




Foreign direct investment and inclusive finance: do financial markets and quality of institutions matter?

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Received: 14 March 2023 / Accepted: 10 February 2024
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Abstract

We examine the impact of foreign direct investment (FDI) on financial inclusion. To identify the causal effect of FDI on financial inclusion, we use plausibly exogenous source of variations in bilateral investment treaties (BITs) as a novel instrumental variable (IV) for net FDI inflows. Using annual data for a broad panel of 90 countries over the period 2004 to 2017, our results show that FDI improves financial inclusion for both “access to finance” and “use of financial services”. This impact is more pronounced for relatively poor countries and developing countries compared to rich and developed countries. We also find that higher financial market development and quality institutions improve financial inclusion directly. Moreover, financial market development and institutional quality can serve as potential channels and moderating variables through which FDI affects financial inclusion. Our results are robust to

We are grateful to one associate editor and two anonymous referees for their valuable comments, which helped to improve the quality and readability of the article. We also would like to thank seminar participants at the Centre for Global Finance (CGF), University of London for helpful comments. All the remaining errors are our own.

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various estimations and sample splitting and have important implications for policy on financial inclusion.

Keywords FDI · Financial inclusion · Financial market development · Institutional quality · Bilateral investment treaties

JEL Classification E44 · F21 · G21

1 Introduction

Finance literature abounds on inequality and how the gap between population subsets could be bridged. In this study, we concentrate on a type of inequality that has the potential of further worsening poverty and inhibiting national growth: financial inclusion (exclusion). For many parts of the world, especially low-income countries, financial inclusion remains a luxury. Even though global financial inclusion improved by about 18 per cent between 2011 and 2017 (Demirgüç-Kunt et al. 2018), more people especially the poor are still financially excluded. For instance, globally, about 31% of adult population have no account with a financial institution or mobile money with about 200 million adults in rural China alone out of the formal financial services (Demirgüç-Kunt et al. 2018). The literature on financial inclusion is not in dearth. Many of these studies have, however, centred on the measurement and the impact of inclusion on income inequality (Dabla-Norris et al. 2015), poverty reduction (Awaworyi Churchill and Marisetty 2020; Neaime and Gaysset 2018), financial development (Anarfo et al. 2019) and economic growth (Allen et al. 2016; Demirgüç-Kunt and Klapper 2012; Sharma 2016).

Foreign direct investment (FDI hereafter) has, for a very long time, been a policy goal of many economies, especially for developing countries. The argument for FDI has, in most cases, been anchored on growth and income-related outcomes. However, defending FDI with only growth, and income-related utility may be limiting and too simplistic. If so, it seems to suggest that in countries where no positive relationship exists between FDI and growth, governments should be discouraged from investing in promoting FDI. We posit that the benefit of FDI may be indirect on growth even if growth is argued to be the ultimate measure of welfare. FDI can drive several economic outcomes aside economic growth (Agbloyor et al. 2014) to include wages and employment (Zhao 1998), institutional quality (Long et al. 2015), and income inequality (Liu et al. 2023). Chief among them yet somehow neglected by the literature is financial inclusion.

FDI can help expand the financial sector and increase financial inclusion. Multi-national firms are seen to bring technology and knowledge transfer that can spillover to and improve the efficiency of domestic firms; for financial firms, this presents an opportunity to improve their efficiency and extend their services to the financially excluded. Therefore, FDI has the potential to increase financial inclusion. There are, however, little empirical evidence that explore the potential impact of FDI on financial inclusion. Moreover, we know little about the transmission channels through which FDI influences financial inclusion. Together, these are significant shortcomings in the

existing literature on the relationship between FDI and financial inclusion when policy makers are increasingly cared about the role of FDI.

In the present study, we investigate the role of FDI in driving financial inclusion using data on a panel of 90 countries from 2004 to 2017. We contribute to the literature in four ways. First, this is the first study, to the best of our knowledge, that uses cross-country panel data to investigate the causal link between FDI and financial inclusion.

Second, we develop a composite index for financial inclusion that captures both dimensions of access and use of financial services to examine how FDI affects financial inclusion. This gives a broader scope of the study to capture how FDI affects both dimensions of financial inclusion.

Our third contribution is that we use bilateral investment treaties (BITs) as a novel instrumental variable (IV) for net FDI inflows. Studies such as Bhagwat et al. (2021) found that BITs have a positive impact on cross-border mergers—a form of capital flows—by protecting the property rights of foreign acquirers. The authors found a doubling of the probability and dollar volume of mergers after the signing of a BIT. The study found that BITs are effective in improving capital flows especially from developed countries to developing countries. We therefore find BIT is a plausible and novel instrument for FDIs.

Our fourth contribution is to examine the role of financial market development and institutional quality as a potential mediator of the relationship between FDI and financial inclusion. We argue that FDI through the financial market has the ability to increase the supply of loanable funds within the financial market. Such increase could lessen the stringent credit requirements in times of shortage of loanable funds; thereby increasing the likelihood of credit being advanced to the financially excluded. On the other hand, capital flows even to non-deposit taking institutions could increase investment and savings, which would eventually flow to the financial sector. With the flow of funds into the sector, financial institutions can extend their services to areas that hitherto were not serviced. Moreover, capital is likely to flow into countries with strong institutional framework that protects investor rights. We therefore explore whether financial market development and the quality of institutions play a role in the FDI-financial inclusion nexus.

Foreshadowing the main results, we find that FDI has a direct positive impact on inclusive finance. Our results also suggest that domestic financial markets and institutional quality can serve as a channel through which FDI affects financial inclusion. Moreover, countries with higher level of domestic financial market development and stronger institutional quality amplify the positive effect of FDI on financial inclusion.

The rest of the paper is organized as follows. Sect. 2 provides a brief review of related literature. Section 3 describes the dataset. Section 4 presents the empirical methodology used in this study. Section 5 discusses empirical findings and conducts mechanism analysis. Section 6 concludes with policy recommendations provided.

2 Definitions, measures of financial inclusion and review of related studies

There is a large body of research on financial inclusion—mainly on its definition, determinants and its impact on economic outcomes. In a broader sense, Naceur et al. (2015) define financial inclusion as the share of the population who use financial services. This definition is also adopted by the World Bank in the 2014 Global Financial Development Report (World Bank 2014). Demirgüç-Kunt et al. (2017) more specifically in the 2017 Global Financial Indicators Database define financial inclusion to involve adults having access to and use of financial services. This shows two main components of financial inclusion—financial access and usage. These financial services like access to credit helps people to be able to undertake critical financial transactions like financing education, health or business which can translate into poverty reduction and growth.

The World Bank (2014) in the 2014 Global Financial Development Report show several measures of financial inclusion. These have largely been categorized into financial access and usage. On financial access, The World Bank (2014) provide various measures which include having a bank account or a mobile money account, the number of bank branches and ATMs, and owning a debit or credit card. Financial services usage, however, relate to the use of these financial services like sending or receiving money using the bank account or mobile money wallet, making payment with debit or credit card, saving money in the bank account, applying for credit as an account holder among others. The literature has either used one or more of these measures. For instance, Grohmann et al. (2018) used account ownership, and debit card ownership as measures of financial access while using savings with a formal financial institution and debit card usage as measures of financial usage. Anarfo et al. (2019), however, criticized the frequent use of single financial inclusion variable in the literature; arguing that such measurements are insufficient in capturing overall financial inclusion. Other studies like those of Liu and Walheer (2022) and Sarma (2012) use a composite measure of financial inclusion that captures different dimensions of financial inclusion. We therefore use a composite financial inclusion measure borne out of principal component analysis of multiple inclusion variables in our estimation.

Indeed, Demirgüç-Kunt et al. (2017) note the increased efforts by governments to increase financial inclusion in their respective countries given the developmental role of financial inclusion evidenced by the extant literature that find positive impact of financial inclusion on development outcomes. However, literature on the determinants of financial inclusion is limited.

The focus of our study is on the relationship between FDI and financial inclusion which has received little attention in literature. To achieve this, we postulate that the level of financial development and institutional quality in a country plays a significant role in this relationship. Given limited studies on FDI and financial inclusion, we review some of the existing literature on the effect of financial markets and institutions on financial inclusions. We then discuss how our study differs from these existing literature as we look at how these variables (financial markets and institutions) could play a moderating in the relationship between FDI and financial inclusion.

2.1 Effect of financial markets development on financial inclusion

There is a large stream of literature that has shown that well-developed financial market has a strong positive link with easy access to finance leading to economic growth in the long run. For instance, Beck et al. (2007) demonstrated that poor access to credit in the financial markets can widen inequality between the developed and developing world. This is due to the fact that access to financial tools enhances consumption, savings and investment (Dupas and Robinson 2013). According to Beck et al. (2007), countries with strong financial markets are able to access credit at low cost and improve on the welfare of the individual and economy at large. Swamy (2012) also demonstrated that robust financial market system increases access to finance by the poor resulting in poverty reduction, inclusive growth and economic development. Anarfo et al. (2019) recommended the pursuit of financial sector development in achieving financial inclusion. From the literature, there seem to be a consensus that development of the financial sector helps promote financial inclusion.

2.2 Effect of institutions on financial inclusion

According to North (1990, p3) institutions are “the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction.” Based on North (1990), such institutions comprise the society’s incentive structure and in particular the political and economic institutions form the basis of economic growth. Extensive literature has established the stylized fact that improved institutional qualities lead to higher economic growth and development (see e.g. Acemoglu et al. 2001; Hall and Jones 1999; Knack and Keefer 1995; Mauro 1995). A plethora of studies have also established the connection between institutional factors and capital flow (see e.g. Okada 2013; Rivera-Batiz and Oliva 2002) with focus mainly on political and legal factors. However, the institutional quality (such as rule of law and political and socio-economic stability) in facilitating financial inclusion and creating the enabling environment for FDI has not yet been studied systematically. Meanwhile these institutional qualities have been proven to be critical drivers of capital inflows especially in environments characterized by declining regulation and weak financial integration systems (Rivera-Batiz and Oliva 2002). Nkoa and Song (2020) in a more recent study examined the impact of institutional quality (governance indicators) on financial inclusion in 51 African countries. Using the generalized method of moments (GMM) approach, their results show a positive impact of quality institutions on financial inclusion. Muriu (2020) examined the role of institutional quality in promoting financial inclusion by using panel data from 125 countries over the period 2004 to 2015, and found that the institutional context non-negligibly drives financial inclusion. The study suggested the sequencing of institutional reforms in ways that could promote financial inclusion. In this study, we introduce institutions in our empirical model and examine their relationship with financial inclusion.

From the literature, we see that financial development and institutional quality help increase financial inclusion. What is lacking in the literature is the relationship between FDI and financial inclusion. As we note earlier, we posit that FDI can have a

direct impact on financial inclusion as well as an indirect impact through its effect on financial development and institutional quality. On the direct impact, we conjecture that higher FDI inflows—especially those targeted at the financial sector—can help expand financial services to the financially excluded. Thus, FDIs which are in the form of Fintech or investment in banking or financial sector can directly increase access and usage of financial services provided by Fintech firms and banks. On the other hand, FDI can have an indirect effect on financial inclusion through its effect on financial development. More generally, higher FDI in the country would lead to higher inflows of funds which can increase the savings in banks and hence credit supply. As these multinational companies (MNCs) operate in the country, they will access and use financial services. This can be in the form of savings or financial transactions. Access to and use of financial services by these MNCs would directly increase financial inclusion while at the same time the savings of these multinational companies would expand the credit supply of banks. As banks receive more savings, the available credit supply increases leading to potential supply of credit to the financially excluded. Moreover, banks revenue are likely to increase as they provide financial services to the MNCs. Increased revenue would help banks finance their expansion to provide financial services to the financial excluded.

In another breadth, a well functioning institutional environment can facilitate the impact of FDI on financial inclusion. Indeed, host countries have an incentive to improve their institutional environment in order to accommodate more foreign firms. In order to keep improving the institutional framework, higher FDI inflows would encourage host countries to improve their institutional environment to meet international standards. Indeed, as argued earlier, multinational companies typically come from developed countries where there are quality institutions that encourage innovation and business success. Host countries are more likely to review their regulatory environment as well as have a stable political environment in order to maintain foreign investments in the country. This may involve meeting the growing needs of MNCs by adjusting their business regulatory environment to be more business friendly. More specifically, this could be in the form of reducing bureaucracies in government services; fighting corruption; having a politically stable environment; and strengthening the legal system by increasing investment in commercial courts that handle international transaction among others.

The presence of these MNCs can also encourage strategic partnerships between the host and origin countries in technical areas that can help improve the regulatory environment of the host country. For instance, the growth of the Fintech sector driven by MNCs would encourage the host country to have a more favourable Fintech regulatory sector that encourages innovation learning from international standards where the MNCs originate.

The increased attention to the institutional environment and their development there-off can have positive spillovers on financial inclusion. As the institutional environment improves and becomes business friendly, MNCs and other local firms in the country can operate well and be profitable. If these companies are either banks or Fintech firms, with higher revenue and profit, they can expand their services to include the financially excluded. Moreover, as other firms grow, their demand for financial services like credit will also increase leading to higher financial inclusion. As indi-

cated above, more revenues would also mean more savings leading to higher credit supply which would lead to higher financial inclusion.

Following from the literature and the theoretical background given, the current study seeks to examine the direct impact of FDI on financial inclusion as well as the indirect impact through financial development and institutional quality.

3 Data and sources

3.1 Data

We use annual unbalanced data from 2004 to 2017 for a total of 90 countries.¹ For the financial inclusion data used in this study, we include four measures that have been widely used in the literature: (i) bank accounts per 1000 adults; (ii) bank branches per 100,000 adults; (iii) ATMs per 100,000 adults; and (iv) depositors with commercial banks per 1000 adults. The key components of financial inclusion are access and use of financial services. Financial access includes having a bank account with a financial institution, bank branches and number of ATMs. These have been widely used in the literature (Brune et al. 2016; Grohmann et al. 2018; Karlan and Morduch 2010). Having access to a bank account with a financial institution, for instance, affords users the opportunity to easily and safely use financial services. Aside the measures of access, we also include the number of depositors with commercial banks to indicate usage. Making deposits at a financial institution affords the opportunity for depositors to take advantage of other financial products and services that may be available at the bank. The number of depositors shows that people do not only have a bank account which may be dormant but actually makes use of it for financial transactions. Our financial inclusion index therefore captures both dimensions of access and use.

Based on these indicators, we then build a composite index of financial inclusion using principal component analysis (PCA). The PCA helps to reduce highly correlated variables into one or set of smaller variables that are uncorrelated so called the principal component(s). These components represent a considerable variation in the original dataset. In this study, we use the Kaiser (1974) and Jolliffe (2002) criterion who indicate that only common factors with an eigenvalue greater than one should be retained. From Table 1, we retain component one as the financial inclusion index as it has an eigenvalue of 2.951 which explains about 74% of the total variation or information contained in the four financial inclusion variables. We scale our financial inclusion index to fall between 0 and 1 with higher values indicating higher financial inclusion.

Table 2 presents the correlation matrix between the composite financial inclusion index and the four measures of financial inclusion. The composite index shows a high correlation between the variables from 69 to 94%, suggesting that our index appropriately represents the four indicators of financial inclusion.

¹ The list of countries used in this study is provided in Appendix. Note that the total of 110 countries is used in the cross-sectional analysis provided in Appendix.

Table 1 Principal component analysis for financial inclusion (FINIC)

Component	Eigenvalue	Difference	Proportion	Cumulative
Comp1(FINIC)	2.951	2.288	0.738	0.738
Comp2	0.664	0.283	0.166	0.904
Comp3	0.381	0.376	0.095	0.999
Comp4	0.005	–	0.001	1.000

FINIC denotes financial inclusion index

Table 2 Correlation between financial inclusion index and financial inclusion indicators

Variable	FINC
FINIC	1.000
Depositors	0.939
Accounts	0.939
ATM	0.840
Branches	0.694

FINIC denotes financial inclusion index. Depositors refers to depositors with commercial banks per 1000 adults. Accounts represents bank accounts per 1000 adults, ATM stands for ATMs per 100,000 adults, and Branches is bank branches per 100,000 adults

Table 3 Summary statistics of financial inclusion (FINC)

Stats	FINC
25th Percentile	0.066
50th Percentile	0.206
75th Percentile	0.412

Again, when we observe the financial inclusion variable, we see that the median index is around 0.206 which is quite low indicating that most countries within the sample fall below 0.206. However, 75th percentile of our index records a value of 0.412 still below the 0.50 mid-point value. This shows that countries still need to improve their efforts in increasing financial inclusion in their countries.

Also, from Fig. 1, we see that generally financial inclusion has been increasing over the decades. This shows that countries have generally made progress towards improving inclusive finance. Meanwhile, when we look at Fig. 2, we observe that on average, Ukraine has the most inclusive financial system with Chad being the least financially included country. We also observe that, most of the countries with weak financial inclusion are countries in Sub-Saharan Africa (SSA).

FDI is measured by net inflows of FDI as a percentage of gross domestic product (GDP). For domestic financial market development, we use private sector credit to GDP ratio as a proxy. We use four institutional quality measures of Kaufmann et al. (2010). They are the rule of law, control of corruption, government effectiveness, and regulatory quality. These indicators ranges from approximately -2.5 (weak) to 2.4 (strong). Thus, higher values indicate better or stronger institutional quality. Institutional quality

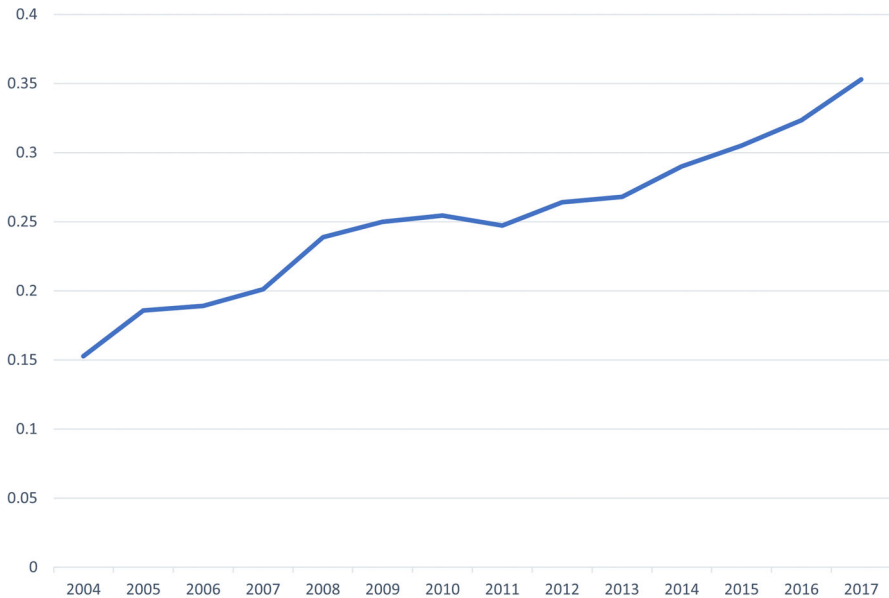


Fig. 1 Trend of mean financial inclusion index (FINC)

can have a significant influence on financial inclusion. For instance, regulatory quality captures perceptions of the ability of government to formulate and implement sound policies and regulations that permit and promote private sector development. Hence, the quality of regulations in the country is likely to promote the activities of banks to help extend financial access to people.

Our study also uses a number of control variables that have been identified in the existing studies that can affect financial inclusion. First, we control for economic development which is captured by natural log of real GDP at purchasing power parity (PPP) per capita. This is to compare progress in economic development across different countries and how this affects financial inclusion. We also control for adult population which is the ratio of population of ages between 15 and 64 to total population. As indicated by Klapper et al. (2015), there is high possibility of people of working age to gain financial knowledge and thus be financially included. Furthermore, we also add mobile cellular subscriptions (per 100 people) to control for information and communication technology (ICT) penetration. The use of mobile phones and other technology tools being championed especially by financial technology (Fintech) firms is revolutionizing the progress in achieving financial inclusion. People can access financial services on their phones and thus ICT would be a good complement to improve financial inclusion.

Finally, measures of education attainment are included as control variables. More specifically, we use gross secondary enrolment and gross tertiary enrolment ratios as the proxy. Including both allows us to capture how various levels of education affects financial inclusion. We expect higher levels of education at the tertiary level to improve financial inclusion. We conjecture that students at tertiary levels are normally

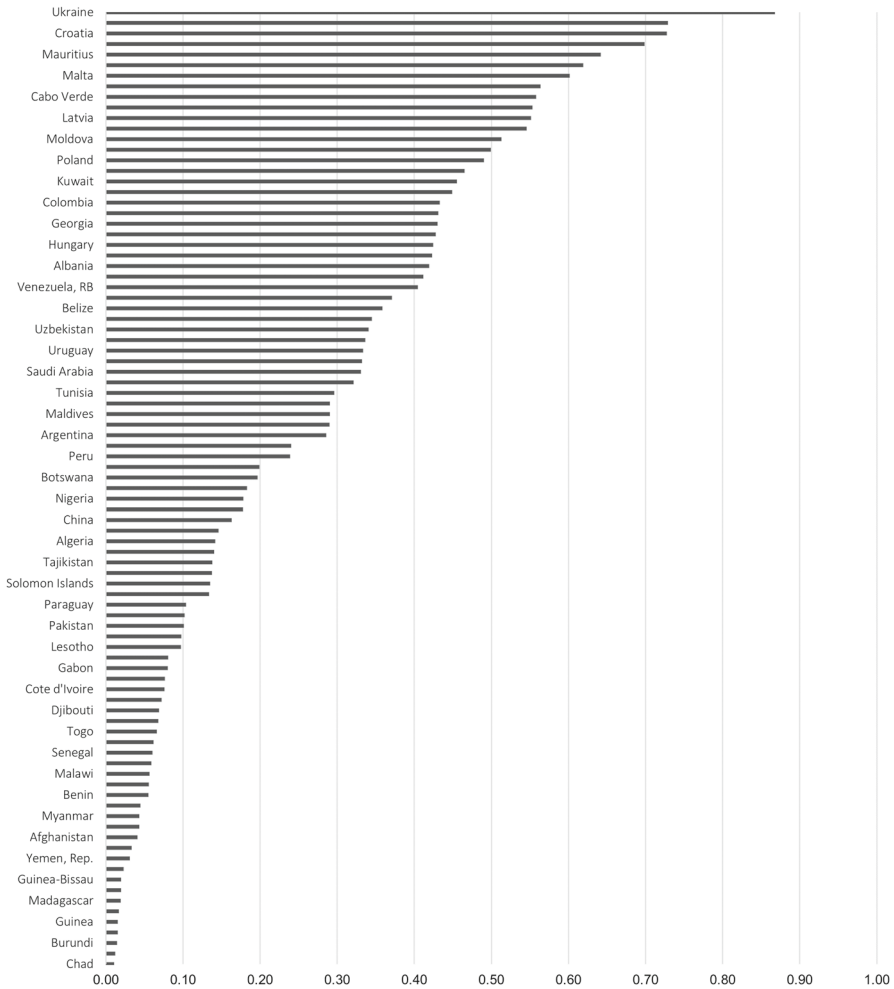


Fig. 2 Mean financial inclusion index (FINC) by country. Note: Country labels adjusted with 2 intervals

of adult age and are also more likely to access financial services unlike students at the secondary level who are more likely to be younger. Hence, having higher proportion the population as students at the secondary level would mean a negative impact on financial inclusion considering that it is the adult population that are captured in the financial inclusion measures. Data on financial inclusion measures were taken from the Global Financial Development Database of the World Bank. All other controls except the institutional quality measures (taken from World Governance Indicators of the World Bank) were taken from the World Development Indicators of the World Bank.

3.2 Descriptive statistics

Table 4 presents the summary statistics. For financial inclusion measures, bank branch penetration is seen to have a mean of 12.376 bank branches per 100,000 adults ranging from a minimum of 0.392 to 59.123 per 100,000 adults. ATM, on the other hand, shows higher financial access than bank branches with a mean of 28.824 ATMs per 100,000 of adults. Deposits and accounts show the widest variations with deposits having a minimum of 1.17 and a maximum of 3383.357 deposits per 1000 adults, while accounts ranged from a minimum of 1.166 to a maximum of 3379.810 number of bank accounts per 1000 adults. The mean accounts recorded is 610.041 bank accounts per 1000 adults. This shows that the number of ATMs provides the widest access to financial services, while accounts shows the least. Our financial inclusion variable ranges from 0 to 1 with a mean of 0.211 generally showing low levels of financial inclusion.

In regard to FDI, it has a mean value of 6.8% of GDP. This indicates the important role of FDI flows to the global economy. For the domestic financial market measure, the private sector credit to GDP ratio has the mean of 36% of GDP. The institutional quality indicators show that globally countries on average have poor institutions with the lowest mean value in the rule of law (Law). This suggests that much effort is needed to make progress in countries' institutional qualities especially those related to the rule of law. Real GDP per capita has a mean of 8.870 with a minimum of 6.337 and a maximum of 11.861. The mean share of adult population is 62.09 with a minimum of 47.18 and a maximum of 86.40. ICT on the other hand show an average of approximately 82 mobile phones per 100 people. The indicators on education shows greater average enrolment at the secondary level (74%) than at the tertiary level (32%). This shows the needed progress that needs to be made at educating more people at the tertiary level to realize the benefits of higher education.

4 Empirical methodology

4.1 Model specification

Our basic econometric model that relates FDI and financial inclusion can be specified as below:

$$\text{FINIC}_{i,t} = \alpha_0 + \alpha_1 \text{FDI}_{i,t} + \alpha_2 \text{FM}_{i,t} + \alpha_3 \text{INST}_{i,t} + \varphi \mathbf{X}_{i,t} + \varepsilon_{i,t} \quad (1)$$

where the subscript $i = 1, 2, \dots, N$ represents countries; $t = 1, 2, \dots, T$ denotes the time span in years; $\text{FINIC}_{i,t}$ refers to the financial inclusion variable and is measured by a composite financial inclusion index obtained by applying a PCA on four financial inclusion variables namely, bank accounts per 1000 adults, bank branches per 100,000 adults, ATMs per 100,000 adults, and depositors with commercial banks per 1000 adults. Our key variable of interest is FDI ($\text{FDI}_{i,t}$) measured by net inflows of FDI (% of GDP); $\text{FM}_{i,t}$ represents domestic financial market development which is captured by domestic credit to private sector ratio (% of GDP); $\text{INST}_{i,t}$ stands for

Table 4 Descriptive statistics

Variable	Obs	Mean	Std. dev	Min	Max
<i>Panel A: Financial inclusion</i>					
Branches	977	12.376	11.537	0.392	59.123
ATM	977	28.824	30.264	0.000	140.421
Deposits	977	619.045	556.745	1.170	3383.357
Accounts	977	610.041	557.469	1.166	3379.810
FINIC	977	0.255	0.211	0	1
<i>Panel B: Foreign direct investment and treaties</i>					
FDI	968	4.627	6.844	-8.574	105.667
BITs	936	19.983	20.652	0	120
<i>Panel C: Institutional quality</i>					
Law	977	-0.382	0.746	-2.032	1.825
Government	977	-0.350	0.774	-2.484	2.437
Regulatory quality	977	-0.305	0.787	-2.344	2.261
Corruption	977	-0.358	0.759	-1.773	2.326
<i>Panel D: Macroeconomic and infrastructure</i>					
Natural log of real GDP per capita	958	8.870	1.171	6.337	11.861
Adult pop	977	62.093	7.649	47.183	86.398
ICT	973	81.730	44.903	0.190	212.639
Private credit	874	36.426	29.511	0.513	156.230
Secondary education	827	73.708	27.425	9.689	128.930
Tertiary education	859	31.591	20.643	0.502	89.959

Branches refers to the number of bank branches per 100,000 adults; ATM represents the number of ATMs per 100,000 adults; deposits stands for the number of depositors with commercial banks per 1000 adults; accounts denotes the number of bank accounts per 1000 adults; FINIC is the financial inclusion variable derived from the principal component analysis; FDI is the net inflows of foreign direct investment as a percentage of GDP; BITs is the number of Bilateral Investment Treaties-note that we use the BITs per 100,000 adult population in the analysis; private credit represents private sector credit to GDP ratio (% of GDP); law is the rule of law; government refers to government effectiveness; regulatory denotes the measure of regulatory quality; corruption is the control of corruption; adult pop stands for the share of population ages 15 to 64 of total populations; ICT denotes mobile cellular subscriptions per 100 people; secondary education is the secondary school enrolment (% gross); tertiary education refers to tertiary school enrolment (% gross)

the institutional quality variables that contain rule of law, control of corruption, government effectiveness, and regulatory quality. These are included separately in our estimations. $X_{i,t}$ denotes a vector of control variables which includes the natural log of real GDP per capita, population ages from 15 to 64 (% of total population), ICT penetration measured by mobile cellular subscriptions (per 100 people), secondary school enrolment and tertiary school enrolment.

As a benchmark exercise, we first use ordinary least squares (OLS) method to estimate Eq. (1). However, net inflows of FDI are likely to be endogenous when estimating the relationship between FDI and financial inclusion. Possible reasons include reverse causality running from financial inclusion to FDI (Čihák et al. 2016).

Indeed, FDIs are likely to flow into countries where a larger share of the population is financially included. Meanwhile, it is possible that the inflow of FDIs may particularly be the reason to have the needed investment in the financial sector that promotes financial inclusion. There is also possibility of omitted variables bias given that it is unlikely to control for all variables that can affect financial inclusion. To overcome the endogeneity issue, we rely on the two-stage-least squares (2SLS) instrumental variables approach to identify any causal effect between FDI and financial inclusion.

4.2 Identification strategy

We instrument FDI using the total number of bilateral investment treaties (BITs) ratified and come into force by a country with other countries.

The corresponding first-stage IV estimation regression is as below:

$$FDI_{i,t} = \delta_0 + \delta_1 BITs_{i,t} + \delta_2 FM_{i,t} + \delta_3 INST_{i,t} + \varphi X_{i,t} + v_{i,t} \quad (2)$$

where $BITs_{i,t}$ refers to the number of bilateral investment treaties signed and actually come into force by a country at time t with other countries. Given that our financial inclusion measures capture how the adult population is financially included, we scale the number of treaties per 100,000 of adult population. This allows us to capture the number of treaties a country signed to allow for FDI inflows in the country relative to its adult population. BITs are treaties that are voluntary in nature signed between two countries to encourage foreign investment inflows and to protect those investments. They typically operate by having clauses that give protection to foreign investors against political risk. This suggests that BITs is a plausible instrument for FDI given that these treaties will encourage the inflows of FDI and hence their impact on financial inclusion can only be through encouraging more FDIs. Therefore, BITs is uncorrelated with $v_{i,t}$ satisfies the exclusion restriction. $X_{i,t}$ is a vector of covariates in the structural regression and $v_{i,t}$ is the stochastic error term. Having the predicted values of $\hat{FDI}_{i,t}$, we estimate second-stage regression that has the same form as Eq. (1).

5 Empirical results and discussions

We first show some sample results to better illustrate the data. In Fig. 3, we show scatter plots of financial inclusion composite index versus FDI. Clearly, we can see that net inflows of FDI is positively correlated with financial inclusion. In Sects. 5.1, 5.2 and 5.3, we conduct more rigorous analysis using a variety of estimation techniques.

5.1 Baseline results

The baseline OLS results are presented in Table 5. From the table, most of the columns show that FDI has a positive impact on financial inclusion with at least 10% significance level. However, as we discussed earlier, FDI may be endogenous hence the need to

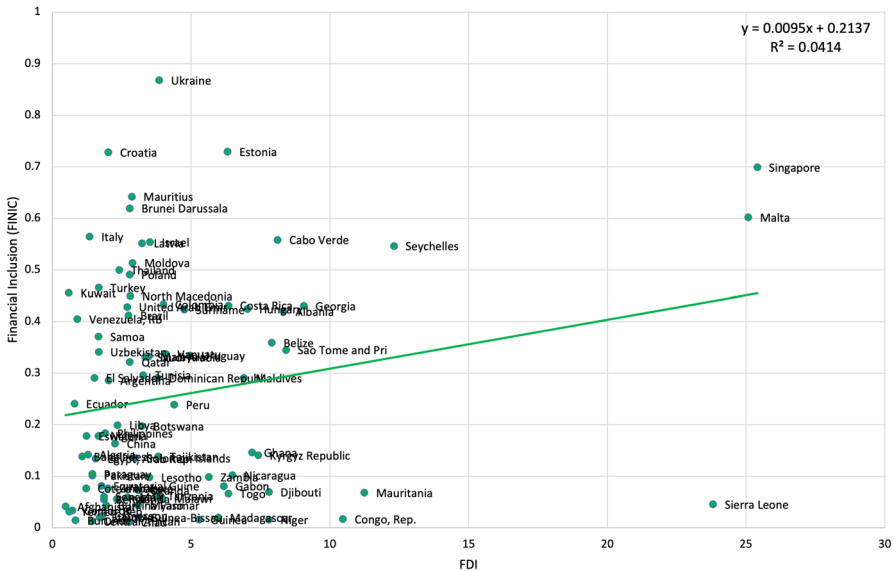


Fig. 3 Association between financial inclusion and FDI

control for this in an instrumental variables approach. The next section shows the results of our IV estimations.

5.2 Main IV results

The results of our main IV estimations are presented in Table 6. From the table, we see that FDI has a significant positive impact on financial inclusion in all estimations at 5% level. In particular, a standard deviation increase in FDI leads to an increase in the financial inclusion index ranging from 0.06 to 0.07. This shows the important role of FDI in promoting inclusive finance. If efforts are made at driving FDI inflows into the country, the financial sector seeks to gain as more capital flows into the financial ecosystem. This can happen as more FDI inflows would mean more capital investment into the economy where these multinational corporations (MNCs) can demand financial services as well as employ more people who would seek financial services. As the financial sector manages the transactions of MNCs, they can have more available funds to expand credit to the otherwise financially excluded. Moreover, FDI can have a rippling effect in the economy through higher direct and indirect employment as other firms benefit in the value chain; these individuals and firms are more likely to seek financial services as they benefit from these investments.

We also see that all the institutional quality variables have the expected sign at 1% significance level. We institutional quality has a positive correlation with financial inclusion. This shows that quality institutional framework could lead to higher financial inclusion. As we noted earlier, the existence of better institutional framework where there is rule of law that protects property rights, less corruption, quality regulatory

Table 5 Financial inclusion and FDI, OLS estimation

Variable	FINIC			
	(1)	(2)	(3)	(4)
FDI	0.001 (0.001)	0.001** (0.001)	0.001** (0.001)	0.001* (0.001)
Law	0.063*** (0.009)			
Government		0.058*** (0.010)		
Regulatory quality			0.040*** (0.009)	
Corruption				0.054*** (0.008)
Private credit	0.002*** (0.0002)	0.002*** (0.0002)	0.002*** (0.00002)	0.002*** (0.00002)
Natural log real GDP per capita	0.039*** (0.008)	0.043*** (0.008)	0.050*** (0.008)	0.043*** (0.008)
Adult population	0.003*** (0.001)	0.002** (0.001)	0.002** (0.001)	0.002** (0.001)
ICT	0.001*** (0.0001)	0.001*** (0.0001)	0.001*** (0.000)	0.001*** (0.0001)
Secondary education	-0.0001*** (0.00002)	-0.000*** (0.00002)	-0.000*** (0.00002)	-0.000*** (0.00002)
Tertiary education	0.002*** (0.0003)	0.002*** (0.0003)	0.002*** (0.000)	0.002*** (0.0003)
R^2	0.72	0.72	0.71	0.72
No. of countries	91	91	91	91
Obs	723	723	723	723

*, ** and *** denote statistical significance at the 10, 5 and 1% levels, respectively

framework including those related to financial institutions, and an effective governance framework can ensure a favourable financial sector environment to encourage inclusive finance.

The results also show that private sector credit to GDP ratio has a significant positive correlation with financial inclusion in all the estimations at 1% significance level. Specifically, when there is strong institutions in relation to the rule of law that protects property rights, we see that a standard deviation increase in private sector credit to GDP ratio raise financial inclusion by 0.03. This shows the important role of financial market development on financial inclusion especially in countries where there is strong rule of law that ensures the protection of private property. As the financial sector develops, access is likely to be expanded to the financially excluded for them to benefit from the financial services. Importantly, in these countries where there are strong institutions, especially the rule of law, people are likely to be confident in the legal system and

hence would feel safe to access and use financial services with the confidence that their funds are protected.

We also find that higher economic growth and adult population have positive correlation with financial inclusion. ICT infrastructure also has a significant positive correlation with financial inclusion at 1% level. Concerning education, we find that while secondary education does not improve financial inclusion, higher education at the tertiary level tend to have a significant correlation with financial inclusion at 1% level. We also test whether we could treat FDI as exogenous. Both the Durbin and Wu–Hausman test statistic are highly significant rejecting the null hypothesis that FDI is exogenous justifying our use of IV approach.

5.3 Robustness checks

In this section, we conduct five types of robustness tests. We first re-estimate the results using the Lewbel (2012) heteroscedasticity-based identification approach. We then estimate the model using the two-step system generalized method of moments approach. We then proceed to examine whether the impact of FDI on financial inclusion differs from one regional bloc to the other and whether it differs based on the income levels of the countries and the development status of the countries. Finally, we conduct further sensitivity test using alternative measure of financial inclusion. These are done to ensure that our results are robust to difference estimation techniques and sub-samples.

5.3.1 Lewbel (2012) heteroscedasticity-based identification

We perform sensitivity analysis with alternative IV estimation by augmenting our external instruments with heteroskedasticity-based instruments developed by Lewbel (2012). The Lewbel (2012)'s method is appealing for the following two reasons: (i) It provides IV estimates when there are lack of external IVs; (ii) In instances in which it is doubtful whether the available IVs satisfy the exclusion restrictions, the Lewbel (2012) method can be combined with potentially weak IVs to provide more robust estimates. We construct instruments based on heteroskedasticity in error terms by following Lewbel (2012). According to Lewbel (2012), the constructed instruments can be used as a valid IV when there are lack of external IVs or can be used to augment external IVs to test over identifying restrictions and improve efficiency.

The results based on Lewbel (2012)'s IV approach are presented in Table 7. Even though the Hansen p -value is significant, We find that FDI still has a significant positive impact on financial inclusion in all estimations except when rule of law is used as institutional quality variable. These results are significant with at least 10%.

5.3.2 Using alternative approach: GMM estimate

Given that our data exhibit relatively large cross-sectional components compared to time-series components, we use system generalized method of moments (GMM) estimator specifically developed for this type of dataset. System GMM approach also

Table 6 Financial inclusion and FDI, IV estimation

Variable	FINIC			
	(1)	(2)	(3)	(4)
FDI	0.009** (0.004)	0.010** (0.004)	0.010** (0.004)	0.009** (0.004)
Law	0.040*** (0.011)			
Government		0.038*** (0.012)		
Regulatory quality			0.023** (0.010)	
Corruption				0.035*** (0.012)
Private credit	0.001*** (0.0003)	0.001*** (0.0003)	0.001*** (0.0003)	0.002*** (0.0003)
Natural log real GDP per capita	0.044*** (0.010)	0.046*** (0.009)	0.051*** (0.009)	0.046*** (0.010)
Adult population	0.003** (0.001)	0.003** (0.001)	0.003** (0.001)	0.003** (0.001)
ICT	0.001*** (0.0002)	0.001*** (0.0002)	0.001*** (0.0002)	0.001*** (0.0002)
Secondary education	-0.0001*** (0.00002)	-0.0001*** (0.00002)	-0.0001*** (0.00002)	-0.0001*** (0.00002)
Tertiary education	0.002***	0.002***	0.002***	0.002***

Table 6 continued

Variable	FINIC			
	(1)	(2)	(3)	(4)
<i>First-stage regression</i>	(0.0004)	(0.0004)	(0.0004)	(0.0004)
BITs	3.732*** (1.038)	3.748*** (1.001)	3.750*** (1.002)	3.703*** (1.035)
Adjusted R^2	0.28	0.28	0.28	0.28
Durbin χ^2 -test	48.07***	58.68***	59.96***	55.19***
Wu-Hausman F -test	50.87***	63.13***	64.64***	59.06***
1st-stage F	12.93***	14.01***	14.01***	12.79***
R^2	0.66	0.64	0.64	0.65
No. of countries	88	88	88	88
Obs	701	701	701	701

Robust standard errors are in parentheses. ** and *** denote statistical significance at the 5 and 1% levels, respectively

Table 7 Financial inclusion and FDI, Lewbel (2012) IV estimates

Variable	FINIC			
	(1)	(2)	(3)	(4)
FDI	0.002 (0.001)	0.004*** (0.001)	0.002* (0.001)	0.004*** (0.001)
Law	0.049*** (0.008)			
Government		0.055*** (0.008)		
Regulatory quality			0.043*** (0.008)	
Corruption				0.038*** (0.008)
Private credit	0.002*** (0.0003)	0.002*** (0.0003)	0.002*** (0.0003)	0.002*** (0.0003)
Natural log real GDP per capita	0.057*** (0.009)	0.060*** (0.008)	0.061*** (0.008)	0.059*** (0.009)
Adult population	0.0007 (0.001)	0.0002 (0.001)	0.001 (0.001)	0.0004 (0.001)
ICT	0.0002 (0.0002)	0.0002 (0.0001)	0.0001 (0.000)	0.0003** (0.0001)
Secondary education	-0.0001*** (0.00002)	-0.0001*** (0.00001)	-0.0001*** (0.00001)	-0.0001*** (0.00001)
Tertiary education	0.002*** (0.0003)	0.002*** (0.0003)	0.002*** (0.0003)	0.002*** (0.0003)
R^2	0.71	0.70	0.71	0.70
No. of countries	88	88	88	88
Obs	701	701	701	701
Hansen J stat	71.60	65	87.2	62.90
Hansen J p -value	0.00	0.00	0.00	0.00

Robust standard errors in the parenthesis. *, ** and *** denote statistical significance at the 10, 5 and 1% levels, respectively

combines in a system the regression in differences with the regression in levels and takes into account the endogeneity issue. Moreover, the introduction of lagged financial inclusion, for instance, is necessary because previous year's progress in financial inclusion is likely to influence the following period's financial inclusion levels. Following Roodman (2009), the lags of the independent variables are used as instruments. Since this reduces the number of observations and power of regressions, we employ the collapsing method of Holtz-Eakin et al. (1988) and Arellano and Bover (1995) forward orthogonalization procedure to limit the number of instruments.

Following a common diagnostic test procedure in the literature, we report the Hansen test of overidentifying restrictions and the second-order autoregressive, AR(2)

Table 8 Financial inclusion and FDI, system GMM estimates

Variable	FINIC			
	(1)	(2)	(3)	(4)
L.FINIC	0.964*** (0.007)	0.960*** (0.007)	0.964*** (0.007)	0.961*** (0.007)
FDI	0.0003*** (0.0001)	0.0003*** (0.0003)	0.0003*** (0.0001)	0.0003*** (0.0001)
Law	0.002** (0.001)			
Government		0.004*** (0.001)		
Regulatory quality			0.001 (0.001)	
Corruption				0.004*** (0.001)
Private credit	0.00003 (0.00004)	0.00004 (0.00004)	0.00005 (0.00004)	0.00005 (0.00004)
Log GDP p.c. (PPP)	0.003*** (0.001)	0.003*** (0.001)	0.004*** (0.001)	0.004*** (0.001)
Adult pop. (15 to 64 years)	0.0003* (0.0002)	0.0003* (0.0002)	0.0003* (0.0002)	0.0003* (0.0002)
ICT	0.00004** (0.0002)	0.00002 (0.00002)	0.00003* (0.00002)	0.00003 (0.00002)
Secondary education	-0.000002 (0.000002)	-0.000002 (0.000002)	-0.000001 (0.000002)	-0.000001 (0.000002)
Tertiary education	-0.00001 (0.0001)	-0.00002 (0.0001)	-0.00002 (0.0001)	-0.00001 (0.0001)
AR (2)	0.405	0.405	0.407	0.411
Hansen test (overid)	0.145	0.191	0.209	0.233
No. of countries	90	90	90	90
No. of instruments	40	40	40	40
Obs	648	648	648	648

Robust standard errors in the parenthesis. *, ** and *** denote statistical significance at the 10, 5 and 1% levels, respectively

tests. The Hansen test provides evidence of the validity of the instruments by evaluating the entire set of moment conditions in satisfying the exclusion restriction.

Table 8 reports the system GMM results. In all the estimations, the AR(2) test and the Hansen test statistic cannot reject the null hypothesis of no second-order serial correlation and the validity of the overidentifying restrictions, respectively. More specifically, the p -value for the second-order serial correlation in the system GMM estimation is greater than 10% in all specifications, hence the null hypothesis of no second-order serial correlation at the conventional significance levels (1, 5 and 10%) cannot be

rejected. Furthermore, from the Hansen test, the null hypothesis of the validity of the overidentifying restrictions at the conventional significance levels cannot be rejected. Overall, the AR(2) tests for second-order serial correlation and the Hansen test of overidentifying restrictions are both satisfied, indicating that our GMM estimates are consistent and efficient. The estimates also indicate that the lag of the dependent variable is significant in all the regressions. This suggests that financial inclusion persists. The system GMM results are consistent with our earlier estimations with FDI having a significant positive impact on financial inclusion at 1% level. Three out of four institutional quality variables also show a significant positive impact on financial inclusion with at least 5% significance level.

5.3.3 Examining regional differences

Here, we examine the regional differences in the impact of FDI on financial inclusion. We classify the countries based on the World Bank's regional grouping, namely South Asia (SA), Europe & Central Asia (ECA), Middle East & North Africa (MENA), Sub-Saharan Africa (SSA), East Asia & Pacific (EAP), Latin America & Caribbean (LAC), and North America (NA). We create dummy variable for the regions and interact with FDI.

The results are presented in Table 9. From the table, we find that FDI has a significant positive impact on financial inclusion in the ECA, MENA, SSA, EAP and LAC regions in all the regressions alternating the institutional quality variables. We observe that the LAC region has the largest impact of FDI on financial inclusion followed by the MENA, EAP, SSA and ECA regions, respectively. FDI has no significant impact on financial inclusion in SA and NA regions. These results generally confirm our earlier findings that FDI has a direct positive impact on financial inclusion.

5.3.4 Examining differences in income and development status of countries

Here, we examine the impact of FDI on financial inclusion by looking at the development status and income level of the countries. To do this, we include dummies based on the income level of the country according to the World Bank classification per year. These are: (i) lower income countries (LIC), (ii) lower middle income countries (LMIC), (iii) upper middle income countries (UMIC), and (iv) high income countries (HIC). We also group the countries whether they are developed or developing based on the United Nations (UN) Classification. The results are presented in Tables 10 and 11. From Table 10, the results show that FDI has a significant positive impact on financial inclusion across all income levels. We, however, observe that the impact is more pronounced in LMIC followed by LIC, UMIC and HIC, respectively. It seems to suggest that countries at the bottom income distribution benefit more from FDIs than those at the top. This affirms the important development role of FDIs for relatively poor and developing countries (see e.g. Reiter and Steensma 2010). We find similar results when we group the countries into developing or developed countries. From Table 11, we can see that developing countries seem to benefit more from net FDI inflows for financial inclusion than their developed counterparts. This further confirms the important role of FDI for financial inclusion in developing countries.

Table 9 Financial inclusion and FDI (regional dummies), IV estimation

Variable	Law (1)	Government (2)	Regulation quality (3)	Corruption (4)
FDI × SA	0.171 (1.142)	0.052 (0.039)	0.072 (0.053)	0.116 (0.096)
FDI × ECA	0.014* (0.008)	0.009** (0.003)	0.074** (0.004)	0.011** (0.006)
FDI × MENA	0.095** (0.046)	0.056*** (0.016)	0.060*** (0.019)	0.078*** (0.030)
FDI × SSA	0.055* (0.028)	0.033*** (0.011)	0.034*** (0.011)	0.046** (0.019)
FDI × EAP	0.068*** (0.026)	0.045*** (0.009)	0.049*** (0.011)	0.059*** (0.019)
FDI × LAC	0.132** (0.061)	0.092*** (0.028)	0.098*** (0.032)	0.115** (0.047)
FDI × NA	0.769 (0.765)	−0.070*** (0.017)	−0.597 (0.779)	0.326 (0.593)
Controls	Yes	Yes	Yes	Yes
Obs	701	701	701	701
No. of countries	88	88	88	88
<i>First-stage regression</i>				
Durbin χ^2 -test	106.69***	107.91***	119.91***	106.24***
Wu–Hausman <i>F</i> -test	17.26***	17.49***	19.84***	17.17***
<i>1st-stage F</i>				
FDI × SA	4.33***	4.64***	4.20***	4.36***
FDI × ECA	17.57***	24.21***	28.77***	21.17***
FDI × MENA	8.58***	10.21***	7.93***	7.27***
FDI × SSA	13.79***	14.26***	16.41***	14.21***
FDI × EAP	12.79***	13.03***	15.24***	12.26***
FDI × LAC	8.79***	8.90***	9.90***	8.79***
FDI × NA	0.94	234.68***	0.47	0.55

Robust standard errors in the parenthesis. *, ** and *** denote statistical significance at the 10, 5 and 1% levels, respectively. SA is South Asia, ECA is Europe & Central Asia, MENA is Middle East & North Africa, SSA is Sub-Saharan Africa, EAP is East Asia & Pacific, LAC is Latin America & Caribbean, and NA is North America

5.4 Mechanisms

In this section, we examine whether development of domestic financial market and institutional quality can serve as potential channels through which FDI affects financial inclusion. As we argued earlier, FDI has the potential to increase the supply of loanable funds as financial markets receive funds in the form of investment or savings through FDIs. Financial institutions can therefore extend their reach to the financially excluded.

Table 10 Financial inclusion and FDI (income level), IV estimation

Variable	Law (1)	Government (2)	Regulation quality (3)	Corruption (4)
FDI × Lower income	0.027* (0.015)	0.028* (0.015)	0.026 (0.016)	0.027* (0.015)
FDI × Lower middle income	0.036*** (0.006)	0.038*** (0.006)	0.037*** (0.006)	0.037*** (0.006)
FDI × Upper middle income	0.019*** (0.004)	0.019*** (0.004)	0.019*** (0.004)	0.019*** (0.005)
FDI × High income	0.007** (0.003)	0.007** (0.003)	0.008** (0.003)	0.008** (0.003)
Controls	Yes	Yes	Yes	Yes
Obs	701	701	701	701
No. of countries	88	88	88	88
<i>First-stage regression</i>				
Durbin χ^2 -test	97.14***	111.44***	112.77***	105.16***
Wu-Hausman <i>F</i> -test	27.55***	32.37***	32.83***	30.22***
<i>1st-stage F</i>				
FDI × Lower income	24.01***	24.75***	24.00***	22.88***
FDI × Lower middle income	55.72***	54.17***	52.77***	58.95***
FDI × Upper middle income	30.52***	27.53***	29.09***	29.17***
FDI × High income	9.10***	9.00***	9.20***	9.12***

Robust standard errors in the parenthesis. *, ** and *** denote statistical significance at the 10, 5 and 1% levels, respectively

Table 11 Financial inclusion and FDI (development status), IV estimation

Variable	Law (1)	Government (2)	Regulation quality (3)	Corruption (4)
FDI × Developing	0.022*** (0.005)	0.024*** (0.005)	0.025*** (0.005)	0.021*** (0.005)
FDI × Developed	0.007** (0.003)	0.008** (0.003)	0.008** (0.003)	0.008** (0.003)
Controls	Yes	Yes	Yes	Yes
Obs	645	645	645	645
No. of countries	78	78	78	78
<i>First-stage regression</i>				
Durbin χ^2 -test	74.74***	97.71***	106.77***	70.10***
Wu–Hausman <i>F</i> -test	41.48***	56.51***	62.78***	38.59***
<i>1st-stage F</i>				
FDI × Developing	38.95***	36.38***	38.40***	38.57***
FDI × Developed	8.75***	8.36***	7.94***	9.65***

Robust standard errors in the parenthesis. ** and *** denote statistical significance at the 5 and 1% levels, respectively

Also, as FDIs flow to countries, the domestic authorities are inclined to improve the quality of their institutions as a way to give more confidence to foreign firms. This can also send a signal to other MNCs to follow the herd as they see their counterparts operate well in these countries.

To examine whether domestic financial market and quality of institutions qualify as potential channels through which FDI impacts financial inclusion, we follow the approach in the literature such as Alesina and Zhuravskaya (2011) and Ackermann et al. (2021). There are two conditions that need to be satisfied for domestic financial market and institutional quality can serve as potential channels. First, domestic financial market development and institutional quality need to be correlated with FDI. Table 12 presents results for the influence of FDI on the two potential channels. The results indicate that FDI is positively associated with domestic financial market development and institutional quality. Specifically, 1 percentage point increase in net FDI inflows leads to 0.40 unit rise in private sector credit to GDP ratio and 1 unit increase in net FDI inflows leads to an increase in institutional quality ranging from 0.011 to 0.016 unit. This shows that FDI has a significant impact on both financial market development and institutional quality suggesting that these variables are channels through which FDI affects financial inclusion.

The second condition is incorporating private sector credit to GDP ratio or quality of institution as an additional control variable in the regression relates FDI and financial inclusion should reduce the scale of the coefficient on FDI or render it insignificant. Tables 13 and 14 report the results. Column (2) in Table 13, and columns (2), (4), (6) and (8) in Table 14 show that when private sector credit to GDP ratio or institutional quality indicator is added as an additional control, the coefficient on FDI reduces in magnitude or becomes insignificant. Our findings suggest that domestic financial

Table 12 Effect of FDI on the potential channel

Variable	(1) Private credit	(2) Law	(3) Government	(4) Regulatory quality	(5) Corruption
FDI	0.402*** (0.118)	0.016*** (0.003)	0.011*** (0.002)	0.012*** (0.003)	0.014*** (0.003)
Controls	Yes	Yes	Yes	Yes	Yes
R^2	0.41	0.44	0.55	0.46	0.40
Obs	723	809	809	809	809

*** indicates statistical significance at the 1% level

Table 13 Effect of FDI and domestic financial market as a channel on financial inclusion

Variable	(1)	(2)	(3)
FDI	0.0025*** (0.0006)	0.0018*** (0.0006)	0.0044*** (0.0012)
Private credit		0.0021*** (0.0002)	0.0023*** (0.0002)
FDI × Private credit			-0.00003** (0.00001)
Controls	Yes	Yes	Yes
R^2	0.66	0.70	0.71
Obs	809	723	723

** and *** indicate statistical significance at the 5 and 1% levels, respectively

market development and quality of institution can serve as potential channels through which FDI affects financial inclusion.

As a further robustness check on our mediation (potential channel) results, we also examine whether domestic financial market development and institutional quality moderate the relationship between FDI and financial inclusion. To do so, we augment Eq. (1) to include the interaction term between FDI and private sector credit to GDP ratio (or institutional quality indicators). Column (3) in Table 13 shows that the interaction term between FDI and domestic financial market is negative and significant at 5% level. This implies that FDI and domestic financial market may act as substitutes. Columns (3), (5), (7) and (9) in Table 14 show that the interaction terms between FDI and institutional quality are also mostly negative and significant at 10% level or higher. The marginal effect plots in Fig. 4 confirm the substitution effect between FDI and financial markets, and FDI and our institutional quality variables. In summary, our results suggest that domestic financial market and quality of institution also moderate the relationship between FDI and financial inclusion. Specially, the relationship between FDI and financial inclusion is lower in countries with higher level of financial market development or stronger institutional quality.

Table 14 Effect of FDI and institution quality as a channel on financial inclusion

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
FDI	0.0018*** (0.0006)	0.0010 (0.0006)	0.0018** (0.0008)	0.0013** (0.0006)	0.0022*** (0.0008)	0.0014** (0.0006)	0.0028*** (0.0008)	0.0011* (0.0006)	0.0012* (0.0007)
Law		0.0632*** (0.0087)	0.0670*** (0.0089)						
FDI × Law			-0.0013* (0.0007)						
Government				0.0583*** (0.0100)	0.0636*** (0.0103)				
FDI × Government					-0.0016** (0.0007)				
Regulatory quality						0.0397*** (0.0085)	0.0466*** (0.0087)		
FDI × Regulatory quality							-0.0021*** (0.0007)		
Corruption								0.0544*** (0.0079)	0.452*** (0.070)
FDI × Corruption									-0.0003 (0.0009)
Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R ²	0.70	0.72	0.72	0.72	0.72	0.71	0.72	0.72	0.72
Obs	723	723	723	723	723	723	723	723	723

*, ** and *** indicate statistical significance at the 10, 5 and 1% levels, respectively

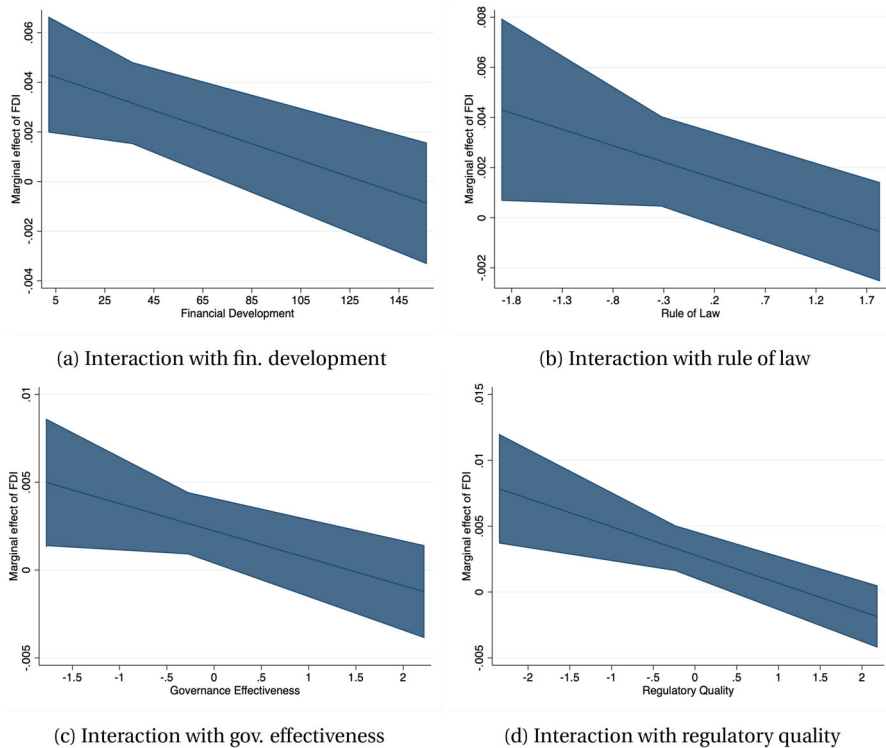


Fig. 4 Marginal effects of FDI on financial inclusion (with 95% confidence interval)

6 Conclusion and policy recommendations

We examine the impact of FDI on financial inclusion and show the role of domestic financial markets and institutions. The results show that higher net FDI inflows improve financial inclusion. Higher level of financial market development and stronger institutional quality also improve financial inclusion directly. Moreover, we find that domestic financial market and quality of institution can be potential channels through which FDI influences financial inclusion. We also find that financial market development and institutional quality play moderating role in the relationship between FDI and financial inclusion. In particular, financial market development and institutional quality can be substitute to net FDI inflows in countries with more developed capital markets and stronger quality of institutions.

The policy implication is that countries should put in appropriate measures to attract more FDI while being mindful of their country specific characteristics. For instance, as the results show a possible substitution between net FDI inflows and financial markets (or institutions), countries with low development of financial markets need more FDI flows than those with advanced financial markets if they want to get more of their citizens in the financial ecosystem. Similarly, countries with poor institutional quality need FDI to make progress in financial inclusion. As these countries attract

more FDI and as they develop their financial markets and build stronger institutions, their dependence on FDI flows to improve financial inclusion would dwindle. It is not surprising that developing countries in particular are the most countries that are financially excluded and needing the most FDI flows owing to the underdeveloped financial markets and poor institutions. More effort is needed to improve financial inclusion and FDI flows can be a key channel to achieve this.

Our results also show per capita income improves financial inclusion. As countries improve in their income levels, more investment can be made in their financial system to broaden the net to get more people included. As a policy direction, countries should pursue the attainment of higher income levels as this can give them room to invest in the financial system to improve financial inclusion.

Our results also reveal that higher share of adult population improves financial inclusion. This suggests that as more people grow and gets to the working age, they are more likely to appreciate and engage in financial transactions through the formal sector. This could be a good policy area where the government invests more in the financial sector by providing the necessary framework of favourable regulations for banks and financial technology (Fintech) companies to bring out innovate financial products and services targeted at the adults. When these adults get financially included, they are more likely to encourage the younger ones and even their children in the financial services. They can take up insurance for their children as well as invest in financial products for their kids; for instance, investing in financial products that would cater for the tertiary education of their kids. The adult population therefore presents a good opportunity for the government, banks and Fintech companies to get the younger ones included.

Furthermore, the results show that higher ICT penetration improves financial inclusion. There is no doubt the importance of ICT to modern financial services and products. The traditional means of reaching the unbanked through bank branches and ATMs may not be enough to reach the financially excluded especially in deprived communities where it is unprofitable to set up a branch or to put an ATM because of low security. Mobile and internet banking is providing banking services on the go. People can now perform their banking transactions on their phones anywhere in the world either through the internet or without internet through mobile money or unstructured supplementary service data (USSD) mobile banking. Governments especially should invest in information technology (IT) infrastructure that other small private Fintech companies can tap onto to provide modern financial services. Central banks in particular should also provide the favourable regulatory environment that would encourage more firms to use digital financial services. For instance, deregulation could allow telecommunication companies to partner with banks and other financial institutions to provide mobile banking services like the mobile money services.

Our study also show that secondary school enrolment reduces financial inclusion. As indicated earlier, most of the students enrolled at the secondary level are young and thus are more likely to be financially excluded. These students are normally limited in accessing key financial services because of age restrictions. They are mostly required to come with an adult guarantor who may be their parent or sibling or a relative. As indicated above, a good way to include these students would be through the adult population. As more of their parents and adult siblings get financially included, they

are more likely to be available to introduce and support the student to engage in financial services.

In contrast, higher tertiary enrolment leads to improved financial inclusion. Students at the tertiary levels are most likely adults who are of working age. These students are more likely to be exposed to financial services at this level. It is not surprising that most banks take advantage of freshmen orientations to introduce their financial products and services to students at the tertiary levels. At this level the students are more likely to work to either finance their education or the students may already be in the working class. As people work, the need for financial services goes up like the need for a bank account to save and possibly acquire loans in the future. As a policy direction, governments can focus on these tertiary students as a conduit for scaling up financial inclusion in their countries. These students are also mostly of age and can thus be exposed to more financial education that can also increase their likelihood of accessing diverse financial services.

Funding Open Access funding enabled and organized by CAUL and its Member Institutions

Declarations

Conflict of interest No potential competing interest was reported by the authors.

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Appendix

Table 15 provides the list of countries used in the study (including cross-sectional analysis).

A.1 Correlation analysis

Here, we present the correlation matrix of the independent variables in Table 16. From the table, we see that the institutional quality variables are highly correlated and hence we use them individually in separate regressions. All the other correlations have absolute values of less than or equal to 0.70 indicating that their inclusion will not present any problem of multicollinearity (Kennedy 2008).

Table 15 List of countries

Afghanistan	Costa Rica	Indonesia	Mongolia	Sierra Leone
Albania	Cote d'Ivoire	Ireland	Montenegro	Singapore
Algeria	Croatia	Israel	Morocco	Slovak Republic
Argentina	Cyprus	Italy	Mozambique	Slovenia
Armenia	Czech Republic	Jordan	Myanmar	South Africa
Australia	Denmark	Kazakhstan	Namibia	Spain
Austria	Dominican Republ	Korea, Rep	Nepal	Sri Lanka
Azerbaijan	Ecuador	Kuwait	Netherlands	Sweden
Bangladesh	Egypt, Arab Rep	Kyrgyz Republic	New Zealand	Tajikistan
Belarus	El Salvador	Latvia	Niger	Tanzania
Belgium	Estonia	Lesotho	Norway	Thailand
Benin	Finland	Liberia	Pakistan	Togo
Bolivia	France	Lithuania	Panama	Tunisia
Bulgaria	Georgia	Luxembourg	Peru	Turkey
Burkina Faso	Germany	Madagascar	Philippines	Uganda
Cambodia	Ghana	Malaysia	Poland	United Arab Emir
Cameroon	Greece	Mali	Portugal	United Kingdom
Central African	Guatemala	Malta	Romania	United States
Chad	Honduras	Mauritania	Russian Federation	Uruguay
Chile	Hong Kong SAR, C	Mauritius	Rwanda	Uzbekistan
China	Hungary	Mexico	Saudi Arabia	Vietnam
Colombia	India	Moldova	Serbia	Zambia

Table 16 Correlation matrix

Variable	FDI	Law	Government	Regulatory quality	Corruption	Private credit	ln(real GDP per capita)	Adult population	ICT	Secondary education	Tertiary education
FDI	1										
Law	0.245***	1									
Government	0.236***	0.912***	1								
Regulatory quality	0.243***	0.890***	0.903***	1							
Corruption	0.241***	0.923***	0.881***	0.831***	1						
Private credit	0.205***	0.609***	0.663***	0.627***	0.510***	1					
ln(real GDP per capita)	0.137***	0.647***	0.718***	0.656***	0.604***	0.568***	1				
Adult population	0.139***	0.490***	0.593***	0.514***	0.47***	0.605***	0.622***	1			
ICT	0.082**	0.498***	0.564***	0.545***	0.465***	0.495***	0.704***	0.601***	1		
Secondary education	0.014	0.03	-0.016	-0.004	-0.008	0.023	0.064*	0.025	0.074**	1	
Tertiary education	0.022	0.360***	0.432***	0.423***	0.290***	0.441***	0.534***	0.445***	0.493***	-0.119***	1

** and *** denote statistical significance at the 5 and 1% levels, respectively

A.2 Further robustness

A.2.1 Using lags of independent variables

Here, we use the lags of the independent variables and re-estimate our baseline model. This is to provide some robustness checks for our initial results. Perhaps, FDI may have some kind of gestation lag before they exert some impact on financial inclusion. Again, the use of lags of the independent variables helps to reduce the likelihood of any contemporaneous correlations and thus reduces any potential endogeneity concerns. The results as shown in Table 17 are consistent with our main estimates that FDI has a positive impact on financial inclusion with at least 5% significance level.

A.2.2 Cross-sectional analysis: alternative measure of financial inclusion

As further robustness check, we use the 2017 round of the global FINDEX survey by the World Bank. Even though this represents a cross-sectional data, the data has several measures of financial inclusion. As indicated by Suri and Jack (2016), financial inclusion involves access to and use of financial services. We create two financial inclusion indices: (i) financial access, which measures access to financial services; (ii) use of financial services, which measures the actual usage of financial services. Thus, respectively, these represent the proportion of adult population that have access and used any form of financial services over the past year. We use PCA to extract these measures and scale between 0 and 1. For financial access, we use four variables: (i) If an individual owns an account with a financial institution or a mobile money account; (ii) If an individual owns an account with a financial institution; (iii) If an individual owns a debit card, and (iv) If an individual owns a credit card. Also, for financial usage, we use four variables: (i) If the individual saved with a financial institution within the study period; (ii) If the individual borrowed within that period; (iii) If the individual used a debit or credit card, and (iv) If the individual received digital payments within that period.

The descriptive statistics and description of the variables are indicated in Table 18. From the table, we see that the highest financial inclusion measure is account ownership with about an average of 61% of people owning an account with the least being owning a credit card. This shows that more people in SSA tend to own an account but very few tend to use a credit card even though about 43% use a debit card. We also generally see that more people use financial services compared to financial usage considering the all the sub-components. We observe the country rankings of financial access and usage this time with 142 countries for financial access and 123 countries for financial usage, we see that Norway tops the list with the highest access to financial services while Denmark uses financial services the most.

The regression estimates are reported in Tables 19 and 20. Overall, the IV results confirm our earlier findings that FDI has a positive impact on financial inclusion for both access to and usage of financial services. The impact of FDI on access to financial services seems to be larger than that of usage of financial services. This suggests that higher FDI inflows has higher potential to extend financial services to the excluded

Table 17 Financial inclusion and FDI, lags of independent variables

Variable	FINC			
	(1)	(2)	(3)	(4)
L.FDI	0.0078** (0.004)	0.0086** (0.004)	0.0089** (0.004)	0.0081** (0.004)
L.Law	0.0429*** (0.011)			
L.Government		0.0420*** (0.012)		
L.Regulatory quality			0.0249** (0.010)	
L.Corruption				0.0421*** (0.011)
L.Private credit	0.0015*** (0.0003)	0.0015*** (0.0004)	0.0016*** (0.0004)	0.0016*** (0.0003)
L.Natural log real GDP per capita	0.0436*** (0.010)	0.0451*** (0.009)	0.0506*** (0.010)	0.0435*** (0.010)
Adult population	0.0030** (0.001)	0.0027** (0.001)	0.0030** (0.001)	0.0028** (0.001)
ICT	0.0005*** (0.0002)	0.0005*** (0.0002)	0.0005*** (0.0002)	0.0005*** (0.0002)

Table 17 continued

Variable	FINC (1)	(2)	(3)	(4)
Secondary education	-0.0001*** (0.00002)	-0.0001*** (0.00002)	-0.0001*** (0.00002)	-0.0001*** (0.00002)
Tertiary education	0.0021*** (0.00004)	0.0020*** (0.00004)	0.0020*** (0.00004)	0.0022*** (0.00004)
<i>First stage regression</i>				
BITs	4.453*** (1.173)	4.421*** (1.128)	4.424*** (1.126)	4.410*** (1.172)
Adjusted R^2	0.31	0.31	0.31	0.31
Durbin χ^2 -test	38.72***	47.52***	49.67***	42.70***
Wu-Hausman F -test	40.625***	50.61***	53.11***	45.10***
1st-stage F	14.41***	15.36***	15.44***	14.15***
R^2	0.674	0.66	0.652	0.672
No. of countries	87	87	87	87
Obs	623	623	623	623

Robust standard errors are in parentheses, ** and *** denote statistical significance at the 5 and 1% levels, respectively

Table 18 Descriptive statistics for cross-sectional data

Variable	Obs	Mean	Std. dev	Min	Max
<i>Panel A: Financial access</i>					
Account ownership	142	61.05	26.69	8.57	99.92
Financial account ownership	142	57.75	29.31	8.57	99.92
Own a debit card	142	43.78	31.43	1.73	98.81
Own a credit card	142	18.86	20.86	0	82.59
Access	142	0.42	0.29	0	1
<i>Panel B: Financial usage</i>					
Saved	142	23.35	19.44	1.63	79.33
Borrowed	142	23.58	18.62	2.36	82.83
Used a debit or credit card	123	38.83	31.58	1.98	95.69
Made or received digital payments	142	53.51	28.39	7.35	99.39
Usage	123	0.37	0.29	0	1
<i>Panel C: Other variables</i>					
FDI	140	4.94	9.63	-10.62	81.10
Private credit	132	58.99	46.12	3.59	223.39
Law	142	-0.04	1.00	-2.26	2.03
Government	142	0.03	0.99	-2.48	2.22
Regulatory quality	142	0.07	1.00	-2.21	2.16
Corruption	142	-0.08	1.00	-1.71	2.24
Natural log of real GDP per capita	140	9.41	1.17	6.82	11.63
Adult population	141	63.53	6.33	47.32	84.46
ICT	141	111.35	35.02	25.56	251.77
Secondary education	118	90.83	28.15	17.14	158.54
Tertiary education	122	46.95	28.90	3.73	136.60

Account ownership is the percentage of respondents who report having an account (by themselves or together with someone else) at a bank or other financial institution or owning a mobile money account (% age 15+); financial account ownership is the percentage of respondents who report having an account (by themselves or together with someone else) at a bank or other financial institution (% age 15+); own a debit card is the percentage of respondents who report having a debit card (% age 15+); own a credit card is the percentage of respondents who report having a credit card (% age 15+); saved is the percentage of respondents who report saving or setting aside any money at a bank or another type of financial institution in the past 12 months (% age 15+); borrowed is the percentage of respondents who report borrowing any money from a bank or another type of financial institution, or using a credit card, in the past 12 months (% age 15+); used a debit or credit card is the percentage of respondents who report using a debit or credit card to make a purchase in the past 12 months; made or received digital payments is the percentage of respondents who report using mobile money, a debit or credit card, or a mobile phone to make a payment from an account, or report using the internet to pay bills or to buy something online, in the past 12 months. It also includes respondents who report paying bills, sending or receiving remittances, receiving payments for agricultural products, receiving government transfers, receiving wages, or receiving a public sector pension directly from or into a financial institution account or through a mobile money account in the past 12 months (% age 15+). All other variables are as defined earlier

Table 19 Financial inclusion (access) and FDI, IV estimation

Variable	Financial inclusion index (access)		
	(1)	(2)	(3)
FDI	0.0045 (0.003)	0.0056* (0.003)	0.0056 (0.004)
Law	0.1181*** (0.024)		
Government		0.1485*** (0.039)	
Regulatory quality			0.0798** (0.031)
Corruption			0.0958*** (0.023)
Private credit	0.0002 (0.0004)	0.00005 (0.0004)	0.0005 (0.0004)
Natural log real GDP per capita	0.1152*** (0.028)	0.1012*** (0.035)	0.1460*** (0.032)
Adult population	-0.0034 (0.003)	-0.0048 (0.003)	-0.0061* (0.003)
ICT	-0.0006 (0.0004)	-0.0006 (0.0004)	-0.0007 (0.0005)
			0.1347*** (0.026)
			-0.0038 (0.003)
			-0.0007 (0.0005)

Table 19 continued

Variable	Financial inclusion index (access)			
(1)	(2)	(3)	(4)	
Secondary education	0.0008 (0.001)	0.0009 (0.001)	0.0012* (0.001)	0.0010* (0.001)
Tertiary education	0.0010 (0.001)	0.0009 (0.001)	0.0007 (0.001)	0.0009 (0.001)
<i>First-stage regression</i>				
BITs	3.558*** (0.877)	3.491*** (0.866)	3.365*** (0.878)	3.470*** (0.859)
Adjusted R^2	0.21	0.21	0.21	0.21
Durbin χ^2 -test	4.96**	7.08***	6.20**	9.33***
Wu-Hausman F -test	4.72**	6.88***	5.97**	9.27***
1st-stage F	5.83**	5.91**	5.09**	6.64***
R^2	0.86	0.85	0.83	0.83
No. of countries	110	110	110	110

Robust standard errors in the parenthesis. *, ** and *** denote statistical significance at the 10, 5 and 1% levels, respectively

Table 20 Financial inclusion (usage) and FDI, IV estimation

Variable	Financial inclusion index (usage)		
	(1)	(2)	(3)
FDI	0.0076* (0.005)	0.0089* (0.005)	0.0090 (0.006)
Law	0.1489*** (0.039)		
Government		0.1955*** (0.068)	
Regulatory quality			0.1010** (0.050)
Corruption			0.1109*** (0.039)
Private credit	-0.0004 (0.001)	-0.0007 (0.001)	-0.0001 (0.001)
Natural log real GDP per capita	0.1213*** (0.045)	0.1034* (0.059)	0.1612*** (0.051)
Adult population	-0.0086* (0.005)	-0.0106** (0.005)	-0.0122** (0.005)
ICT	-0.0004 (0.001)	-0.0004 (0.001)	-0.0007 (0.001)
			0.1505*** (0.045)
			-0.0096* (0.005)
			-0.0006 (0.001)

Table 20 continued

Variable	Financial inclusion index (usage)	(1)	(2)	(3)	(4)
Secondary education		0.0010 (0.001)	0.0010 (0.001)	0.0016 (0.001)	0.0013 (0.001)
Tertiary education		0.0016 (0.001)	0.0014 (0.001)	0.0011 (0.001)	0.0014 (0.001)
<i>First-stage regression</i>					
BITs		3.561*** (0.943)	3.482*** (0.930)	3.361*** (0.941)	3.467*** (0.921)
Adjusted R^2		0.20	0.20	0.20	0.20
Durbin χ^2 -test		4.51**	6.10**	5.59**	7.86***
Wu-Hausman F -test		4.24**	5.84**	5.32**	7.66***
1st-stage F		5.36**	5.33**	4.79**	6.23***
R^2		0.72	0.70	0.67	0.65
No. of countries		96	96	96	96

Robust standard errors in the parenthesis. *, ** and *** denote statistical significance at the 10, 5 and 1% levels, respectively

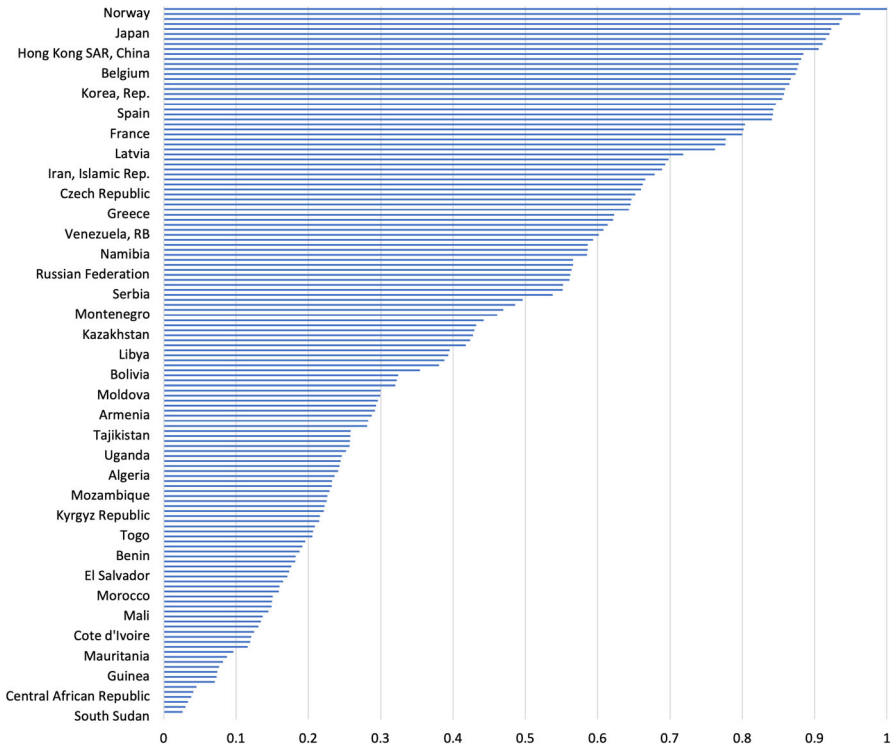


Fig. 5 Mean financial inclusion (access) by country. Note: Country labels adjusted with 2 intervals. Based on 142 countries

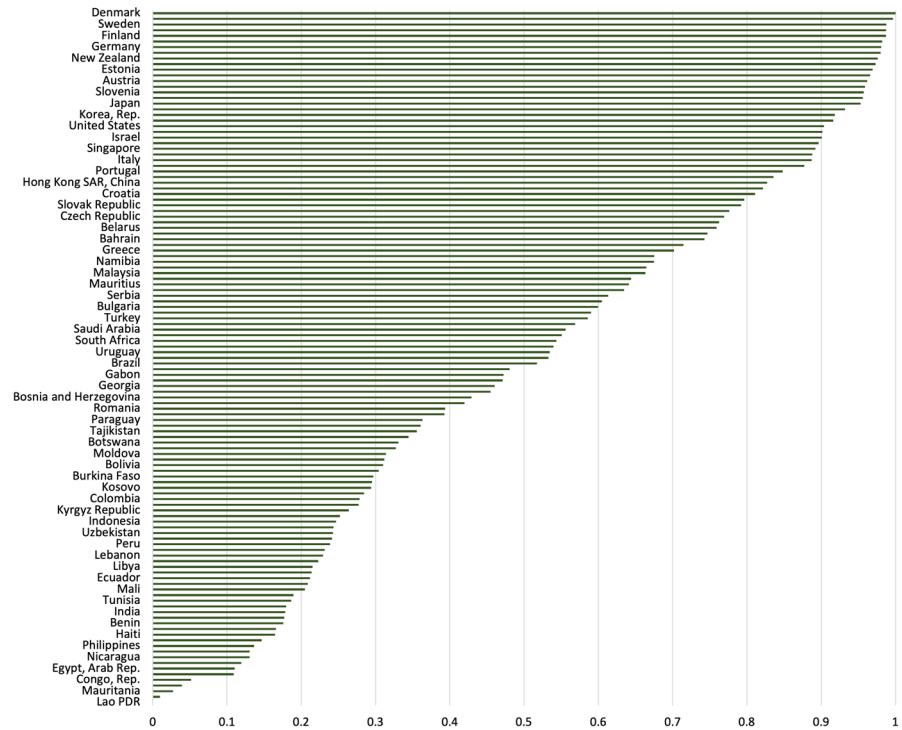


Fig. 6 Mean financial inclusion (usage) by country. Note: Country labels adjusted with 2 intervals. Based on 123 countries

while also increasing the usage of these financial services by those who otherwise were excluded.

References

- Acemoglu D, Johnson S, Robinson JA (2001) The colonial origins of comparative development: an empirical investigation. *Am Econ Rev* 91(5):1369–1401
- Ackermann K, Awaworyi Churchill S, Smyth R (2021) Mobile phone coverage and violent conflict. *J Econ Behav Organ* 188:269–287
- Agbloyor EK, Abor JY, Adjasi CKD, Yawson A (2014) Private capital flows and economic growth in Africa: the role of domestic financial markets. *J Int Finan Markets Inst Money* 30:137–152
- Alesina A, Zhuravskaya E (2011) Segregation and the quality of government in a cross section of countries. *Am Econ Rev* 101(5):1872–1911
- Allen F, Demirguc-Kunt A, Klapper L, Peria MSM (2016) The foundations of financial inclusion: understanding ownership and use of formal accounts. *J Finan Intermed* 27:1–30
- Anarfo EB, Abor JY, Osei KA, Gyekye-Dako A (2019) Financial inclusion and financial sector development in Sub-Saharan Africa: a panel VAR approach. *Int J Manag Financ* 15(4):444–463
- Arellano M, Bover O (1995) Another look at the instrumental variable estimation of error-components models. *J Econom* 68(1):29–51
- Awaworyi Churchill S, Marisetty VB (2020) Financial inclusion and poverty: a tale of forty-five thousand households. *Appl Econ* 52(16):1777–1788

- Beck T, Demirgüç-Kunt A, Levine R (2007) Finance, inequality and the poor. *J Econ Growth* 12(1):27–49
- Bhagwat V, Brogaard J, Julio B (2021) A BIT goes a long way: bilateral investment treaties and cross-border mergers. *J Financ Econ* 140(2):514–538
- Brune L, Giné X, Goldberg J, Yang D (2016) Facilitating savings for agriculture: field experimental evidence from Malawi. *Econ Dev Cult Change* 64(2):187–220
- Čihák M, Mare DS, Melecký M (2016) The nexus of financial inclusion and financial stability: a study of trade-offs and synergies. World Bank Policy Research Working Paper, (7722), Washington D.C.: World Bank
- Dabla-Norris ME, Ji Y, Townsend R, Unsal MF (2015) Identifying constraints to financial inclusion and their impact on GDP and inequality: a structural framework for policy. International Monetary Fund Working Paper No. 2015/022
- Demirgüç-Kunt A, Klapper L, Singer D (2017) Financial inclusion and inclusive growth: a review of recent empirical evidence. World Bank Publications, Washington
- Demirgüç-Kunt A, Klapper L, Singer D, Ansar S (2018) The global index database 2017: measuring financial inclusion and the fintech revolution. World Bank Publications, Washington
- Dermirgüç-Kunt A, Klapper L (2012) Measuring financial inclusion: the global index database. The World Bank, Washington
- Dupas P, Robinson J (2013) Why don't the poor save more? Evidence from health savings experiments. *Am Econ Rev* 103(4):1138–1171
- Grohmann A, Klühs T, Menkhoff L (2018) Does financial literacy improve financial inclusion? Cross country evidence. *World Dev* 111:84–96
- Hall R, Jones C (1999) Why do some countries produce so much more output per worker than others? *Quart J Econ* 114(1):83–116
- Holtz-Eakin D, Newey W, Rosen HS (1988) Estimating vector autoregressions with panel data. *Econometrica* 56(6):1371–1395
- Jolliffe IT (2002) Choosing a subset of principal components or variables. *Principal Comp Anal* 2002:111–149
- Kaiser HF (1974) An index of factorial simplicity. *Psychometrika* 39(1):31–36
- Karlan D, Morduch J (2010) Access to Finance. In: Dani R, Mark R (eds) *Handbook of Development Economics*. Springer, USA, pp 4703–4784
- Kaufmann D, Kraay A, Mastruzzi M (2010) The worldwide governance indicators: methodology and analytical issues. World Bank Policy Research Working Paper No. 5430, The World Bank
- Kennedy P (2008) *A guide to econometrics*, 6th edn. Blackwell Publishing, Oxford
- Klapper L, Lusardi A, van Oudheusden P (2015) Financial literacy around the literacy survey. Available at: <https://www.finlit.mhfi.com>
- Knack S, Keefer P (1995) Institutions and economic performance: cross-country tests using alternative institutional measures. *Econ Politics* 7(3):207–227
- Lewbel A (2012) Using heteroscedasticity to identify and estimate mismeasured and endogenous regressor models. *J Bus Econ Stat* 30(1):67–80
- Liu Z, Spiegel MM, Zhang J (2023) Capital flows and income inequality. Federal Reserve Bank of San Francisco. Working Paper 2020-14. Available at: <https://doi.org/10.24148/wp2020-14>
- Liu F, Walheer B (2022) Financial inclusion, financial technology, and economic development: a composite index approach. *Emp Econ* 63(3):1457–1487
- Long C, Yang J, Zhang J (2015) Institutional impact of foreign direct investment in China. *World Dev* 66:31–48
- Mauro P (1995) Corruption and growth. *Quart J Econ* 110(3):681–712
- Muriu PW (2020) Role of institutional quality in promoting financial inclusion. AERC Research Paper 384, African Economic Research Consortium, Nairobi
- Naceur MSB, Barajas MA, Massara MA (2015) Can Islamic banking increase financial inclusion?. IMF Working Paper (WP/15/31), International Monetary Fund
- Neaime S, Gaysset I (2018) Financial inclusion and stability in MENA: evidence from poverty and inequality. *Financ Res Lett* 24:230–237
- Nkoa BEO, Song JS (2020) Does institutional quality affect financial inclusion in Africa? A panel data analysis. *Econ Syst* 44(4):100836
- North DA (1990) *Institutions, institutional change and economic performance*. Cambridge University Press, New York

- Okada K (2013) The interaction effects of financial openness and institutions on international capital flows. *J Macroecon* 35:131–143
- Reiter SL, Steensma HK (2010) Human development and foreign direct investment in developing countries: the influence of FDI policy and corruption. *World Dev* 38(12):1678–1691
- Rivera-Batiz L, Oliva M-A (2002) Political institutions, capital flows, and developing country growth: an empirical investigation. *Rev Dev Econ* 6(2):248–262
- Roodman D (2009) How to do xtabond2: an introduction to difference and system GMM in Stata. *Stand Genomic Sci* 9(1):86–136
- Sarma M (2012) Index of financial inclusion—a measure of financial sector inclusiveness. Berlin Working Papers on Money, Finance, Trade and Development
- Sharma D (2016) Nexus between financial inclusion and economic growth: evidence from the emerging Indian economy. *J Financ Econ Policy* 8(1):13–36
- Suri T, Jack W (2016) The Long-run poverty and gender impacts of mobile money. *Science* 354(6317):1288–92
- Swamy, V. (2012). Bank-based financial intermediation for financial inclusion and inclusive growth. Available at SSRN: <https://ssrn.com/abstract=2126834> or <http://dx.doi.org/10.2139/ssrn.2126834>
- World Bank (2014) Financial Inclusion, Global Financial Development Report, The World Bank, Washington D.C
- Zhao L (1998) The impact of foreign direct investment on wages and employment. *Oxf Econ Pap* 50(2):284–301

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