2014) find female headed households have lower access to finance in India. As our data set is on the aggregate country level, we are not able to capture such effects.

In summary, we provide robust evidence that higher financial inclusion significantly covaries with lower poverty rates (Table 4). But the significant covariation between financial inclusion and poverty is mainly attributed to high- and middle-high-income economies (Table 5). Furthermore, the covariation between financial inclusion and poverty is considerably less for high-income economies than other income groups, as poverty rates are lower in high-income economies, and, thus, the reduction in poverty rates smaller (Table 7a). Taken together, these results imply that the covariation between financial inclusion and poverty differs across country income levels, reflecting different socioeconomic and other structural features associated with varying stages of economic development, including financial development. This key finding is new to the financial inclusion empirical literature, and in line with the model predictions of Bhattacharya and Patnaik (2015).

Our results remain robust when we use varying indicator and dimension weights based on country income group samples.[19] This is expected, as there is little difference between the financial inclusion index when country group weights are used. We also run robustness checks considering institutional quality. Table 8 presents the estimates when we add the rule of law variable.[20] The findings show that economies with higher financial inclusion have significantly lower poverty rates, but the magnitude of covariance is much smaller for the economies with high rule of law. The interaction term between high financial inclusion and high rule of law suggest the effect of financial inclusion on poverty reduction decreases over the degree of rule of law. Interestingly, we also find that, accounting for rule of law, financial inclusion significantly covaries with higher income inequality, but the covariation is significantly less for countries with high rule of law compared to other groups. The positive covariation between financial inclusion and income inequality may be likely at the early stage of economic development. What our estimates also demonstrate is that the magnitude of covariation significantly decreases as the rule of law improves. Given that countries with high rule of law are usually those with high per capita income, the findings imply that as countries develop, financial inclusion could help contain further widening of income inequality. Overall, these results demonstrate that the effects of financial inclusion on poverty and income inequality vary across countries with different institutional qualities such as presented by the rule of law.

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[19]   See Table 1 for the indicator and dimension weights based on country income group samples.
[20]   We transformed our measure of rule of law, as discussed in the appendix, to avoid multicollinearity between financial inclusion and rule of law.

Table 8: Estimates on Poverty, Income Inequality, Entrepreneurship, and
Female Empowerment, with Rule of Law

Variables	Poverty$_{14-16}$	Income Inequality$_{14-16}$	Entrepre$_{14-16}$	Female Empower$_{14-16}$
Financial Inclusion$_{2011-14}$	−0.559*	0.319**	−0.063	0.019
	[−1.772]	[2.000]	[−0.704]	[0.050]
Education Completion$_{2011-13}$	−0.206***	−0.134***	−0.082***	−0.077
	[−2.690]	[−3.212]	[−3.548]	[−1.166]
Growth$_{2011-13}$	−0.345	0.335	0.410***	0.260
	[−0.820]	[1.294]	[4.254]	[0.633]
Rule of Law	−7.290**	2.488	−1.531*	−5.836**
	[−2.634]	[1.456]	[−1.830]	[−2.042]
Law*Financial Inclusion$_{2011-14}$	0.137*	−0.105***	0.023	0.041
	[1.823]	[−2.706]	[1.067]	[0.427]
Constant	59.870***	38.645***	13.755***	56.428***
	[9.363]	[9.776]	[6.569]	[9.166]
Observations	91	86	118	118
R-squared	0.476	0.349	0.465	0.122

Notes: Dependent variables are average values of poverty, income inequality, entrepreneurship and female empowerment for 2014 to 2016. The regressors are average values of financial inclusion for 2011 and 2014; and education completion and gross domestic product growth rates for 2011 to 2013. Rule of law is an index with values 1 to 4 corresponding to the quartile ranking of economies in the World Governance Indicators. Refer to Table 2 for the list of economies included in each income group. *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Robust standard errors are used for t-stats reported in brackets.
Source: Authors' estimates.

V. CONCLUSIONS

This paper constructs a new index of financial inclusion for 151 economies using weights derived from principal component analysis in aggregating indicators for access, availability, and usage. Using the World Bank's Global Findex database, we combine Sarma's (2008) multidimensional approach with the normalized weights from principal component analysis of Camara and Tuesta (2014) in deriving our index. The financial inclusion index shows that the weights using principal component analysis are relatively stable for two survey periods, suggesting its suitability in measuring financial inclusion.

Using the index, this paper first investigates what matters for financial inclusion. The results show that greater financial inclusion significantly covaries with higher output growth among high- and middle-high-income economies. The results do not hold for middle-low and low-income economies. This implies the presence of nonlinear effects of economic growth and financial sector development on financial inclusion. It may be due to high institution quality in high-income economies that helps positive workings of economic growth and financial sector development on financial inclusion.

This paper also assesses the cross-country impact of financial inclusion on poverty and income inequality. Using a cross-sectional approach, our estimates provide robust evidence that economies with high financial inclusion have significantly lower poverty rates, using a recent sample period. In addition, splitting the sample by country income groups, we find higher financial inclusion significantly covaries with lower poverty rates for high- and middle-high-income economies. We do not find similar

results for middle-low and low-income economies. However, we find that the impact of financial inclusion on poverty is considerably less for high-income economies than for other income groups. Accounting for rule of law, our results indicate that the effects of financial inclusion on poverty and income inequality change subject to the degree of institutional quality, such that the effects of financial inclusion on poverty reduction and income inequality become weaker for countries with high rule of law.

APPENDIX: DATA DEFINITION AND SOURCES

Variable	Definition	Sources
Account (% aged 15+)	Population 15 years old and above to total population with an account in a financial institution	World Bank, Global Financial Inclusion database
Credit Card (% aged 15+)	Population 15 years old and above to total population with a credit card	World Bank, Global Financial Inclusion database
Debit Card (% aged 15+)	Population 15 years old and above to total population with a debit card	World Bank, Global Financial Inclusion database
Mobile Money Account (% aged 15+)	Population 15 years old and above to total population with mobile money account	World Bank, Global Financial Inclusion database
Branches	Number of commercial bank branches per 100,000 adult population	World Bank, World Development Indicators
ATMs	Number of ATMs per 100,000 adult population	World Bank, World Development Indicators
Borrower (% aged 15+)	Borrowed from a financial institution, percentage of population 15 years old and above	World Bank, Global Financial Inclusion database
Saver (% aged 15+)	Saved in a financial institution, percentage of population 15 years old and above	World Bank, Global Financial Inclusion database.
Credit (% GDP)	Domestic credit to the private sector as % of nominal GDP	World Bank, World Development Indicators
Change in IFI$_{2011-14}$	Log difference of IFI for 2011 and 2014	Authors calculations
Growth$_{2011-13}$	Average GDP growth rate for 2011 to 2013 (%)	World Bank, World Development Indicators
Credit$_{2011-13}$	Average of domestic credit provided by the financial sector for 2011 to 2013 (% of GDP), converted to log value	World Bank, World Development Indicators
Technology$_{2011-13}$	Average percentage of population who used the internet in the past 3 months for 2011 to 2013 (% of population), converted to log value	World Bank, World Development Indicators
AFI Member	Dummy variable with a value of 1 if a country has an institution that is a member of the Alliance for Financial Inclusion; 0 otherwise	Alliance for Financial Inclusion
Per capita GDP$_{2011-13}$	Average of the log value of real GDP per capita (PPP in constant US dollars)	World Bank, World Development Indicators
Poverty$_{2014-16}$	Average of poverty headcount ratio at national poverty lines for 2014 to 2016 (% of population); if data is unavailable for 2014, the most recent data is used up to 2010	Asian Development Bank (Basic Statistics), OECD Statistics, and World Bank (World Development Indicators)
Income Inequality$_{2014-16}$	Average of GINI Index for 2014–16; if data is unavailable for 2014, the most recent data is used up to 2010	Asian Development Bank (Basic Statistics), OECD Statistics, UNU-WIDER, and World Bank (World Development Indicators)
Entrepre$_{2014-16}$	2014 value of population age 15 and above who borrowed to start, operate or expand a farm or business (%)	World Bank, Global Financial Inclusion database

Variable	Definition	Sources
Female Empower$_{2014–16}$	2014 value of the percentage of female population age 15 and above who borrowed in a financial institution for any purpose (%)	World Bank, Global Financial Inclusion database
Education Completion$_{2011–13}$	Average value of the percentage of population ages 25 and over who attained or completed lower secondary education. Values can be for an earlier period if 2011 to 2013 data are unavailable.	Barro and Lee Data Set from Barro and Lee (2013), UNESCO Institute of Statistics, World Bank (World Development Indicators)
Rule of Law	Values refer to the average of the percentile ranking of countries. Data for Table 8 take the value of 1 if a country falls in the lowest quartile, 2 for the second lowest quartile, 3 for the second highest quartile, and 4 for the higher quartile. The values are transformed to avoid multicollinearity in Table 8.	World Bank, World Governance Indicators

AFI = Alliance for Financial Inclusion, GDP = gross domestic product, IFI = Index of Financial Inclusion, OECD = Organisation for Economic Co-operation and Development, PPP = purchasing power parity, UNESCO = United Nations Educational, Scientific and Cultural Organization, UNU-WIDER = United Nations University World Institute for Development Economics Research, US = United States.
Source: Authors' enumeration.

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Financial Inclusion: New Measurement and Cross-Country Impact Assessment

Financial inclusion—one of the pillars of the global development agenda—aids inclusive growth and economic development. This paper introduces a new index of financial inclusion for 151 economies using principal component analysis to compute weights for aggregating nine indicators of access, availability, and usage. It then assesses the impact of financial inclusion on poverty and income inequality. The results indicate that high- and middle-high-income economies with high financial inclusion have significantly lower poverty, while no such relation exists for middle-low and low-income economies. The nonlinearities in the cross-country determinants and impacts of financial inclusion on poverty and income inequality across income groups are important to choosing appropriate policies for achieving inclusive growth in different development stages.

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