Do sound financial systems improve the financing constraints of firms?

Abstract

We use firm-level data to explore the effect of a country measure of financial system soundness on the individual firms' financing constraints in low- and middle-income countries. We measure financial system soundness using a data-driven approach and a dynamic factor model to synthesize the IMF's financial soundness indicators into a single index. Our financial soundness index captures the time varying, cross-country dependencies among the indicators and therefore provides a useful tool for monitoring financial stability and assessing the effects of macroprudential policies on firms' behavior. We subsequently examine the effect of our index on the financing constraints of 64,717 non-financial firms in 76 countries during 2010-2018. We include fixed effects to capture country, year and sector heterogeneity. We find that firms operating in countries with higher levels of financial system soundness are associated with lower financing constraints. The effect depends on the individual firm-specific characteristics. The results remain robust after applying various sensitivity tests and endogeneity analysis as well as accounting for various economic and institutional influences.

Keywords: Financial stability, Financing constraints, data-driven, Dynamic Factor Model, Institutions, Developing countries

JEL: G01, G18, G32, C52, C23, O57

1. Introduction

Financing constraints affect firms' investment and growth. The determinants of the financing constraints of firms have therefore been an important issue in the finance literature (Fazzari et al., 1988; 2000, Kaplan and Zingales, 1997; 2000, Brown et al., 2012, Ferrando et al., 2017). While a key consideration for firms across the globe, financing constraints are especially important for firms operating in developing countries due to specific financial and institutional reasons (i.e., inadequate collateral, inefficient governance, etc.) (Claessens, 2006, Beck and Laeven, 2006, Beck et al., 2005, Karlan and Morduch, 2010).

The determinants of financing constraints of firms have been analyzed within a framework that emphasizes the role of the specific characteristics of firms and of country-level economic factors and institutions. Prior studies have documented the importance of firms' size and age for understanding their financing constraints (Devereux and Schiantarelli, 1990, Schiantarelli, 1995, Oliner and Rudebusch, 1992, Schiffer and Weder di Mauro, 2001, Klapper et al., 2006, Kuntchev et al., 2013, Petersen and Rajan, 1994, Beck et al., 2005). Other studies emphasized the role of the sectoral characteristics of firms (Hall et al., 2000, Abor, 2007). Yet, other studies stressed the importance of ownership structure (Harrison and McMillan, 2003, Colombo, 2001, Clarke et al., 2006, Mertzanis, 2017). Some other studies explored the effects of firms' location on their access to finance (Berger and Udell, 1995, Gilbert, 2008). Finally, some studies explored the role of the firms' legal incorporation status (Harhoff and Korting, 1998, Cassar, 2004, Abor, 2007). While using diverse methodologies and data, these and subsequent studies have broadly documented that the specific characteristics of firms play an important role in explaining their financing constraints.

However, the sole focus on their specific characteristics has not been sufficient for understanding the causes of firms' financing constraints (Kaplan and Zingales, 1997), redirecting focus on the broader association between the financial system, financial access and economic growth. Especially influential have been the studies that documented robust associations between financial depth and economic growth

(Levine, 1997, Levine et al., 2000a), financial depth and corporate finance (Demirgüç-Kunt and Maksimovic, 1998, Rajan and Zingales, 1998, Levine et al., 2000b), financial depth and income inequality (Beck et al., 2007, Honohan, 2006), as well as the role of financial liberalization (Laeven, 2003), among others. However, the link between finance, corporate investment and economic growth is far from being well understood (Rodrik and Subramanian, 2009, Stiglitz, 2000).

A related strand of literature focused on the role of institutions in affecting directly and indirectly the conditions and behavior of economies and firms. For example, some studies emphasized the role of historical origins and political systems (Acemoglu et al., 2001, Acemoglu and Robinson, 2005), other studies stressed the role of the individual legal rights (North, 1990), and further studies analyzed the role of culture and religion (Guiso et al., 2006) and social capital (Putnam, 2000). Other studies documented the important role of social fractionalization (Alesina and La Ferrara, 2005) and family ties (Mertzanis, 2019), whilst some studies emphasized the need to properly differentiate among institutions for explaining firms' external finance decisions (Knack and Xu, 2017).

The recent global financial crisis stressed the role of alternative financial markets and infrastructure for understanding the financing constraints of firms. For example, the latter are found to be affected by the developments in the interbank markets that determine the ability of the banking system to extend credit to firms (Ivashina and Scharfstein, 2010, Campello et al., 2010, Duchin et al., 2010). The supply-side credit effects are found to be more pronounced in bank-dependent firms (Leary, 2009), in firms financed by short-term debt and trade credit (Akbar et al., 2013), in firms with large institutional holdings (Erkens et al., 2012) and where banks were inadequate capitalized (Paravisini, 2008).

A related post-crisis literature stressed the role of regulation as well as financial stability and macro-prudential policies. Credit availability to firms was linked, inter alia, to macroprudential policies (Ayyagari et al., 2018, Yarba and Guner, 2020), the bank capital requirements (Fisera et al., 2019, Fang et al., 2020, Gopalakrishnan et al., 2021), the financial supervision structure (Mertzanis, 2020) and the central bank-imposed liquidity constraints (Ananou et al., 2021). While several studies exist that measure financial stability (see surveys by Acharya et al. (2017), Gadanecz and Jayaram (2008)), they do not directly assess the effects of these measures on the financing constraints of firms. Moreover, empirical studies mainly focus on developed countries and tend to analyze the impact of financial stability policy on bank lending accounting for the characteristics of banks and less so for the characteristics of borrowing firms. The evidence regarding the effect of financial stability considerations on the financial of firms in less developed countries is limited and focuses on single countries only (European Central Bank, 2005, Gray et al., 2007).

We contribute to the latter strand of literature by developing a novel country-level measure of financial soundness that captures financial stability considerations and using it to explain the financing constraints of individual firms in medium and low-income countries. We use a data-driven statistical approach and a dynamic factor model to combine the individual country-level financial soundness indicators (FSIs) formed by the International Monetary Fund (IMF) and produce a financial soundness index (FSIND). Subsequently, using micro data from the World Bank's Enterprise Surveys, we explore the impact of our financial soundness index on the financing constraints of 63,894 firms in 76 low- and middle-income countries during 2010-2018. We analyze the extent to which macro-prudential and other regulatory policies (as captured by the FSIs) influence the extent to which firms experience access to finance as an obstacle to their business operations. The use of firm-level data to study the effects of our country-level financial soundness index has the advantage of mitigating reverse causality bias since it is unlikely that individual firms' decisions will influence macro policies and of allowing the inclusion of country-year fixed effects to control for the impact of omitted variable bias. The results show that the financial soundness index is a broadly robust predictor of financing constraints of firms in developing countries. We find that firms operating in countries with higher levels of financial system soundness experience lower financing constraints. The effect is stronger for older and larger firms, which are publicly listed. Interesting the effect is insignificant for subsidiary and state-owned firms. These results are robust to controlling for country, year and industry shocks through country-year-sector fixed effects, allowing for heterogeneous effects of other industry and country-level factors that influence firm behavior. Our analysis deploys several sensitivity tests to check the predictive robustness of the FSIND with respect to alternative variable measures, sample structures and estimation methods. We finally use the Oster test (Oster, 2019) to determine omitted variable bias by testing the relevance of additional country-level variables on the value of the key coefficients.

A major concern with our empirical findings is potential endogeneity that may affect the observed association among financial system soundness at the country level and individual firms' access to finance. Our country-level index captures general policy conditions and policies and not firm-level decisions. Further, it is possible that country-level economic and other factors affect simultaneously the financial soundness conditions and the individual firm decisions creating confounding bias. While our data captures within-firm variation and across-firm differential effects, the potential endogeneity may still be a problem. We address the endogeneity concern by applying alternative variable measurement, alternative sample structures and instrumental variable analysis.

Our analysis adds to the literature in several ways. First, extending prior studies (Claessens et al., 2013, Cerutti et al., 2017, Akinci and Olmstead-Rumsey, 2018), we develop a new measure of the health and soundness of financial institutions, markets and households together using credible IMF information that accounts for the effect of macroprudential and other policies that assess and monitor the strengths and vulnerabilities of the financial system as a whole. Our measure is not limited by its dependence on the conditions and prudential ratios of individual financial institutions alone (Čihák and Schaeck, 2010, Cihak et al., 2012), but it reflects the broader, combined financial conditions, including compliance with international financial sector standards and compliance codes, and the outcome of stress tests. We construct of financial soundness index that is fully data-driven, tested and validated. The data 'speak' by means of an unsupervised statistical learning technique, which makes neither a priori assumptions on the relationship among the independent variables nor a subjective decision on the variables to be possibly dropped.

Second, our analysis uses information on a large number of diverse firms operating in the important medium and low-income countries. We analyze the controlling effect of a wide range of firm-specific characteristics to account for firm-level heterogeneity. Our analysis contributes to the large literature on the role of firm-specific characteristics in explaining the financing constraints of firms (Petersen and Rajan, 1994, Berger and Udell, 1995, Beck et al., 2008) and on the micro effects of macroprudential policies (Ayyagari et al., 2018, Yarba and Guner, 2020). Moreover, our analysis covers a large number of developing countries, where financial stability information is scant and fragmented, mostly based on single country measures (European Central Bank, 2005, Gray et al., 2007), using a consistent and uniform measure. In this respect, our analysis helps elucidate the challenging tradeoff between financial stability and economic dynamism in developing countries. Third, our analysis contributes to the literature on the effect of aggregate economic shocks (Gertler and Gilchrist, 1994, Chodorow-Reich, 2014, Ananou et al., 2021) and institutional factors on the financial decisions of firms.

In what follows, Section 2 reviews the related literature; Section 3 describes the construction of the FSIND, the data and the empirical methodology used for the analysis; Section 4 explores the predictive power of FSIND and other firm-specific characteristics on the financing constraints of firms and applies various sensitivity tests; Section 5 contains different endogeneity tests; and finally section 6 concludes the paper.

2. Relevant literature

The 2007-8 financial crisis raised the need for macroprudential analysis. The latter is seen as important for identifying vulnerabilities in the financial system as a whole, which in turn requires improved information on the soundness of financial systems. The paucity of data in this area, and a lack of dissemination and cross-country comparability have been recognized as key stumbling blocks. In response, the International Monetary Fund (IMF) has worked closely with national agencies and regional and international institutions to develop a set of Financial Soundness Indicators (FSIs), which monitor the financial sector's current health condition (International Monetary Fund, 2019). The soundness of a country's financial system has attracted the researchers' attention and it is directly linked to financial stability considerations (Restoy, 2017). It is especially important for developing countries, where the financial systems are less developed, firms suffer from inadequate credit access and information quality, and financial inclusion is a key policy consideration.

The soundness of a country's financial system is intertwined with its macroprudential policies. Claessens et al. (2013) classify different types of macroprudential policies according to their purpose. Some focus on dampening an expected credit boom or credit crunch and they are more cyclical in nature. Others focus on increasing the resilience of the financial sector, using capital or provisioning requirements, and they are more capital-driven. Subsequently, some policies focus more on the conditions of financial institutions whilst others focus more directly on borrowers. Thus, depending on the phase of the business cycle and the choice of financial policies in different counties, the overall configuration of macroprudential policies and financial soundness will differ among countries. Cerutti et al. (2017) analyze the use of various macroprudential policies in 119 countries over the period of 2000–13 and find that macroprudential policies are associated with lower country credit growth. Their effects are weaker in open and financially more developed countries. Akinci and Olmstead-Rumsey (2018) use quarterly data to construct an index that measures the tightening and easing of macroprudential policies in 57 countries and show that these policies are used in tandem with bank reserve requirements, capital flow management measures, and monetary policy. Lim et al. (2011) study a subset of 49 countries and find that macroprudential policies are associated with reductions in the procyclicality of credit and firm leverage. Edge and Liang (2019) stress the role of the establishment of Financial Stability Committees (FCSs) as a tool for financial risk mitigation and use the interaction between FCSs and regulatory agencies in 58 countries to analyze the drivers of financial stability. Their results show that, after controlling for the severity of the financial crisis, countries with stronger FSCs are more likely to use the countercyclical measures of credit growth, especially relative to countries where a bank regulator or the central bank has the authority to set counter-cyclical policy. Fendoglu (2017) constructs a macroprudential policy stance index based on the IMF's detailed survey on macroprudential policy actions and he finds that an overall tightening in the macroprudential policy stance is effective in containing both the credit cycles per se and the impact of portfolio inflows on the credit cycles.

Financial soundness considerations affect the indirect financing of firms through the banking system and especially the conditions of financial institutions and the regulation of capital requirements. For example, Chodorow-Reich (2014) examines the impact of credit supply disruptions associated with the crisis and finds bigger effects among small firms, due information asymmetries caused by frictions. Firms that had pre-crisis relationships with less healthy lenders had a lower likelihood of obtaining a loan during the crisis, paid a higher interest rate on the loan, and reduced employment. Degryse et al. (2015) use data that comprise geographical information of bank branches or headquarters and analyze the effect of banks' financial conditions (leverage, core deposits, etc.) on their provision of credit on SMEs before and during the financial crisis. They document a significant association between banks' financial conditions and firms' access to credit, which is affected by the firms' proximity to branches and headquarters as well as the phasing of the crisis. Fisera et al. (2019) analyze the effect of Basel III rules on the financing constraints of small- and medium-size enterprises in developing countries. They find that higher capital requirements are associated with a negative effect on firms' access to finance, especially those that have limited access to the financial system (only a bank account). Gopalakrishnan et al. (2021) analyze the effects of Basel regulations on risk-sensitive assets on the debt financing choices of firms. Using a difference-in-difference analysis of firms in 52 countries, they find that low-rated firms experience a reduction in credit availability, which is further associated with lower investment and lower dividend payout to shareholders. They also find that the effect is stronger in countries that allow banks to implement internal ratings systems. Calem et al.

(2020) analyse the impact of several prudential policies on the supply of credit in the US. They find a negative effect of stricter stress-test regulation on the amount of mortgage credit. They also find that the share of speculative-grade loan origination decreased with higher bank regulation. Fang et al. (2020) show that higher bank capital requirements are associated with lower firms' access to credit. They use quarterly data for 14 Peruvian banks and several model specifications to address concerns about the endogeneity of capital requirements. They find that the capital requirement effect is stronger during periods of lower economic growth and that banks with low levels of liquidity, capitalization and profitability, are more reactive to changes in capital requirements. Desai et al. (2004) analyze how multinational firms capitalize their affiliate firms around the world and show that, in response to prudential policies, these affiliates substitute internal borrowing for expensive external financing thereby alleviating their financing constraints. Ananou et al. (2021) focus on the role of central bank-imposed liquidity constraints. They find that bank liquidity shortages during the global financial crisis of 2007-2009 led to the introduction of liquidity regulations (Liquidity Balance Rule) in the Netherlands, the impact of which was an increase in corporate credit due to higher inflow of retail deposits and equity injections.

On the other hand, the soundness of a country's financial system can have a direct impact on firms' capability and willingness to demand external finance. The effect operates through the general level of uncertainty, which is a source of destabilization that affects individual firm behavior. Mac an Bhaird et al. (2016) examine the effects of the perception of a loan application rejection by firms in 9 European countries. They find that the transmission of macro-financial uncertainty effects through the banking system may lead to higher levels of firms' discouragement in applying for loans. They highlight the importance of capital market regulation and enforcement mechanisms in mitigating the negative effects of higher uncertainty on firms borrowing discouragement. Becchetti and Trovato (2002) argue that, in conditions of uncertainty, younger and the smaller firms are least likely to lower their demand for external finance because they may have higher growth potential, which they need more finance to secure.

The impact of macroprudential policies may also be affected by the characteristics of the financial intermediation structure. Dabla-Norris et al. (2015) use firm-level data from emerging markets and a general equilibrium model based on game theory, to identify constraints to financial inclusion. They find that macroprudential policies influence the size of participation costs and of collateral thereby affecting firms' access to finance. Their results also show that alleviation of financial frictions is associated with a differential impact on firms across countries, due to country-specific characteristics that determine the connections and balance between inequality and financial inclusion. Mertzanis (2020) explores the impact of financial supervision structure on firms' financing constraints in 48 developing countries. He suggests that decentralized structures of prudential supervision are associated with more binding financing constraints of firms in high-income developing countries and less binding ones in market-based financial systems. Ehigiamusoe and Samsurijan (2021) provide evidence that a stable macro-financial environment and higher levels of regulatory quality are necessary conditions for enhancing the role of finance in accelerating economic growth in developing countries. They also find that the mitigating effect turns negative beyond a certain level of finance in the economy.

In this paper, we extent this line of research by examining the effect of a novel composite financial soundness index at the country level, based on combined information from the IMF's financial soundness indicators across countries, on the financing constraints of the individual firms operating in those countries. The nature of information used for its construction makes our indicator a reasonable proxy of the state of macroprudential policies of countries (Claessens et al., 2013, Cerutti et al., 2017, Akinci and Olmstead-Rumsey, 2018). Our study follows other studies that experimented with the construction of composite measures of financial stability. For example, Van den End (2006) and Nelson and Perli (2007) argue that the complexity of financial intermediation makes general financial market indicators valuable inputs to measuring financial stability. Similarly, Hawkins and Klau (2000), Nelson and Perli (2007), Gray et al. (2007), Illing and Liu (2006), used alternative combinations of aggregate financial variables and different aggregation models to produce different aggregate financial stability indicators. The interest in constructing financial stability indicators has also been extended to central banks (Bank of England, 2008, Sveriges Riksbank, 2008). In the next section, we explain the construction of the FSIND.

3. Data and Methodology

3.1. Construction of the Financial Soundness Index

We construct our financial soundness index as a synthetic aggregation of country-level information provided by the IMF's financial soundness indicators. Synthetic measures are typically based on assumptions made by experts regarding the choice of weights. These assumptions are subjective by nature and therefore the associated synthetic indices may be questionable, leading to debate on what is a robust financial indicator to consider. Prior studies have implemented various methods for producing synthetic financial indexes, which can be broadly grouped into econometric methods and statistical learning methods. The former comprises inter alia the studies by Moccero et al. (2014), Opschoor et al. (2014), Mamatzakis and Tsionas (2020), Huang et al. (2021). Those papers typically employ Vector Autoregressive or GARCH models to naturally elicit the temporal evolution of the considered financial variables. The latter comprise studies that use dimension reduction techniques like Principal Component Analysis or Factorial Analysis, such as Kabundi and Mbelu (2017), Ahamed and Mallick (2019), Saha and Dutta (2020).

In this paper, we use a data-driven statistical approach to construct our financial soundness index based on country-level information included in the 17 financial soundness indicators (FSIs) produced by the IMF during 2010-2018 that cover 140 developed and developing countries. Tables A4 and Table A1 in the Appendix present the summary statistics of the index's constituent variables 1 to 17 and their pairwise correlations. Unfortunately, some countries have missing values of the 17 indicators and years. As a result, we restrict our analysis to 76 countries from 2010 to 2018, selected with an incidence of missing values not exceeding 30%. Table

A2 in the Appendix provides the selected countries and the associated percent of missing values. Since the presence of many missing values could considerably impact the quality and reliability of results, we carry out missing values treatment and imputation. In our sample, 16 countries show a percent of missing values between 20-29%. Thus, we apply two alternative data imputation methods: a Matrix Completion with Low Rank SVD method (MC-SVD) (Hastie et al., 2015) and Bayesian Tensor Factorization (BTF) method (Khan and Ammad-ud-din, 2016). Briefly, MC-SVD solves the minimisation problem $\frac{1}{2}\|X - AB^T\|_F^2 + \frac{\lambda}{2}(\|A\|_F^2 + \|B\|_F^2)$ for A and B where $\|\cdot\|_F$ is the Frobenius norm by setting to 0 the missing values. Once estimated, AB^T can approximate the original matrix X, including the missing values. This is applied to the 2-dimensional "slice" of countries-FSI for each year. BTF acts in a similar way but using a tensorial decomposition of the 3-dimensional tensors that stacks all the annual slices together so that the imputation process involves information coming from a temporal dimension as well. Appendix B describes the assessment of the reconstruction performance for the two imputation techniques. Overall, we find that Bayesian Tensor Factorisation performs better.

After having imputed missing data, in order to ensure the adequate sample size suitable for the presented methodologies, we run the Kaiser–Meyer–Olkin test (Kaiser, 1970) resulting in the large score of 81.9% and 82.7% for MC-SVD and BTF respectively. Moreover, we check for stationarity of each FSI-country pair over the time span. We perform standard Augmented Dickey-Fuller and Ljung-Box test and since some non-stationarity is revealed, we integrate all time series with lag 1, in order not to sacrifice too many observations. Additionally, we run the Im-Pesaran-Shin test (Im et al., 2003) obtaining p-values $p \ll 0.01$ for both model specifications, i.e. "individual intercepts" and "individual intercepts and trends" for the underlying Augmented Dickey-Fuller test, implying the acceptance of alternative hypothesis of stationarity for the independent variables time-series. Consequently, we remove differences in magnitude among the independent variables by standardising the values, i.e. we subtract the mean and divide by the standard deviation. Having all variables on the same reference scale is crucial for unbiased estimation when applying dimensionality reduction techniques.

Then we take advantage of a statistical methodology to build the index following the dimensionality reduction approach: Factor Analysis (FA). FA models the measurement of latent variables, seen through the relationships they cause in a set of Y variables. The model is represented by a set of equations $Y_i = b_i F_i + u_i, i = 1, \ldots, p$, where Y_i are the original variables, F_i are the latent factors and b_i, u_i are the parameters of the combination. Recalling that our dataset has three dimensions, *Country*, *Variable* and *Time*, we evaluate a temporal dependent version of FA called Dynamic Factor Model (DFM), modelling country/variable interactions for all the available years within the same model. Given the $p \times n$ matrix $\mathbf{X}$, the model assumes that there exist some $k \times n$ factors $\mathbf{F}$ such that their mutual interaction over time can be expressed by a $k \times k$ interaction matrix $\mathbf{A}$ and the observed variable can be expressed as a linear function of the factors themselves through a $p \times k$ loading matrix $\mathbf{C}$. The problem can be solved as a system of equations:

$$\begin{cases} \mathbf{F}_t = \mathbf{A}\mathbf{F}_{t-1} + \mathscr{N}(0, \mathbf{Q}) \\ \mathbf{X}_t = \mathbf{C}\mathbf{F}_t + \mathscr{N}(0, \mathbf{R}) \end{cases} \tag{1}$$

where $\mathscr{N}$ is the normal probability distribution and $\mathbf{Q}$ and $\mathbf{R}$ are the covariance matrix of the residuals of each equation in (1), respectively. Due to the short time series of the independent variables, this model cannot be fitted considering all countries together as the resulting system of equations (1) is under-determined. Thus, we deal with the problem as follows: first, following Holmes et al. (2018), we fit DFM for each country, obtaining the factor matrices $\mathbf{F}^i$, the factor interactions $\mathbf{A}^i$ and the factor loadings $\mathbf{C}^i$, $i = 1, \ldots, n$. Second, we fit a Vector Auto Regressive (VAR) model in order to get $\hat{\boldsymbol{A}}$ 1-year lag matrix that incorporates cross-countries interactions of $\mathbf{A}^i$. We implement the model using *R* package `sparsevar` because this calibration problem has too many parameters to estimate relative to the number of observations, thus requiring a sparse approach. Then, we use Kalman Filter to get smoothed factors $\widehat{\mathbf{F}^i}$ using $\hat{\boldsymbol{A}}$ and $\hat{\boldsymbol{C}} = diag(\boldsymbol{C}^i)$, that is to get latent factors that incorporate cross-countries interactions. Briefly, Kalman filter re-estimates the factor matrix $\mathbf{F}$ iterating the two equations in (1) until the error between the predicted observed variables $\hat{\boldsymbol{X}}$ and the true one is minimised. We implement the model using *R* package `FKF`. We assume $\hat{\boldsymbol{C}}$ to be diagonal in order not to double-count correlations within the observed variables and because cross-country interactions are already modelled through the VAR. Moreover, the described procedure depends upon two hyper-parameters: the sparsity coefficient α of the VAR and the correlation structure of the residuals for Kalman filter. Thus, we simulate synthetic factors $\widetilde{\mathbf{F}}$ with different combinations of number of observed variables, countries, years, latent factors $\mathbf{F}$, and we generate the corresponding $\mathbf{X}_t$ given different combination of $\mathbf{A}$, defined by α, and $\mathbf{C}$, randomly generated, using equation (1). Then, for each of the previous combination and correlation structure of residuals $\mathbf{Q}$, we apply the described algorithm and assess the reconstruction error on the fitted factors $\widetilde{\mathbf{F}}$ with the simulated factors $\mathbf{F}$. The optimal parameters found are $\alpha = 0.2$ and a diagonal structure. The final index, hereinafter referred to as Financial Soundness Index (FSIND), will be represented by the k-dimensional factor matrix F. One of the goals is to select the optimal number of components k as a trade-off between the maximal explained variance and the smallest value of components k. We produce a k-dimensional continuous FSIND per country-year pair. Afterwards, we evaluate the R^2 on both the whole dataset and subsets with values trimmed for the 95$^{\text{th}}$ and 99$^{\text{th}}$ percentiles in order to check for the impact of outliers. In our context, in analogy with the classical R^2, we compute the RSS term as the squared residuals given after the reconstruction step using only the retained principal components and the TSS term as the total variance contained in the original variables. We fit the DFM model with one and two factors as well under the assumption of interactions between factors, i.e. estimated $\hat{\boldsymbol{A}}$, and no interactions, i.e. $\hat{\boldsymbol{A}} = \boldsymbol{I}$, where $\boldsymbol{I}$ is the identity matrix. Table A5 in the Appendix reports the results. Models with no factors' interactions have low performance, meaning that cross-countries effects are relevant in order to capture the intrinsic relationship within the data. In fact, the normalised entries of the estimated interaction matrix $\hat{\boldsymbol{A}}$ turn out to rather large, ranging into $[-0.76, 0.75]$.

Moreover, the use of two factors provides very small improvements on the performances compared to the single factor version in both model settings. Therefore, we prefer to retain only the single factor model, which explains at its minimum an R^2 of 65% and because the possibility of building up our FSIND index considering just one component eases the interpretation, the relative employment and the subsequent monitoring. Additionally, we run the Im-Pesaran-Shin test on the FSIND index and $p - values \ll 0.01$ for all model specifications ensure its stationarity. The stationarity is important because we can infer that the changes over time, which the index is expected to capture, can be statistically robust and not caused by any trend in the data or mean-reversion effects. Appendix C reports the interpretation of the relative importance of the DFM loadings and their impact on each country. Finally, the animated map in Figure A4 in the Appendix reports the global distribution of FSIND index over years for each country. For sake of clarity, we recall that high values of FSIND are reported for less riskier countries, on the contrary high values correspond to riskier and unstable countries.

3.2. Description of Data

To identify the causal effect, we use firm-level data from the Enterprise Surveys carried out by the World Bank (ES hereafter). The basic dataset includes 105,665 non-financial firms located in 76 middle- and low-income countries during 2007-2018. The collection of the ES data is based on successive rounds of surveys. These survey rounds are essentially independent collections of cross-section data, where only few firms systematically appear throughout the successive surveys. The data panel structure is therefore unbalanced but it has the advantage of containing consistent information based on standardized response across all survey years and countries. The data have the important strength of representing diverse firms by size, industrial sector, incorporation status, location of operations, and other specific to them characteristics. The responses reflect the firms' experience of firm performance given the surrounding business environment. To contain self-selection bias, the ES data use random samples of representative firms with different characteristics, which the collectors update for each country and properly bring them into consistent form. The ES data have the reasonable drawback of whether they truly reflect firm behavior. However, at the absence of high-quality census data in most developing countries, survey data include information that directly reflects the firms' knowledge, which may convey more valuable information on their true experience. This limits the chance of inverse causation, for changes in a country's financial soundness conditions resulting from changes in an individual firm's performance are highly improbable. We test different control variables and model designs to ensure that improper specification does not affect the causal effect. We further deal with potential asymmetry of information problems by applying proper clustering of estimated standard errors.

The outcome variable in our analysis is the firms' experience of financing constraints (ACCESS). Based on the ES description, it is the response of firms to the survey question: "How problematic is financing for the operation and growth of your business?". The response varies between zero (no constraint), one (minor constraint), two (moderate constraint), three (major constraint) and four (very severe constraint). Thus, ACCESS is an ordinal variable within the range $[0,4]$. However, it is possible that these answers may not capture all reality as well as that some firms may report financing constraints while they are not actually constrained by them but only facing temporary liquidity distress. Therefore, one must be cautious of this behavioral bias and interpret the results carefully. Alternative measures of financing constraints are typically based on balance-sheet information (Almeida et al., 2021). We acknowledge some disadvantages associated with the subjective nature of our measure of financing constraints. However, our measure has certain advantages. First, it captures both financing availability and financing cost (interest rates, fees and collateral requirements). Second, it comprises all alternative forms of external financing that are common and often indistinguishable in developing countries (bank financing, equity financing, trade/supplier finance, informal finance, etc.). Third, paradoxically it may better reflect reality. Claessens and Tzioumis (2006) argue that balance-sheet information in many developing countries is low quality, inconsistent and mostly unaudited. Instead, information based on micro-survey data reflecting directly firms' views may be more valuable at least with regards to the developing countries. Bouton and Tiongson (2010) document a significant association between subjective appraisals of credit market constraints and objectively measurable indicators. Finally, survey information may better capture firms' decisions in conditions of uncertainty.

Table 1 reports the average value of ACCESS and the range of FSIND across countries. Firms operating in Estonia, Israel, Thailand and Sweden have low average level of ACCESS, implying that they experience lower constraints in accessing external finance, whereas firms operating in Afghanistan and several African countries (Ghana, Angola, Tanzania, etc.) show higher average level of ACCESS, implying that they experience higher financing constraints. Given the temporal evolution of the FSIND variable, we show the range of values across countries for it better reflects the index's overtime fluctuation. We observe a differentiated pattern, in which some countries (i.e., Sweden, Croatia, Thailand and Israel) are characterized by small variations and other countries (i.e., Colombia, Slovak Republic, Portugal and Argentina) are characterized by large variations during our analysis period. Further, the data show an inverse association between ACCESS and FSIND. Figure 1 shows the distribution of FSIND values for each level of ACCESS, which is indeed characterized by an inverse relationship. We observe that, as we move from ACCESS level 2 to level 4, the value of FSIND decreases faster, signaling a higher index sensitivity to upper levels of the ACCESS distribution.

However, while the FSIND is expected to affect firms' financing constraints, its effect is not directly observed. Therefore, we control for other characteristics of firms that could mitigate the effect. These include the firm's age (AGE), size (SIZE), sector of activity (SECTOR), location of operations (LOCATION), foreign ownership (OWNFOR), state ownership (OWNGOV), whether the firm is an exporter of goods and services (EXPORT) and whether the firm is a local subsidiary of a foreign firm (SUBSID). The ES provide the data for all the firm-level controls. Many studies have documented the significant effect of the specific characteristics of firms on their financing constraints (Beck and Laeven, 2006, Mertzanis, 2019).

Moreover, we use country-level controls to capture the role of economic and institutional factors in mitigating the FSIND effect on firm's financing constraints. We use the World Development Indicators for macro-economic variables, the World Bank's Country Policy and Institutional Assessments (CPIA) for institutional variables, the Center of Government (COG) for political variables and the Global Financial Inclusion (GFI) database for financial access variables. Table 2 presents the summary statistics of the variables used in the analysis. Table A3 in the Appendix presents their pairwise correlations. The correlations and the VIF value do not show severe collinearity between the FSIND and among the firm-specific variables and we therefore include them all in the regression analysis.

Table 1
Comparison between the ACCESS average values and minimum-maximum range of FSIND and total number of considered firms in each country.

Country	Mean ACCESS	FSIND range	Total firms	Country	Mean ACCESS	FSIND range	Total firms	Country	Mean ACCESS	FSIND range	Total firms
Afghanistan, Islamic Republic of	2.37	[-3.14 , 4.83]	412	Estonia	0.41	[-5.13 , 2.53]	281	Panama	0.90	[-4.57 , 1.91]	373
Albania	0.74	[-2.33 , 2.63]	368	Georgia	1.06	[-4.23 , 3.62]	368	Papua New Guinea	0.74	[-4.61 , 4.67]	76
Angola	2.45	[-2.39 , 2.64]	343	Ghana	2.52	[-2.04 , 2.30]	722	Paraguay	1.17	[-3.83 , 3.35]	734
Argentina	1.91	[-8.48 , 9.65]	2,033	Guatemala	1.44	[-3.76 , 4.90]	938	Peru	1.19	[-3.75 , 4.01]	2,007
Armenia, Republic of	1.72	[-2.67 , 4.15]	370	Honduras	1.53	[-3.35 , 2.00]	695	Philippines	0.79	[-5.11 , 2.68]	1,292
Bangladesh	1.81	[-3.38 , 2.04]	1,448	Hungary	0.79	[-6.10 , 5.22]	317	Poland	1.07	[-2.80 , 1.31]	545
Belarus	0.99	[-1.63 , 1.88]	364	India	1.16	[-3.86 , 3.00]	9,255	Romania	1.49	[-2.60 , 2.55]	543
Bhutan	1.13	[-5.01 , 1.25]	262	Indonesia	1.19	[-4.55 , 2.72]	1,319	Russian Federation	1.32	[-3.87 , 4.02]	4,092
Bolivia	1.40	[-3.64 , 2.15]	719	Israel	0.53	[-3.89 , 3.13]	489	Rwanda	1.67	[-1.76 , 2.66]	249
Bosnia and Herzegovina	1.23	[-5.25 , 1.77]	371	Kazakhstan	0.86	[-2.49 , 4.89]	581	Slovak Republic	1.05	[-4.22 , 4.22]	275
Botswana	1.48	[-1.55 , 1.13]	275	Kenya	1.39	[-1.93 , 4.07]	778	Slovenia	1.20	[-4.21 , 4.11]	281
Bulgaria	0.96	[-3.44 , 4.71]	298	Kosovo, Republic of	2.01	[-2.96 , 2.99]	209	Solomon Islands	1.17	[-1.52 , 5.00]	161
Burundi	1.92	[-1.53 , 3.47]	167	Kyrgyz Republic	1.21	[-2.38 , 4.02]	279	Sri Lanka	1.60	[-1.06 , 5.40]	599
Cambodia	1.22	[-2.10 , 4.90]	828	Latvia	1.11	[-3.25 , 2.58]	343	Sweden	0.61	[-2.22 , 1.18]	605
Cameroon	2.13	[-2.67 , 4.56]	361	Lebanon	1.76	[-2.95 , 1.83]	569	Tanzania	2.33	[-4.93 , 5.56]	782
Central African Republic	2.09	[-4.73 , 2.57]	161	Lesotho	2.17	[-4.28 , 2.62]	160	Thailand	0.58	[-8.49 , 8.03]	993
Chile	1.37	[-2.67 , 3.39]	1,034	Lithuania	0.91	[-2.43 , 2.63]	274	Trinidad and Tobago	1.78	[-5.14 , 2.74]	380
China, P.R.: Mainland	0.81	[-7.11 , 9.89]	2,683	Macedonia, FYR	1.32	[-4.40 , 4.82]	370	Turkey	0.73	[-5.14 , 1.71]	1,330
Colombia	1.72	[-2.52 , 3.44]	1,937	Madagascar	1.24	[-2.56 , 1.96]	347	Uganda	1.79	[-2.15 , 2.09]	747
Costa Rica	2.06	[-2.92 , 2.16]	542	Malaysia	1.37	[-6.08 , 4.10]	1,011	Ukraine	1.33	[-3.35 , 2.60]	994
Croatia	1.28	[-1.05 , 2.40]	370	Mexico	1.51	[-2.29 , 3.46]	1,471	Uruguay	1.24	[-2.18 , 3.08]	941
Czech Republic	1.08	[-4.51 , 2.63]	261	Moldova	0.65	[-4.69 , 1.41]	361	Vietnam	0.90	[-5.94 , 6.11]	962
Djibouti	1.11	[-10.40 , 74.68]	274	Namibia	2.01	[-5.83 , 5.91]	587	West Bank and Gaza	2.02	[-3.84 , 4.44]	442
Dominican Republic	1.37	[-3.75 , 2.11]	723	Nicaragua	1.14	[-7.08 , 2.66]	668	Zambia	1.86	[-3.92 , 1.66]	715
Ecuador	1.47	[-1.09 , 2.67]	729	Nigeria	1.55	[-4.29 , 2.59]	2,589				
El Salvador	1.46	[-5.08 , 2.22]	1,069	Pakistan	1.31	[-1.99 , 4.56]	1,216				

In our sample, most firms are small and medium size rather than large size, they are exporters of goods and services and operate in the large urban than rural areas. Most firms are private, non-listed firms and a minority of them are subsidiaries of foreign companies, owned by domestic and foreign owners, with only few of them owned by the state. We subsequently match firm-level information with our country-level FSIND and other economic and institutional information. However, our FSIND has missing values for some countries, which reduces our full sample to 76 countries during 2010-2018 with a rate of missing values not exceeding 30% and about 63,894 firms. Our sample has an unbalanced panel structure, which led us to apply two alternative missing value imputation methods, i.e., the MC-SVD and BTF methods,

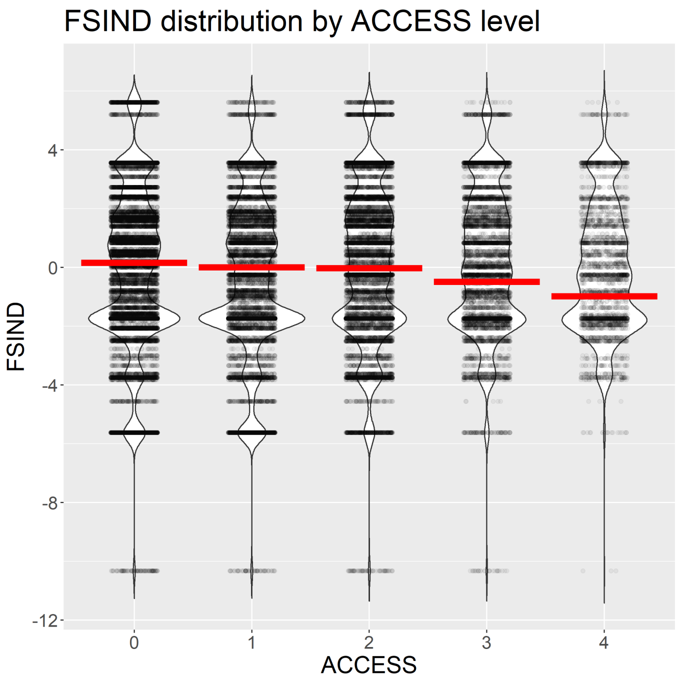

Fig. 1. Distribution of FSIND values for each level of ACCESS. Dots represent each firms' FSIND value and red bars represent FSIND average values.

Table 2
List of variables used to predict ACCESS, with sources, aggregation level, total number of observations and descriptive summary statistics. Top table reports numeric variables, bottom table reports ordinal variables, i.e. variables with discrete values such as ranking.

Variable	Description	Source	Aggregation Level	Obs	Mean	S.D.	Min	P25	Median	P75	Max
FSIND	FSIND index	Authors	Country	64,717	-0.16	2.57	-10.33	-1.74	-0.26	1.61	5.61
GDPCAP	1-Y lag of GDP per capita (constant 2000 US$)	WDI	Country	63,894	5901.67	6726.12	242.85	1544.62	3692.97	8947.74	53408.79
INFLDFL	Inflation, GDP deflator (annual %)	WDI	Country	63,894	5.73	6.97	-3.85	2.98	3.98	6.57	52.99
LENDINT	1-Y lag of Lending interest rate (%)	WDI	Country	60,757	12.73	6.23	4.59	8.46	10.88	15.65	56.13
FININD	1-Y lag of IMF: financial institutions index	WDI	Country	63,894	0.24	0.17	0.03	0.13	0.2	0.28	0.98
FINDEP	1-Y lag of Financial system deposits to gdp (%)	WDI	Country	63,894	43.49	27.54	8.33	24.07	36.78	60.46	222.97
GENDEQ	1-Y lag of CPIA gender equality rating (1=low to 6=high)	CPIA	Country	49,032	3.76	0.7	1.5	3	3.82	4.5	5
BILHUM	CPIA building human resources rating (1=low to 6=high)	CPIA	Country	49,032	3.82	0.33	2.5	3.5	4	4	4.5
FISPOL	1-Y lag of CPIA fiscal policy rating (1=low to 6=high)	CPIA	Country	49,032	3.74	0.49	2.5	3.5	3.5	4	5
STABDEM	Stability of Democratic Institutions rating	COG	Country	27,918	6.09	2.32	1	5	6.5	7.5	10
LIMLEND	Limitations on lending to the government (%)	COG	Country	18,853	0.71	0.17	0.01	0.62	0.73	0.8	1
OUTLOAN	Outstanding loans from commercial banks (% of GDP)	GFI	Country	64,634	2209.51	28898.53	3.04	24.78	37.89	50.39	530000
NUMBRW	log of Household Borrowers	GFI	Country	36,974	3e+07	7.8e+07	3980	760000	3100000	9e+06	4.9e+08
AGE	log of the years since the firm's establishment	ES	Firm	63,894	3.08	0.53	1.1	2.71	3.04	3.37	5.39
EXPORT	percent of firm's sales directly exported	ES	Firm	63,894	7.44	21.48	0	0	0	0	100
OWNFOR	percent of firm's stock owned by foreign investors	ES	Firm	63,894	6.82	23.23	0	0	0	0	100
OWNGOV	percent of firm's stock owned by the state	ES	Firm	63,894	0.55	5.66	0	0	0	0	100

							Level					
Variable	Description	Source	Aggregation Level	Obs	Mean	S.D.	0	1	2	3	4	5
ACCESS	access to finance (0-4), 4=highest difficulty	ES	Firm	63,894	1.33	1.25	34.7%	23.1%	22.7%	13.3%	6.2%	
SIZE	1=Small(<20),2=Medium(20-99),3=Large(100 And Over)	ES	Firm	63,894	1.78	0.77		43.5%	35.4%	21.1%		
LOCATION	1=capital city,2=city with over 1 million,3=city btwn 1/4 and 1 million, 4=city btwn 50K and 250K,5=city with less than 50K	ES	Firm	63,427	2.79	1.19		11.5%	36.9%	23.8%	16%	11.7%
SUBSID	0=independent firm,1=subsidiary of a larger firm	ES	Firm	63,894	0.19	0.39	81.5%	18.5%				
LISTED	whether the firm is listed in an exchange, 1=yes, 0=no	ES	Firm	63,894	0.04	0.2	95.9%	4.1%				
VETOPWR	Legislature Veto Power	COG	Country	18,588	0.86	0.34	13.6%	86.4%				

Notes: Macro-economic variables are collected from World Development Indicators (WDI) https://databank.worldbank.org/source/world-development-indicators, institutional governance variables are collected from Country Policy And Institutional Assessment Primary (CPIA) https://datacatalog.worldbank.org/dataset/country-policy-and-institutional-assessment, political variables are collected from Center of Government (COG) https://www.worldbank.org/en/topic/governance/brief/center-of-government-global-solution-group and financial access variables are collected from Global Financial Inclusion (GFI) https://datacatalog.worldbank.org/dataset/global-financial-inclusion-global-findex-database. World Bank's Enterprise Surveys (ES) variables can be found athttps://www.enterprisesurveys.org/en/enterprisesurveys.

so as to take advantage of the temporal dependence of the variables between years. Thus, we standardize numerical variables and rescale ordinal variables to the range

$[0, 1]$ and use country-mean value imputation for numeric variables and country-median value imputation for ordinal variables.

3.3. Identification strategy and estimation model

Identifying a causal effect running from the country-level FSIND to the firm-level financial behavior is challenging due to the possible presence of unobserved countrywide factors that are simultaneously linked with both the digital adoption conditions and firm performance. We include alternative model specifications to reduce this possibility. As a first step to causal identification, we include fixed effects at country, year, and sector levels. Country effects control for time-invariant conditions in a firm's country. Year effects control for time-varying shocks, which affect the behavior of all firms in our sample (e.g., technological shocks). Sector effects control for any time-invariant and industry-specific conditions (i.e., competition, regulation) that affect firm performance. Rajan and Zingales (1998) found that financing constraints of firms are stronger in sectors that require more external finance. Carreira and Lopes (2016) show that firms in the service sector suffer from more severe financial constraints than those in manufacturing. Deploying both fixed effects and diverse firm-specific variables could control for some of the unobserved influence on financing constraints. This implies that we identify the trend of our FSIND only from changes between consecutive years within the same country, as shown in the dynamic map in Figure A4 in the Appendix. We attempt to capture the potentially remaining omitted-variable bias by using endogeneity analysis later in the document.

Since the outcome variable is an ordinal one, we use an ordered probit model and the maximum likelihood estimator for estimating the regression (Greene, 2012). In this setting, we measure the key predictor variable at the country level whereas we measure the outcome variable at the firm level. Moulton (1990) identified the statistical bias that results from the attempt to measure the effect of aggregate policy variables on micro units. Consequently, we cluster the standard errors at the country level. Our setting also implies that in a given country and year, there are several different firm-level observations per one key predictor observation. The error term of the estimation might be large since it is difficult to fit all the outcome points at the same time, thereby inducing a more conservative estimate of the effect of the key predictor variable. We also test for the impact of outliers and data imbalances by capping the maximum number of firms in each country and removing countries with extreme values. We perform sensitivity and endogeneity analysis based on the use of alternative measures of the key variables and alternative estimation methods using instrumental variables. After assessing the model's stability with respect to the sample, we check for its robustness by including additional control variables. The estimation model assumes that the firms' response is described by the following equation:

$$ACCESS_{if_jt} = \beta_0 + \beta_1 FSIND_{it} + \boldsymbol{\beta_2 X}_{if_jt} + \boldsymbol{\beta_3 K}_{it} + u_{if_jt} \tag{2}$$

where $ACCESS_{if_jt}$ is the underlying probability that the firm f_j ($f_j = 1,\ldots,M_i$) among all M_i firms in country i ($i = 1,\ldots,N$) and year t ($t = 1,\ldots,T$) perceives access to finance to be no, low, moderate, major or severe constraint; $FSIND_{it}$ is the index of financial soundness of country i and year t; $\boldsymbol{X}_{if_jt}$ is the vector of firm-specific control variables per firm f_j in country i and year t; and $\boldsymbol{K}_{it}$ is the vector of country-level control variables per country i and year t. The term u_{if_jt} is the composite error term component that comprises the sum of η_i, λ_t and ε_{it}, where η_i accounts for unobservable country-specific effects, λ_t accounts for year-specific effects and the ε_{it} is a disturbance parameter that is assumed to vary across countries and years. Note that when analyzing ordinal data with a probit model, there is no equivalent statistic to the OLS based R^2 to evaluate the goodness-of-fit. The model estimates are maximum likelihood ones obtained through an iterative process. Similarly, unlike the OLS case, the coefficients of the probit estimation should be interpreted as changes in conditional probability of the outcome variable following changes in the regressors. Finally, we are well aware of the difficulty in interpreting the observed correlations as causal effects. We therefore interpret our results as strength of association rather than causation, and the use of the words "prediction" or "impact" or "effect" is made to simplify exposition.

4. Analysis of the results

4.1. Baseline Results

Table 3 presents the results of the probit model. The first column shows the estimates of the baseline model. The FSIND is statistically significant in the whole sample, documenting a negative association between financial soundness conditions and firms' access to finance across countries. The second and third columns show the estimates after splitting the sample into high- and low-income countries by the median level of GDP per capita. The remaining columns show the estimates for each level of firm size. Fafchamps and Labonne (2017) show that splitting sample delivers more predictive power. The improvement operates through a lower likelihood that relevant hypotheses are left untested. The FSIND is negative throughout and significant in the whole sample, for small firms and for those operating in low-income countries. It appears that financial stability considerations are relatively more important in affecting the financing constraints of small-size firms in less developed countries. These results appear to be in line with Laeven (2003) where the analysis of a panel of 400 firms from 13 developing countries shows that liberalization has an impact on the financial constraints of small firms, whereas large firms do not experience any change. Moreover, older firms, with strong foreign ownership and operating in large urban areas face lower financing constraints. Publicly listed firms also experience lower constraints. Further, Table 4 reports the marginal effects for each predicted level of ACCESS and Figure 2 highlights the marginal probability of ACCESS compared with the increase of FSIND. Thus, changes in FSIND appear to be associated with stronger marginal effects at the higher levels of financing constraints. As a consequence, the effects of policies that improve financial stability will be relatively more beneficial for the finance-hungry firms.

4.2. Sensitivity tests

We then run several sensitivity tests to ensure the stability of the estimated coefficients and make our findings robust against potential measurement error. A first

Table 3
Predicting ACCESS with ordinal probit model - OLS.

Variable	Baseline	High Income Countries	Low Income Countries	Small Firms	Medium Firms	Large Firms
FSIND	-0.0961**	0.00705	-0.143***	-0.151**	-0.0636	-0.101
	(0.0391)	(0.0834)	(0.0377)	(0.0759)	(0.0454)	(0.0698)
LISTED	-0.112***	-0.184***	-0.0684	-0.104	-0.148***	-0.0922***
	(0.0409)	(0.0610)	(0.0451)	(0.0797)	(0.0570)	(0.0357)
AGE	-0.763***	-0.544*	-1.043***	-0.755***	-0.617***	-0.847***
	(0.169)	(0.279)	(0.206)	(0.273)	(0.171)	(0.221)
SIZE	-0.0631***	-0.102***	-0.0252			
	(0.0136)	(0.0152)	(0.0180)			
SUBSID	-0.0290	-0.0143	-0.0417	-0.0601	0.00327	-0.0282
	(0.0317)	(0.0487)	(0.0380)	(0.0416)	(0.0465)	(0.0293)
LOCATION	0.180**	0.263*	0.104	0.174**	0.234**	0.121
	(0.0910)	(0.147)	(0.0970)	(0.0864)	(0.114)	(0.0993)
EXPORT	-0.0759*	-0.102	-0.0378	-0.0494	-0.0497	-0.0674*
	(0.0424)	(0.0744)	(0.0380)	(0.102)	(0.0609)	(0.0385)
OWNFOR	-0.244***	-0.250***	-0.244***	-0.274***	-0.239***	-0.207***
	(0.0279)	(0.0476)	(0.0364)	(0.0500)	(0.0394)	(0.0383)
OWNGOV	-0.292	-0.0221	-0.433*	-0.205	-0.331	-0.288
	(0.190)	(0.0991)	(0.248)	(0.137)	(0.289)	(0.200)
Observations	64,717	32,029	32,688	28,201	23,014	13,502
Pseudo R^2	0.0437	0.0431	0.0429	0.0522	0.0382	0.0343
Wald χ^2	10161.42	12908.46	8773.01	16670.74	7511.31	6223.87
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes
Sector effects	Yes	Yes	Yes	Yes	Yes	Yes
Clustered Std. Err.	Country	Country	Country	Country	Country	Country

Notes: The table reports coefficients and their standard error (in parentheses). The outcome variable is ACCESS and all variables are defined in Table 2. Data span over the period 2010-2018 for 76 countries. Estimation method is OLS with standard errors clustered by firm's country. The bottom part of the table reports which fixed effects are used in each model specification. First column reports the baseline model, second and third report the countries' income-based subset models and last three columns report the firms' size-based subset models. The *, ** and *** symbols denote the p-values at 10^{th}, 5^{th} and 1^{st} significance level, respectively.

sensitivity test is run by splitting the sample in Table 3. A second sensitivity test focuses on the clustering specification of standard errors. The unbalanced panel nature of the dataset which contains different number of firms in each country can cause heteroskedasticity bias in the estimation of the coefficients (Abadie et al., 2017). Thus, we test for potential bias in the coefficients by using alternative clustering specifications. Table 5 shows the effect of the different specifications. Given the negligible difference between the alternative clustering approaches, we maintain our clustering strategy at the country level. A third sensitivity test focuses on the measurement of the ordinal outcome variable, ACCESS. The five levels of the outcome

Table 4
Marginal effects for baseline model - OLS.

	ACCESS				
	0	1	2	3	4
FSIND	0.0337***	0.0139***	-0.00658***	-0.0204***	-0.0206***
	(0.00499)	(0.00270)	(0.00139)	(0.00340)	(0.00327)
LISTED	0.0628***	0.0260***	-0.0123***	-0.0381***	-0.0385***
	(0.0149)	(0.00734)	(0.00331)	(0.00957)	(0.00983)
AGE	0.271**	0.112**	-0.0529**	-0.164*	-0.166**
	(0.138)	(0.0551)	(0.0231)	(0.0930)	(0.0765)
SUBSID	0.0382***	0.0158***	-0.00746***	-0.0231***	-0.0234***
	(0.0126)	(0.00544)	(0.00260)	(0.00721)	(0.00839)
LOCATION	-0.0747**	-0.0309**	0.0146*	0.0453***	0.0457**
	(0.0317)	(0.0150)	(0.00779)	(0.0172)	(0.0217)
EXPORT	0.0499	0.0206	-0.00974	-0.0302*	-0.0305
	(0.0306)	(0.0137)	(0.00696)	(0.0178)	(0.0196)
OWNFOR	0.0542***	0.0224***	-0.0106***	-0.0328***	-0.0332***
	(0.0153)	(0.00835)	(0.00391)	(0.0103)	(0.00986)
OWNGOV	0.116***	0.0481***	-0.0227**	-0.0705***	-0.0712***
	(0.0359)	(0.0186)	(0.00953)	(0.0212)	(0.0244)

Notes: The table reports the marginal effects for each predicted level of ACCESS and their standard error (in parentheses) in the baseline setting of Table 3. Estimation method is OLS with standard errors clustered by firm's country. The *, ** and *** symbols denote the p-values at 10^{th}, 5^{th} and 1^{st} significance level, respectively.

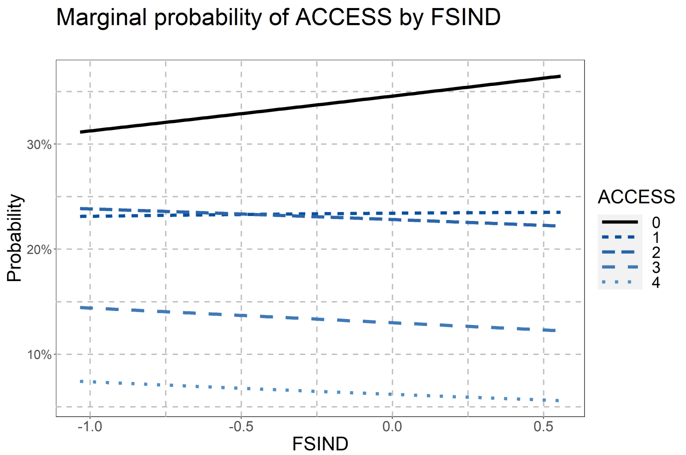

Fig. 2. Marginal probability of each level of ACCESS compared with the increase of FSIND.

variable may cause model overfit, i.e. the model could adapt too closely to relationships between each single level and the independent variables leading to loss of generalization power (Agresti, 2012). For this reason, we test the model's ability to generalize the causal effect between outcome and independent variables by transforming the five levels ACCESS variable into a binary one. We examine the effect of FSIND on different specifications for the binary transformation of ACCESS, grouping the levels above a selected threshold tr, with $tr = 1,2,3,4$: all levels above tr will be assigned the label "1" and the remaining ones will be assigned the label "0". Table 6 shows that the FSIND coefficient is negative and significant in all binary specifications except for the $tr = 1$ case, where it becomes positive and not significant. The reason for the latter behavior may be the following: the small number of firms with "0" ACCESS level affects the distribution of the outcome variable to be predicted, resulting in a coefficient quite close to zero and with no statistical significance (Agresti, 2012). A fourth sensitivity test is concerned with the structure of the sample. It focuses on the impact of data imbalances and outliers. Since the number of firms in each country differs substantially, we cap the total number of firms at different levels, randomly selecting the countries to be retained and averaging the coefficients' estimation over 10 sampling trials. The first four columns of Table 7 report the results after using capping limits of 850, 900, 950 and 1000 firms in each country respectively. The capping limits have been selected taking as a reference the interquartile range of the distribution of the total number of firms in each country. The FSIND coefficient remains negative and significant for all the considered levels. The last column shows that FSIND remains negative and significant after excluding all countries that have extreme values in one or more independent variables, namely Lesotho, New Guinea, China, India and Russia. Extreme values and relative countries have been selected according to a thresholding of the 5^{th} and 95^{th} percentiles of each independent variables.

5. Endogeneity and Robustness Analysis

5.1. Endogeneity Analysis

In order to identify the causal effect, we use a cross-section of data capturing the individual firms' experience of financing constraints for multiple years. This limits the possibility of reverse causality: observing a change in the financial soundness conditions of a country as a result of a change in a firm's experience of constraints in obtaining external finance is unlikely. We also experiment with different specifications of models and control variables to ensure that our causal effect does not

Table 5
Predicting ACCESS with ordinal probit model - OLS.

Variable	Standard Errors	Robust Standard Errors	Country-Year Clustering	Country Clustering
FSIND	-0.0961**	-0.0961***	-0.0961***	-0.0961**
	(0.0399)	(0.0352)	(0.0254)	(0.0391)
LISTED	-0.112***	-0.112***	-0.112***	-0.112***
	(0.0227)	(0.0227)	(0.0401)	(0.0409)
AGE	-0.763***	-0.763***	-0.763***	-0.763***
	(0.0892)	(0.0900)	(0.162)	(0.169)
SIZE	-0.0631***	-0.0631***	-0.0631***	-0.0631***
	(0.00631)	(0.00636)	(0.0135)	(0.0136)
SUBSID	-0.0290**	-0.0290**	-0.0290	-0.0290
	(0.0121)	(0.0120)	(0.0314)	(0.0317)
LOCATION	0.180***	0.180***	0.180**	0.180**
	(0.0204)	(0.0205)	(0.0893)	(0.0910)
EXPORT	-0.0759***	-0.0759***	-0.0759*	-0.0759*
	(0.0216)	(0.0219)	(0.0412)	(0.0424)
OWNFOR	-0.244***	-0.244***	-0.244***	-0.244***
	(0.0202)	(0.0206)	(0.0287)	(0.0279)
OWNGOV	-0.292***	-0.292***	-0.292	-0.292
	(0.0814)	(0.0857)	(0.190)	(0.190)
Observations	64,717	64,717	64,717	64,717
Pseudo R^2	0.0437	0.0437	0.0437	0.0437
Wald χ^2	7713.42	8319.34	82695.62	53591.33
Year effects	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes
Sector effects	Yes	Yes	Yes	Yes

Notes: The table reports coefficients and their standard error (in parentheses). The outcome variable is ACCESS and all variables are defined in Table 2. Data span over the period 2010-2018 for 76 countries. Estimation method is OLS with different standard errors estimations. The bottom part of the table reports which fixed effects are used in each model specification. First and second columns report the classical and robust standard errors estimation. Third and fourth columns report the country-year and country clustering for standard errors estimation. The *, ** and *** symbols denote the p-values at 10^{th}, 5^{th} and 1^{st} significance level, respectively.

suffer from improper specification. We further deal with potential asymmetry of information problems by applying proper clustering of estimated standard errors. Despite the inclusion of fixed effects controlling for invariant country factors, our estimates will not produce unbiased assessments of the FSIND effect on firms' financing constraints, because of the possible presence of unobserved factors affecting the financial soundness conditions and the financing constraints of firms simultaneously. For example, countries that in recent years may have experienced improving

Table 6
Predicting ACCESS with binary probit model - OLS.

Variable	0 vs 1 2 3 4	0 1 vs 2 3 4	0 1 2 vs 3 4	0 1 2 3 vs 4
FSIND	0.0159	-0.167***	-0.186**	-0.170*
	(0.0694)	(0.0595)	(0.0722)	(0.103)
LISTED	-0.119**	-0.134***	-0.124**	-0.0170
	(0.0471)	(0.0432)	(0.0542)	(0.0657)
AGE	-1.040***	-0.790***	-0.547**	-0.321
	(0.259)	(0.175)	(0.244)	(0.217)
SIZE	-0.0295**	-0.0771***	-0.0993***	-0.0984***
	(0.0142)	(0.0202)	(0.0174)	(0.0166)
SUBSID	-0.0180	-0.0356	-0.0414	-0.0569
	(0.0303)	(0.0424)	(0.0352)	(0.0364)
LOCATION	0.207*	0.189*	0.115*	0.106
	(0.117)	(0.110)	(0.0659)	(0.0778)
EXPORT	-0.0866**	-0.0665	-0.0782	-0.0590
	(0.0377)	(0.0560)	(0.0549)	(0.0746)
OWNFOR	-0.255***	-0.269***	-0.237***	-0.192***
	(0.0370)	(0.0285)	(0.0333)	(0.0509)
OWNGOV	-0.408	-0.189	-0.121	-0.0431
	(0.248)	(0.164)	(0.200)	(0.265)
Observations	64,717	64,717	64,717	64,717
Pseudo R^2	0.0784	0.0766	0.0858	0.0805
Wald χ^2	8749.12	9520.18	12392.67	15987.78
Year effects	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes
Sector effects	Yes	Yes	Yes	Yes
Clustered Std. Err.	Country	Country	Country	Country

Notes: The table reports coefficients and their standard error (in parentheses). The outcome variable is ACCESS and all variables are defined in Table 2. Data span over the period 2010-2018 for 76 countries. Estimation method is OLS with standard errors clustered by firm's country. The bottom part of the table reports which fixed effects are used in each model specification. All columns report the results of the binary probit model when the ACCESS variable is grouped into a binary variable splitting levels above and below a certain threshold. The *, ** and *** symbols denote the p-values at 10^{th}, 5^{th} and 1^{st} significance level, respectively.

conditions for firms' access to finance may have also implemented policies that improved the health conditions of financial institutions and markets (e.g., improved prudential ratios, governance institutions, etc.) during the same period, thereby increasing the soundness of the financial system as a whole. This possibility means that the covariance term $\text{Cov}(FSIND_{it}, u_{if_jt})$ is non-zero, because even if it is conditional on the fixed effects, the FSIND might be endogenous to financing constraints

Table 7
Predicting ACCESS with ordinal probit model - OLS.

Variable	Cap to 850	Cap to 900	Cap to 950	Cap to 1000	Outlier Countries Excluded
FSIND	-0.1188 *	-0.1247 *	-0.1293 *	-0.1362 **	-0.148 ***
	-0.0656	-0.062	-0.0644	-0.0638	-0.0565
LISTED	-0.1269 ***	-0.1294 ***	-0.1261 ***	-0.1263 ***	-0.140 ***
	-0.0352	-0.0347	-0.0342	-0.0338	-0.0319
AGE	-0.2669 ***	-0.2693 ***	-0.2724 ***	-0.2707 ***	-0.242***
	-0.0524	-0.0517	-0.0511	-0.0505	-0.0476
SIZE	-0.1424 ***	-0.1407 ***	-0.1403 ***	-0.1403 ***	-0.152 ***
	-0.0166	-0.0164	-0.0162	-0.016	-0.155
SUBSID	-0.0913 ***	-0.0894 ***	-0.0864 ***	-0.0862 ***	-0.0817 ***
	-0.0153	-0.0151	-0.0149	-0.0147	-0.0138
LOCATION	-0.1020 ***	-0.0999***	-0.1012 ***	-0.1008 ***	-0.0798 ***
	-0.0253	-0.0249	-0.0246	-0.0244	-0.0233
EXPORT	-0.1047 ***	-0.1070 ***	-0.1090 ***	-0.1098 ***	-0.129 ***
	-0.027	-0.0266	-0.0262	-0.0259	-0.0246
OWNFOR	-0.0429 ***	-0.0419 ***	-0.0417 ***	-0.0402 ***	-0.0347 ***
	-0.0124	-0.0123	-0.0121	-0.012	-0.0115
OWNGOV	-0.0805 *	-0.0799 *	-0.0773 *	-0.0816 *	-0.0941 **
	-0.0417	-0.0411	-0.0406	-0.0402	-0.0377
Observations	41,953	43,003	44,032	44,931	48,451
Pseudo R^2	0.0512	0.051	0.0507	0.0504	0.0493
Wald χ^2	12462.56	8345.89	7923.23	6765.71	5529.37
Year effects	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes
Sector effects	Yes	Yes	Yes	Yes	Yes
Clustered Std. Err.	Country	Country	Country	Country	Country

Notes: The table reports coefficients and their standard error (in parentheses). The outcome variable is ACCESS and all variables are defined in Table 2. Data span over the period 2010-2018 for 76 countries. Estimation method is OLS with standard errors clustered by firm's country. The bottom part of the table reports which fixed effects are used in each model specification. First four columns report the estimation when capping the total number of firms in each country to different thresholds. Last column reports the estimation when removing countries with extreme values in one or more independent variables, namely Lesotho, New Guinea, China, India and Russia. The *, ** and *** symbols denote the p-values at 10th, 5th and 1st significance level, respectively.

decisions. For this reason, we will use instrumental variables (IV) methods that deploy the 2SLS estimator to check the robustness of our estimates. We apply the IV method under four different groups of control variables (Table 8).

We use the log number of household borrowers in a country (NUMBRW) as the external instrument in the IV analysis. NUMBRW correlates highly with the FSIND index (-0.461) and poorly with ACCESS (-0.0152). Santoso and Sukada (2009) document the importance of household borrowing risk for financial stability. Further, the International Monetary Fund (2017) argues that across business cycle frequencies, empirical studies and the recent experience from the global financial crisis have shown that increases in private household debt raise the likelihood of a financial crisis. The IMF provides the data for the instrument. We use the instrumen-

Table 8
List of groups of variables used as controls.

Group	Variable	Description
Macro-economic	GDPCAP	1-Year lag of GDP per capita
	INFLDFL	Inflation deflator
	LENDINT	1-Year lag of Lending interest rate
Financial access	FININD	1-Year lag of IMF's Financial Institutions Index
	FINDEP	1-Year lag of financial system deposits to GDP ratio
	OUTLOAN	Outstanding loans from commercial banks
Institutional governance	GENDEQ	1-Year lag of gender equality rating
	BILHUM	Building human resources rating
	FISPOL	1-Year lag of fiscal policy rating
Political	STABDEM	Stability of democratic institutions rating
	LIMLEND	Percentage of limitations on lending to the government
	VETOPWR	Legislature Veto Power rating

tal variables two-stage least square (2SLS) model with the following specification:

$$\begin{aligned} FSIND_{it} &= \gamma_0 + \gamma_1 NUMBRW_{it} + e_{it} \\ ACCESS_{ifjt} &= \beta_0 + \beta_1 FSIND_{it} + \boldsymbol{\beta_2 X}_{ifjt} + \boldsymbol{\beta_3 K}_{it} + u_{ifjt} \end{aligned} \tag{3}$$

where $\boldsymbol{K}$ is the matrix whose columns are the country-level control variables per country i and year t described in Table 8. Tables from 9 to 12 report the results of 2SLS model for each of the four groups. The first stage results show that the external instruments are robust. The IV results document that the FSIND remains a significant and negative predictor of firms' financing constraints. More specifically, after controlling for the impact of macroeconomic and monetary conditions (Table 9), higher values of the FSIND index are associated with lower financing constraints of firms. The lower is the 1-Year lag of lending interest rate, the stronger is the effect. Further, we control for the impact of financial conditions (Table 10), the effect of our FSIND index remains negative and significant. The lower is the volume of outstanding loans made by commercial banks, the stronger is the beneficial effect on firms' financing constraints. These findings appear to be in line with the view that monetary stability may be necessary but not a sufficient condition for financial stability (Borio and Lowe, 2002, Borio et al., 2003). In this view, financial risks may grow beneath the surface of low-inflation. Excessive focus on monetary stability, as a condition for maintaining expectations of long-term economic growth, may in turn cause corporate indebtedness and discrepancies between prices of asset with varying maturities perpetuating financial instability (Shirakawa, 2012). Moreover, after controlling for the impact of social conditions (Table 11), the effect of our FSIND index also remains negative and significant. The beneficial effect on firms' financing constraints is stronger, the higher is the level of gender equality in the country and the lower is the public's perception of fiscal policy fairness in the country. Ozili (2020) argues that social activism has had adverse effects on financial stability in the post-2008 era in developing countries. He also finds that gender equality and environmental sustainability advocacy have improved financial stability. Finally, after controlling for the impact of political institutions (Table 12), the effect of our FSIND index on financing constraints again remains negative and significant. The beneficial effect on firms' financing constraints is stronger, the higher is the stability of democratic institutions, and the stronger is the veto powers of a country's legislature, whilst any restrictions imposed upon the level of government lending may weakly mitigate the effect of the FSIND on financing constraints. Beck et al. (2020) stress the complex link between politics and finance, and Funke et al. (2016) find that financial crises cause a decrease of government majorities and an increase in political polarization leading to policy uncertainty. In all control groups, the results remain robust to alternative model settings regarding the inclusion of firm size and industry fixed effects to capture firm and industry heterogeneity. Our IV estimations show that the firm-specific characteristics of firms remain significant controls. Generally, older firms which are subsidiaries of multinational firms are associated with lower financing constraints. Export-oriented firms which are located in larger cities also experience lower financing constraints. Finally, firms with considerable foreign and government ownership stakes appear to experience lower constraints. Overall, our analysis shows that the FSIND effect is not significantly affected by unobserved factors which strengthens its statistical independence and explanatory relevance. The Kleibergen-Paap rk LM statistic allows us to reject the null hypothesis that our model is under-identified ($p < 0.001$) (Kleibergen and Paap, 2006). As a result, there is some reason for confidence in the validity of our chosen instruments. The Portmanteau statistic shows the absence of auto-correlation (Inoue and Solon, 2006, Wursten, 2018). Since the two-step process of the 2SLS model can be affected by data imbalances, we also use an alternative IV estimation procedure based on the conditional mixed-process (CMP) that fits both equations described in (3) simultaneously (Roodman, 2011). Tables A6 to A9 in the Appendix report the results of CMP model for each of the four groups. The statistical significance of the Arellano-Bond ρ coefficient (Arellano and Bond, 1991) indicates that the null hypothesis of no endogeneity is rejected, which justifies the use of the IV methods.

5.2. Further Robustness checks

In order to further check the robustness of our results to omitted variable bias, we implement a novel technique that uses the Oster test (Oster, 2019). The distinctive feature of this technique is that it allows for a "full adjustment" by exploiting information not only on coefficient movements after the inclusion of new controls, but also on movements in R^2 values so as to compute bounding values for the treatment effect. The test proposes that, if a regression coefficient changes only a little when new controls are added, any remaining bias is likely to be small. Whereas if the coefficient changes considerably, there may still be a substantial omitted variable bias, undermining confidence in the coefficient estimate. Two key parameters specify the relationship between observable and unobservable variables selection and the maximum amount of variation which can be explained by the model. The first parameter δ defines the importance of the unobservable variables relative to the observable ones in influencing the outcome variable. When $\delta = 1$ the observable and the unobservable variables are equally important and affect the coefficient β in the same direction; when$0 < \delta < 1$ the unobserved variables are less important than the observed ones; the opposite holds when $\delta > 1$. The second parameter, R^2_{max} is the maximum R^2 under the full model where all (observed and unobserved) variables are included. This can be as high as 1 if the outcome variable is measured without error ($u = 0$), but it cannot be smaller than the R^2 obtained from the controlled regression. Both δ and R^2_{max} are unknown parameters to be chosen given the particular

Table 9
Predicting ACCESS with ordinal probit model with instrumental variables and macro-economic controls - 2SLS.

Variable	1	2	3	4	5	6	7	8
FSIND	-0.0519***	-0.0384***	-0.0471***	-0.0338***	-0.0485***	-0.0368***	-0.0505***	-0.0351***
	(0.0113)	(0.0105)	(0.0105)	(0.0103)	(0.0102)	(0.0102)	(0.0117)	(0.0106)
LISTED	-0.0362***	-0.0364***	-0.0297***	-0.0298***	-0.0359***	-0.0361***	-0.0293***	-0.0295***
	(0.00860)	(0.00859)	(0.00882)	(0.00881)	(0.00868)	(0.00867)	(0.00877)	(0.00876)
AGE	-0.260***	-0.262***	-0.178**	-0.179**	-0.235***	-0.237***	-0.197***	-0.199***
	(0.0720)	(0.0723)	(0.0716)	(0.0718)	(0.0715)	(0.0717)	(0.0722)	(0.0725)
SUBSID	-0.0185**	-0.0188**	-0.0155*	-0.0157*	-0.0208**	-0.0210**	-0.0123	-0.0126
	(0.00879)	(0.00883)	(0.00841)	(0.00844)	(0.00896)	(0.00900)	(0.00822)	(0.00824)
LOCATION	0.0521**	0.0506**	0.0506**	0.0493**	0.0534**	0.0522**	0.0487**	0.0472**
	(0.0225)	(0.0234)	(0.0230)	(0.0238)	(0.0227)	(0.0235)	(0.0228)	(0.0236)
EXPORT	-0.0414***	-0.0413***	-0.0198	-0.0196	-0.0317**	-0.0316**	-0.0290**	-0.0289**
	(0.0146)	(0.0146)	(0.0145)	(0.0145)	(0.0152)	(0.0152)	(0.0138)	(0.0138)
OWNFOR	-0.0749***	-0.0749***	-0.0665***	-0.0665***	-0.0740***	-0.0740***	-0.0666***	-0.0665***
	(0.00852)	(0.00849)	(0.00821)	(0.00818)	(0.00852)	(0.00850)	(0.00832)	(0.00829)
OWNGOV	-0.0994***	-0.0993***	-0.0913**	-0.0912**	-0.0976***	-0.0975***	-0.0925**	-0.0924**
	(0.0336)	(0.0337)	(0.0355)	(0.0355)	(0.0328)	(0.0328)	(0.0366)	(0.0367)
GDPCAP		0.0321		0.0350		0.0295		0.0386
		(0.0292)		(0.0263)		(0.0262)		(0.0294)
INFLDFL		0.0382*		0.0308		0.0331*		0.0361*
		(0.0201)		(0.0194)		(0.0191)		(0.0206)
LENDINT		-0.232***		-0.202**		-0.199**		-0.238***
		(0.0826)		(0.0811)		(0.0787)		(0.0848)
First stage results								
NUMBRW	8.156**	5.438***	8.159**	5.443***	8.155**	5.439***	8.160**	5.443***
	(3.965)	(1.645)	(3.964)	(1.645)	(3.965)	(1.645)	(3.964)	(1.645)
Observations	39,383	39,383	39,383	39,383	39,383	39,383	39,383	39,383
Pseudo R^2	0.013	0.013	0.012	0.012	0.011	0.011	0.015	0.015
F-stat	19.72	28.10	14.03	27.21	16.57	31.27	17.09	24.59
Kleibergen-Paap	6.04**	6.01**	5.96**	5.91**	5.96**	5.91**	5.93**	6.01**
Portmanteau	1	1	1	1	1	1	1	1
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector effects	Yes	Yes	No	No	No	No	Yes	Yes
Size effects	No	No	Yes	Yes	No	No	Yes	Yes
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table reports coefficients and their standard error (in parentheses). The outcome variable is ACCESS and all variables are defined in Table 2. Data span over the period 2010-2018 for 76 countries. Estimation method is OLS with standard errors clustered by firm's country and 2SLS of Eq. (3) for instrumental variables. The bottom part of the table reports which fixed effects are used in each model specification. Specifications (1), (3), (5) and (7) report the results for the model without the control variables and different combinations of fixed effects. Specifications (2), (4), (6) and (8) report the results for the model with control variables and different combinations of fixed effects. Null hypothesis of Kleibergen-Paap test is the under-identification of the model. Null hypothesis of Portmanteau test is the absence of auto-correlation. The *, ** and *** symbols denote the p-values at 10th, 5th and 1st significance level, respectively.

context and econometric model. The higher the value of δ associated to a variable, the more relevant that variable is. Table 13 shows the results after applying the Oster test. As further robustness check, we also multiply the R^2_{max} value by an arbitrary number $\pi > 1$ which implies the relaxing of the test's assumptions by an increase in the values of the R^2_{max}. On the contrary, small multiplying effects on R^2_{max} are more restrictive.

In Table 13, we observe that all the control variables present values of $|\delta|$ higher than the threshold, even in the most restrictive case of $\pi = 1$, confirming once again

Table 10
Predicting ACCESS with ordinal probit model with instrumental variables and financial access controls - 2SLS.

Variable	1	2	3	4	5	6	7	8
FSIND	-0.0519***	-0.0630***	-0.0471***	-0.0565***	-0.0485***	-0.0587***	-0.0505***	-0.0609***
	(0.0113)	(0.0194)	(0.0105)	(0.0185)	(0.0102)	(0.0180)	(0.0117)	(0.0202)
LISTED	-0.0362***	-0.0361***	-0.0297***	-0.0296***	-0.0359***	-0.0358***	-0.0293***	-0.0293***
	(0.00860)	(0.00857)	(0.00882)	(0.00880)	(0.00868)	(0.00865)	(0.00877)	(0.00874)
AGE	-0.260***	-0.262***	-0.178**	-0.179**	-0.235***	-0.237***	-0.197***	-0.199***
	(0.0720)	(0.0719)	(0.0716)	(0.0714)	(0.0715)	(0.0714)	(0.0722)	(0.0721)
SUBSID	-0.0185**	-0.0186**	-0.0155*	-0.0155*	-0.0208**	-0.0208**	-0.0123	-0.0123
	(0.00879)	(0.00885)	(0.00841)	(0.00846)	(0.00896)	(0.00901)	(0.00822)	(0.00826)
LOCATION	0.0521**	0.0521**	0.0506**	0.0506**	0.0534**	0.0535**	0.0487**	0.0488**
	(0.0225)	(0.0226)	(0.0230)	(0.0231)	(0.0227)	(0.0228)	(0.0228)	(0.0228)
EXPORT	-0.0414***	-0.0413***	-0.0198	-0.0198	-0.0317**	-0.0316**	-0.0290**	-0.0290**
	(0.0146)	(0.0147)	(0.0145)	(0.0146)	(0.0152)	(0.0153)	(0.0138)	(0.0138)
OWNFOR	-0.0749***	-0.0749***	-0.0665***	-0.0666***	-0.0740***	-0.0740***	-0.0666***	-0.0666***
	(0.00852)	(0.00857)	(0.00821)	(0.00825)	(0.00852)	(0.00857)	(0.00832)	(0.00837)
OWNGOV	-0.0994***	-0.0993***	-0.0913**	-0.0912**	-0.0976***	-0.0974***	-0.0925**	-0.0924**
	(0.0336)	(0.0337)	(0.0355)	(0.0355)	(0.0328)	(0.0328)	(0.0366)	(0.0367)
FININD		-0.182		-0.247		-0.206		-0.225
		(0.442)		(0.401)		(0.395)		(0.452)
FINDEP		-0.179		-0.125		-0.155		-0.149
		(0.258)		(0.236)		(0.231)		(0.266)
OUTLOAN		632.9*		549.2		578.1*		606.9
		(364.3)		(342.2)		(336.7)		(373.0)
First stage results								
NUMBRW	8.156**	5.517***	8.159**	5.523***	8.155**	5.516***	8.160**	5.524***
	(3.965)	(1.968)	(3.964)	(1.967)	(3.965)	(1.968)	(3.964)	(1.967)
Observations	39,383	39,383	39,383	39,383	39,383	39,383	39,383	39,383
Pseudo R^2	0.013	0.013	0.012	0.012	0.011	0.011	0.015	0.015
F-stat	19.72	15.09	14.03	9.994	16.57	11.32	17.09	13.38
Kleibergen-Paap	5.92**	5.54*	5.89*	5.38	5.87*	5.53	6.03**	5.41
Portmanteau	1	1	1	1	1	1	1	1
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector effects	Yes	Yes	No	No	No	No	Yes	Yes
Size effects	No	No	Yes	Yes	No	No	Yes	Yes
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table reports coefficients and their standard error (in parentheses). The outcome variable is ACCESS and all variables are defined in Table 2. Data span over the period 2010-2018 for 76 countries. Estimation method is OLS with standard errors clustered by firm's country and 2SLS of Eq. (3) for instrumental variables. The bottom part of the table reports which fixed effects are used in each model specification. Specifications (1), (3), (5) and (7) report the results for the model without the control variables and different combinations of fixed effects. Specifications (2), (4), (6) and (8) report the results for the model with control variables and different combinations of fixed effects. Null hypothesis of Kleibergen-Paap test is the under-identification of the model. Null hypothesis of Portmanteau test is the absence of auto-correlation. The *, ** and *** symbols denote the p-values at 10th, 5th and 1st significance level, respectively.

the validity and robustness of the analysis.

6. Conclusions

The impact of financial instability on corporate finance is a key policy question that reflects the effectiveness of macroprudential policies. There have been various research efforts to conceptualize and measure financial stability. Following this line of research, our paper constructed a synthetic index of the financial system's soundness for 76 low- and middle-income countries during 2010-2018 using the IMF's

Table 11
Predicting ACCESS with ordinal probit model with instrumental variables and institutional governance controls - 2SLS.

Variable	1	2	3	4	5	6	7	8
FSIND	-0.0519***	-0.0526***	-0.0471***	-0.0477***	-0.0485***	-0.0491***	-0.0505***	-0.0512***
	(0.0113)	(0.0114)	(0.0105)	(0.0106)	(0.0102)	(0.0103)	(0.0117)	(0.0118)
LISTED	-0.0362***	-0.0358***	-0.0297***	-0.0293***	-0.0359***	-0.0355***	-0.0293***	-0.0289***
	(0.00860)	(0.00866)	(0.00882)	(0.00886)	(0.00868)	(0.00873)	(0.00877)	(0.00882)
AGE	-0.260***	-0.260***	-0.178**	-0.177**	-0.235***	-0.235***	-0.197***	-0.197***
	(0.0720)	(0.0720)	(0.0716)	(0.0716)	(0.0715)	(0.0715)	(0.0722)	(0.0722)
SUBSID	-0.0185**	-0.0185**	-0.0155*	-0.0155*	-0.0208**	-0.0208**	-0.0123	-0.0123
	(0.00879)	(0.00879)	(0.00841)	(0.00841)	(0.00896)	(0.00896)	(0.00822)	(0.00822)
LOCATION	0.0521**	0.0534**	0.0506**	0.0517**	0.0534**	0.0546**	0.0487**	0.0501**
	(0.0225)	(0.0225)	(0.0230)	(0.0231)	(0.0227)	(0.0228)	(0.0228)	(0.0228)
EXPORT	-0.0414***	-0.0414***	-0.0198	-0.0198	-0.0317**	-0.0317**	-0.0290**	-0.0291**
	(0.0146)	(0.0146)	(0.0145)	(0.0145)	(0.0152)	(0.0152)	(0.0138)	(0.0137)
OWNFOR	-0.0749***	-0.0750***	-0.0665***	-0.0667***	-0.0740***	-0.0741***	-0.0666***	-0.0668***
	(0.00852)	(0.00857)	(0.00821)	(0.00825)	(0.00852)	(0.00856)	(0.00832)	(0.00836)
OWNGOV	-0.0994***	-0.0995***	-0.0913**	-0.0914***	-0.0976***	-0.0977***	-0.0925**	-0.0927**
	(0.0336)	(0.0336)	(0.0355)	(0.0354)	(0.0328)	(0.0327)	(0.0366)	(0.0366)
GENDEQ		-1.093***		-0.947***		-0.974***		-1.073***
		(0.267)		(0.279)		(0.269)		(0.280)
BILHUM		-1.171		-1.447		-1.262		-1.368
		(0.911)		(0.948)		(0.932)		(0.930)
FISPOL		1.616***		1.447***		1.463***		1.611***
		(0.246)		(0.248)		(0.239)		(0.256)
First stage results								
NUMBRW	8.156**	8.148**	8.159**	8.152**	8.155**	8.148**	8.160**	8.153**
	(3.965)	(3.963)	(3.964)	(3.961)	(3.965)	(3.962)	(3.964)	(3.962)
Observations	39,383	39,383	39,383	39,383	39,383	39,383	39,383	39,383
Pseudo R^2	0.013	0.013	0.012	0.013	0.011	0.011	0.015	0.015
F-stat	19.72	19287.6	14.03	15279.6	16.57	17131.3	17.09	18178.0
Kleibergen-Paap	5.93**	5.89*	5.94**	5.91**	5.86*	5.89*	5.88*	5.95**
Portmanteau	1	1	1	1	1	1	1	1
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector effects	Yes	Yes	No	No	No	No	Yes	Yes
Size effects	No	No	Yes	Yes	No	No	Yes	Yes
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table reports coefficients and their standard error (in parentheses). The outcome variable is ACCESS and all variables are defined in Table 2. Data span over the period 2010-2018 for 76 countries. Estimation method is OLS with standard errors clustered by firm's country and 2SLS of Eq. (3) for instrumental variables. The bottom part of the table reports which fixed effects are used in each model specification. Specifications (1), (3), (5) and (7) report the results for the model without the control variables and different combinations of fixed effects. Specifications (2), (4), (6) and (8) report the results for the model with control variables and different combinations of fixed effects. Null hypothesis of Kleibergen-Paap test is the under-identification of the model. Null hypothesis of Portmanteau test is the absence of auto-correlation. The *, ** and *** symbols denote the p-values at 10^{th}, 5^{th} and 1^{st} significance level, respectively.

financial soundness indicators as constituent elements. The index accounts for the incidence of macroprudential and other policies that assess and monitor the strengths and vulnerabilities of the financial system as a whole.

Our financial soundness index differs from previous approaches in that it is not limited by its dependence on the conditions and prudential ratios of individual financial institutions alone, but it reflects the broader, combined financial conditions, including compliance with international financial sector standards and codes, and the outcome of stress tests. Moreover, our index is fully data-driven, tested and validated

Table 12
Predicting ACCESS with ordinal probit model with instrumental variables and political controls - 2SLS.

Variable	1	2	3	4	5	6	7	8
FSIND	-0.0519***	-0.0336***	-0.0471***	-0.0296***	-0.0485***	-0.0317***	-0.0505***	-0.0312***
	(0.0113)	(0.00612)	(0.0105)	(0.00582)	(0.0102)	(0.00594)	(0.0117)	(0.00598)
LISTED	-0.0362***	-0.0363***	-0.0297***	-0.0302***	-0.0359***	-0.0359***	-0.0293***	-0.0298***
	(0.00860)	(0.00878)	(0.00882)	(0.00901)	(0.00868)	(0.00887)	(0.00877)	(0.00895)
AGE	-0.260***	-0.276***	-0.178***	-0.194***	-0.235***	-0.249***	-0.197***	-0.215***
	(0.0720)	(0.0751)	(0.0716)	(0.0746)	(0.0715)	(0.0746)	(0.0722)	(0.0753)
SUBSID	-0.0185**	-0.0212**	-0.0155*	-0.0183**	-0.0208**	-0.0237**	-0.0123	-0.0147*
	(0.00879)	(0.00910)	(0.00841)	(0.00869)	(0.00896)	(0.00928)	(0.00822)	(0.00847)
LOCATION	0.0521**	0.0496**	0.0506**	0.0482**	0.0534**	0.0510**	0.0487**	0.0462*
	(0.0225)	(0.0235)	(0.0230)	(0.0241)	(0.0227)	(0.0237)	(0.0228)	(0.0238)
EXPORT	-0.0414***	-0.0451***	-0.0198	-0.0236	-0.0317**	-0.0350**	-0.0290**	-0.0331**
	(0.0146)	(0.0148)	(0.0145)	(0.0147)	(0.0152)	(0.0155)	(0.0138)	(0.0138)
OWNFOR	-0.0749***	-0.0752***	-0.0665***	-0.0670***	-0.0740***	-0.0741***	-0.0666***	-0.0671***
	(0.00852)	(0.00870)	(0.00821)	(0.00839)	(0.00852)	(0.00870)	(0.00832)	(0.00852)
OWNGOV	-0.0994***	-0.0937**	-0.0913**	-0.0868**	-0.0976***	-0.0921***	-0.0925**	-0.0878**
	(0.0336)	(0.0366)	(0.0355)	(0.0381)	(0.0328)	(0.0356)	(0.0366)	(0.0394)
STABDEM		-0.171***		-0.183***		-0.166***		-0.192***
		(0.0501)		(0.0498)		(0.0497)		(0.0498)
LIMLEND		-0.116*		-0.0921		-0.0958		-0.114
		(0.0627)		(0.0649)		(0.0586)		(0.0706)
VETOPWR		0.0293***		0.0250***		0.0268***		0.0274***
		(0.00727)		(0.00663)		(0.00669)		(0.00727)
First stage results								
NUMBRW	8.156**	7.004**	8.159**	7.015**	8.155**	7.007**	8.160**	7.013**
	(3.965)	(2.928)	(3.964)	(2.928)	(3.965)	(2.929)	(3.964)	(2.927)
Observations	39,383	37,739	39,383	37,739	39,383	37,739	39,383	37,739
Pseudo R^2	0.013	0.014	0.012	0.013	0.011	0.011	0.015	0.016
F-stat	19.72	30.88	14.03	29.71	16.57	34.00	17.09	28.06
Kleibergen-Paap	5.92**	6.42**	5.86*	6.55**	5.86*	6.37**	5.96**	6.44**
Portmanteau	1	1	1	1	1	1	1	1
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector effects	Yes	Yes	No	No	No	No	Yes	Yes
Size effects	No	No	Yes	Yes	No	No	Yes	Yes
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table reports coefficients and their standard error (in parentheses). The outcome variable is ACCESS and all variables are defined in Table 2. Data span over the period 2010-2018 for 76 countries. Estimation method is OLS with standard errors clustered by firm's country and 2SLS of Eq. (3) for instrumental variables. The bottom part of the table reports which fixed effects are used in each model specification. Specifications (1), (3), (5) and (7) report the results for the model without the control variables and different combinations of fixed effects. Specifications (2), (4), (6) and (8) report the results for the model with control variables and different combinations of fixed effects. Null hypothesis of Kleibergen-Paap test is the under-identification of the model. Null hypothesis of Portmanteau test is the absence of auto-correlation. The *, ** and *** symbols denote the p-values at 10^{th}, 5^{th} and 1^{st} significance level, respectively.

by means of an unsupervised statistical learning technique, which makes neither a priori assumptions on the relationship among the input variables nor a subjective decision on the chosen variables.

Subsequently, we used the index to predict the financing constraints of individual non-financial firms in middle- and low-income countries. We control for the effect of the specific characteristics of firms and the influence of economic and institutional country-level factors. We carry out sensitivity analysis to contain measurement error and we use endogeneity analysis to correct for omitted variable bias. We further

Table 13
Assessing the relevance of macro-control variables.

Group	Variable		$\pi = 1$ $\|\delta\|$	$\pi = 1.01$ $\|\delta\|$	$\pi = 1.02$ $\|\delta\|$	$\pi = 1.03$ $\|\delta\|$	$\pi = 1.04$ $\|\delta\|$	$\pi = 1.05$ $\|\delta\|$
		R^2 baseline	$R^2_{max} = 0.121$	$R^2_{max} = 0.122$	$R^2_{max} = 0.123$	$R^2_{max} = 0.124$	$R^2_{max} = 0.126$	$R^2_{max} = 0.127$
Macro-economic	GDPCAP	0.121	5.842	0.229	0.116	0.078	0.059	0.047
	INFLDFL	0.121	4.64	0.231	0.118	0.079	0.06	0.048
	LENDINT	0.121	15.826	1.608	0.843	0.571	0.432	0.347
		R^2 baseline	$R^2_{max} = 0.121$	$R^2_{max} = 0.122$	$R^2_{max} = 0.123$	$R^2_{max} = 0.124$	$R^2_{max} = 0.125$	$R^2_{max} = 0.127$
Financial Access	FININD	0.121	2.485	0.289	0.153	0.104	0.079	0.063
	FINDEP	0.121	3.576	0.303	0.158	0.106	0.08	0.065
	OUTLOAN	0.121	26.359	0.279	0.139	0.093	0.07	0.056
		R^2 baseline	$R^2_{max} = 0.121$	$R^2_{max} = 0.122$	$R^2_{max} = 0.123$	$R^2_{max} = 0.125$	$R^2_{max} = 0.126$	$R^2_{max} = 0.127$
Institutional governance	GENDEQ	0.121	12.275	0.474	0.241	0.161	0.121	0.097
	BILHUM	0.121	6.013	0.901	0.485	0.332	0.252	0.203
	FISPOL	0.121	1.008	0.16	0.086	0.059	0.045	0.036
		R^2 baseline	$R^2_{max} = 0.112$	$R^2_{max} = 0.113$	$R^2_{max} = 0.114$	$R^2_{max} = 0.115$	$R^2_{max} = 0.116$	$R^2_{max} = 0.118$
Political	STABDEM	0.112	21.289	0.974	0.496	0.333	0.25	0.201
	LIMLEND	0.112	91.159	1.963	0.987	0.659	0.495	0.396
	VETOPWR	0.112	32.977	1.018	0.515	0.344	0.259	0.207

Notes: The table reports results of Oster test in order to state the relevance of each variable compared to unobserved variables and assess the impact on the change of the coefficients' value. For example, $\delta = 2$ means that the unobservable variables would need to be twice as important as the observable ones to shrink the coefficient to zero. The higher the value of δ, the more relevant is that variable. The R^2 of the model with both observable and unobservable variables is required for the calculation of δ. Multiplying the R^2 value by a number $\pi > 1$ relaxes the test's assumptions, allowing the model to take into account the errors in estimation due to poor specification power of the observed variables.

apply the Oster test to obtain more robust results.

Our results show that our financial soundness index is a negative and significant predictor of the firm's financing constraints across countries. The results remain broadly stable after splitting the sample by income level, and controlling for firm size and sector of activity. It appears that financial stability considerations are relatively more important in affecting the financing constraints of small-size firms in less developed countries. Our results hold after carrying out endogeneity analysis using IV methods and remain robust to additions of different groups of country-level control variables.

While the analysis needs to be further extended and tested in different data samples and settings, it emerges that financial stability considerations and the associated macroprudential policies are important interventions for improving firms' access to finance, especially of smaller firms in less developed countries.

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Appendix A. FSIND index and ACCESS prediction dataset

Table A1
Correlation matrix of independent variables for DFM index evaluation. Variable Inflation Factor (VIF) is reported below, showing low collinearity between regressors, as well as p-values significance level legend. Variables' legend is below:
1 'Emerging Markets Bond (EMB) Capital to assets', 2 'Customer deposits to total non interbank loans', 3 'EMB Foreign currency liabilities to total liabilities', 4 'EMB Foreign currency loans to total loans', 5 'EMB Personnel expenses to non interest expenses', 6 'Interest margin to gross income', 7 'Liquid assets to short term liabilities', 8 'Liquid assets to total assets', 9 'Net open position of forex to capital', 10 'Non interest expenses to total income', 11 'Non performing loans net of capital provisions', 12 'Non performing loans to total gross loans', 13 'Regulatory capital to risk weighted assets', 14 'Regulatory tier 1 capital to risk weighted assets', 15 'Return on assets', 16 'Return on equity' and 17 'Sectorial distribution of loans residents'.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	1																
2	0.0071	1															
3	0.0674*	0.164***	1														
4	0.004	0.1305***	0.9271***	1													
5	-0.181***	-0.0464	0.0936**	0.0707*	1												
6	0.0201	0.0352	0.06*	0.0746**	0.3416***	1											
7	0.0451	0.0259	-0.1703***	-0.1903***	-0.1338***	-0.0487	1										
8	0.0508	0.494***	0.1057***	0.0731**	-0.1228***	0.0529	0.2813***	1									
9	-0.0895**	0.2558***	0.2176***	0.2886***	-0.0129	0.0309	0.0724*	0.2063***	1								
10	0.0052	-0.0845**	0.0544	0.0639*	-0.1198***	0.3292***	0.226***	0.0423	-0.0612*	1							
11	-0.1553***	-0.0914***	-0.0662*	-0.0303	0.0787**	-0.0278	-0.0538	-0.0387	-0.0642*	0.0643*	1						
12	0.1221***	0.0074	-0.0431	3e-04	-0.1157***	-0.027	0.0451	0.1241***	-0.0454	0.0949***	0.7802***	1					
13	0.6206***	0.1822***	0.0268	-0.0395	-0.1914***	-0.0562*	0.0655*	0.1964***	-0.1176***	0.037	-0.1335***	0.064*	1				
14	0.6058***	0.2206***	0.0204	-0.0482	-0.2114***	-0.052	0.0893***	0.246***	-0.1135***	0.0641*	-0.0635*	0.1287***	0.9388***	1			
15	0.3928***	0.1213***	-0.1286***	-0.1891***	-0.0812**	-0.0186	-0.0316	0.0208	-0.0183	-0.1454***	-0.4035***	-0.3634***	0.2648***	0.2157***	1		
16	0.0955***	0.0728**	-0.1167***	-0.1639***	-0.0155	0.0189	-0.0194	-0.0227	0.042	-0.1289***	-0.4353***	-0.399***	0.0699**	0.0281	0.875***	1	
17	0.4719***	0.1293***	-0.073*	-0.1446***	-0.091**	0.1896***	0.0191	-0.0532	-0.052	-0.0363	-0.2283***	0.0136	0.1445***	0.1073***	0.3822***	0.2655***	1
VIF	2.654																

* p<0.1, ** p<0.05, *** p<0.01

Appendix B. Missing values imputation methodology

To assess imputation performances and to choose the best method, we test the algorithm in three settings. In the first, referred to as *Original* or setting a, we consider the whole dataset made of 76 countries by 17 variables for 8 years for a total of 16184 entries. It contains 8% of missing values, thus we randomly remove some additional values representing 10%, 20% and 30% of the initial dataset. In the second, referred to as *No missing* or setting b, we drop all entries with missing values and apply the same incremental sampling procedure on the remaining subset. In the last, referred to as *Some missing* or setting c, we drop all countries with at least 3 missing values for any year and apply again the incremental sampling procedure on the remaining subset. Furthermore, we fit the two methods, MC-SVD and BTF, on the previous 3 cases (a,b and c) with different sampling percentages and we evaluate the Mean Absolute Reconstruction Error (MARE) on the excluded observations as

Table A2
Complete list of countries for FSIND evaluation and relative missing values count and percentage over total number of observations. The "x" indicates whether the country is matched in the subset used to predict the ACCESS value.

Country	Missing values	ACCESS Dataset	Country	Missing values	ACCESS Dataset	Country	Missing values	ACCESS Dataset
Albania	-	x	Tanzania	-	x	Lesotho	15 (11%)	x
Argentina	-	x	Turkey	-	x	Pakistan	15 (11%)	x
Armenia, Republic of	-	x	Uganda	-	x	Belgium	16 (11.8%)	
Austria	-		Ukraine	-	x	Finland	16 (11.8%)	
Brazil	-		U. K.	-		Kuwait	16 (11.8%)	
Brunei	-		Uruguay	-	x	Nigeria	16 (11.8%)	x
Burundi	-	x	Italy	2 (1.5%)		Singapore	16 (11.8%)	
Cambodia	-	x	Switzerland	3 (2.2%)		India	17 (12.5%)	x
Cameroon	-	x	Cyprus	4 (2.9%)		Korea Rep	17 (12.5%)	
Central African Republic	-	x	Eswatini	4 (2.9%)		Solomon Islands	17 (12.5%)	x
Chad	-		Latvia	4 (2.9%)	x	Honduras	18 (13.2%)	x
Macao	-		Seychelles	4 (2.9%)		Netherlands	18 (13.2%)	
Congo	-		Colombia	5 (3.7%)	x	Chile	20 (14.7%)	x
Croatia	-	x	Hong Kong	6 (4.4%)		Lebanon	22 (16.2%)	x
Denmark	-		Fiji	6 (4.4%)		Algeria	23 (16.9%)	
El Salvador	-	x	Kenya	6 (4.4%)	x	Australia	24 (17.6%)	
Eq. Guinea	-		Tonga	6 (4.4%)		Moldova	24 (17.6%)	x
Gabon	-		Vanuatu	6 (4.4%)		Panama	24 (17.6%)	x
Georgia	-	x	Ghana	7 (5.1%)	x	San Marino	24 (17.6%)	
Germany	-		Bolivia	8 (5.9%)	x	Spain	24 (17.6%)	
Guatemala	-	x	Bosnia and Herzegovina	8 (5.9%)	x	Thailand	24 (17.6%)	x
Indonesia	-	x	Canada	8 (5.9%)		United States	24 (17.6%)	
Kazakhstan	-	x	Czech Republic	8 (5.9%)	x	Vietnam	24 (17.6%)	x
Kyrgyz Republic	-	x	Dominican Republic	8 (5.9%)	x	Sri Lanka	31 (22.8%)	x
Macedonia, FYR	-	x	Greece	8 (5.9%)		China, P.R.: Mainland	32 (23.5%)	x
Madagascar	-	x	Kosovo, Republic of	8 (5.9%)	x	Costa Rica	32 (23.5%)	x
Malta	-		Luxembourg	8 (5.9%)		Ecuador	32 (23.5%)	x
Mauritius	-		Paraguay	8 (5.9%)	x	Malaysia	32 (23.5%)	x
Namibia	-	x	Portugal	8 (5.9%)		Angola	34 (25%)	x
Nicaragua	-	x	Trinidad and Tobago	8 (5.9%)	x	Botswana	34 (25%)	x
Papua New Guinea	-	x	West Bank and Gaza	8 (5.9%)	x	Gambia	34 (25%)	
Peru	-	x	Zambia	8 (5.9%)	x	Bangladesh	36 (26.5%)	x
Philippines	-	x	Bulgaria	10 (7.4%)	x	France	36 (26.5%)	
Poland	-	x	Lithuania	10 (7.4%)	x	Ireland	37 (27.2%)	
Romania	-	x	Estonia	12 (8.8%)	x	Djibouti	40 (29.4%)	x
Russian Federation	-	x	Mexico	12 (8.8%)	x	Hungary	40 (29.4%)	x
Rwanda	-	x	Afghanistan, Islamic Republic of	13 (9.6%)	x	Norway	40 (29.4%)	
Saudi Arabia	-		Bhutan	13 (9.6%)	x	Slovenia	40 (29.4%)	x
Slovak Republic	-	x	Belarus	14 (10.3%)	x	Sweden	40 (29.4%)	x
South Africa	-		Israel	14 (10.3%)	x			

Table A3
Correlation matrix of variable used to predict ACCESS. Variable Inflation Factor (VIF) is reported below, showing very low collinearity between regressors, as well as p-values significance level legend.

	ACCESS	FSIND	LISTED	AGE	SIZE	SUBSID	LOCATION	EXPORT	OWNFOR	OWNGOV
ACCESS	1									
FSIND	-0.0268***	1								
LISTED	-0.0315***	0.0052	1							
AGE	-0.0253***	0.0095**	0.0864***	1						
SIZE	-0.0903***	-0.0591***	0.1246***	0.2399***	1					
SUBSID	-0.0288***	-0.0426***	0.0982***	0.069***	0.1952***	1				
LOCATION	-0.0341***	0.1188***	-0.0594***	-0.1033***	-0.101***	-0.0192***	1			
EXPORT	-0.0451***	-0.0017	0.033***	0.0532***	0.2371***	0.079***	0.0297***	1		
OWNFOR	-0.046***	-0.0025	0.0811***	0.0154***	0.1672***	0.1334***	-0.0241***	0.1894***	1	
OWNGOV	-0.0234***	-0.0294***	0.057***	0.0207***	0.0498***	0.0282***	-0.003	0.0182***	-0.0008	1
VIF	1.064									

* p<0.1, ** p<0.05, *** p<0.01

follows:

$$MARE = \frac{1}{M}\sum_{i}^{M}|x_{excluded} - x_{reconstructed}|$$

Table A4
List of variables used to build the FSIND index, with sources, aggregation level, total number of observations and descriptive summary statistics.

Variable	Source	Aggregation Level	Obs	Mean	S.D.	Min	P25	Median	P75	Max
1 - EMB Capital to assets (%)	FSI	Country	1,127	10.28	3.57	1.49	7.57	10.02	12.37	24.85
2 - EMB Customer deposits to total non interbank loans (%)			1,077	120.73	56.5	29.01	89.3	111.71	131.83	626.93
3 - EMB Foreign currency liabilities to total liabilities (%)			997	30.61	24.87	0	10.18	23.96	49.26	100
4 - EMB Foreign currency loans to total loans (%)			1,014	28.75	26.26	0	8.03	22.7	43.79	100.06
5 - EMB Personnel expenses to non interest expenses (%)			1,097	44.17	12.04	5.29	36.8	44.03	51.14	91.58
6 - Interest margin to gross income (%)			1,169	59.01	18.4	-294.33	51.58	60.4	68.81	142.77
7 - Liquid assets to short term liabilities (%)			1,111	69.13	61.11	10	34.58	48.99	78.71	690.37
8 - Liquid assets to total assets (%)			1,140	27.92	13.03	4.99	18.82	25.77	33.77	74.97
9 - Net open position of forex to capital (%)			969	9.57	36.74	-95.43	0.14	2.67	8.66	407.97
10 - Non interest expenses to total income (%)			1,169	58.17	17.88	-303.46	49.57	57.14	66.34	115.79
11 - Non performing loans net of capital provisions (%)			1,169	18.78	38.28	-51.61	3.64	9.08	20.38	413.56
12 - Non performing loans to total gross loans (%)			1,167	6.81	7.4	0	2.22	4.05	9.31	54.54
13 - Regulatory capital to risk weighted assets (%)			1,171	17.67	4.83	1.75	14.67	16.83	19.3	42.2
14 - Regulatory tier 1 capital to risk weighted assets (%)			1,166	15.43	4.86	2.18	12.3	14.39	17.31	40.3
15 - Return on assets (%)			1,169	1.5	1.8	-25.61	0.76	1.38	2.24	10.28
16 - Return on equity (%)			1,166	13.22	21.93	-505.64	8.18	14.05	20.34	65.4
17 - Sectoral distribution of loans residents (%)			1,063	87.85	16.05	20.67	83.32	94.9	99.25	100

Table A5
Results for DFM methods with different number of factors and factors interactions. R^2 is reported for the full dataset and for the 99$^{\text{th}}$ and 95$^{\text{th}}$ percentiles. We also report Im-Pesaran-Shin test for stationarity on the FSIND index.

Factors Interactions	Number of Factors	R^2	R^2 on 99$^{\text{th}}$	R^2 on 95$^{\text{th}}$	Im-Pesaran-Shin test
No	1	35.7%	36.5%	39.4%	$\ll 0.01$
No	2	39.9%	42.9%	44.3%	$\ll 0.01$
Yes	1	64.1%	66.5%	69.7%	$\ll 0.01$
Yes	2	66.4%	67.7%	70.3%	$\ll 0.01$

where M is the total number of excluded values. Moreover, we check the sensitivity to the original percentage of missing values by comparing the MARE based on the *No missing* and *Some missing* settings with the one based on the *Original* setting. Figure A1 reports the results of the imputation performance for both techniques. The blue shaded bars in the upper row represent the average reconstruction error for different percentage of additional missing values for each of the three settings. Whiskers on top of each bar show the scaled magnitude of maximum value of reconstruction error. Bars on the lower row represent the percentage variation of the average reconstruction error of the *No missing* (setting b) and *Some missing* (setting c), settings compared to the *Original* (setting a). Green bars signal that the imputation technique has a lower average reconstruction error. The figure shows that when comparing, setting b and setting c with setting a, the method is performing better when considering data with less missing values, as expected. On the other hand, red bars mean that the technique fails in improving the reconstruction performance on subsets with less missing values.

Appendix C. Loadings Plot for DFM method and FSIND evolution over years.

In this appendix we report loadings of the DFM approach. As described in Section 3 the loadings $\mathbf{C}^i$ for the i-th country are stacked into the diagonal matrix $\mathbf{C}$, whereas the cross-country interactions are introduced by the matrix $\hat{\boldsymbol{A}}$ estimated with VAR. Our setting forces the $\mathbf{C}^i$ to be constant so we can estimate loadings for each country-variable pair. Therefore, for ease of visualisation, figure A2 reports the distribution of the loadings for each independent variable over the 76 countries, representing the average trend over the years. The bimodal shape of all distributions implies a clear discriminative power of the index between less risky countries and riskier ones. Figure A3, instead, reports the contribution of independent variables on the loading for each country. Blue shaded points represent the positive contribution of the variables to each loading while red shaded points represent the negative one. The bigger the points the more the independent variable contributes to the loading.

Appendix D. Robustness test for ACCESS prediction models

Fig. A1. Missing values imputation methodologies are tested in three settings. In the first (named *Original*, setting a) the whole dataset contains 8% of missing values, and additional values representing 10%, 20% and 30% of the initial dataset are randomly removed. In the second (named *No missing*, setting b) all entries with missing values are dropped from the whole dataset and the same incremental sampling procedure is applied on the remaining subset. In the last (named *Some missing*, setting c) all countries with at least 3 missing values for any year are dropped and the incremental sampling procedure is again applied on the remaining subset. The blue shaded bars in the upper row represent the average percentage reconstruction error (MAPE) for different percentage of additional missing values for each of the three settings. Whiskers on the top of each bar shows the scaled magnitude of maximum value of reconstruction error as well its numeric value, the relative magnitude *R* of MAPE compared to the average value of the original dataset and the relative magnitude *RM* of the maximum percentage reconstruction error compared to the average value of the original dataset. Bars on the lower row represent the percentage variation of the average reconstruction error of b) *No missing* and c) *Some missing* settings compared to a) *Original* setting, i. e. $MARE/MARE_{\text{Orig}} - 1$. Green bars mean that the imputation technique has a lower average reconstruction error when applied on the subset with no original missing values, setting b, and on the subset with some original missing values, setting c, compared to the average reconstruction error when applied on the full dataset with all original missing values, setting a.

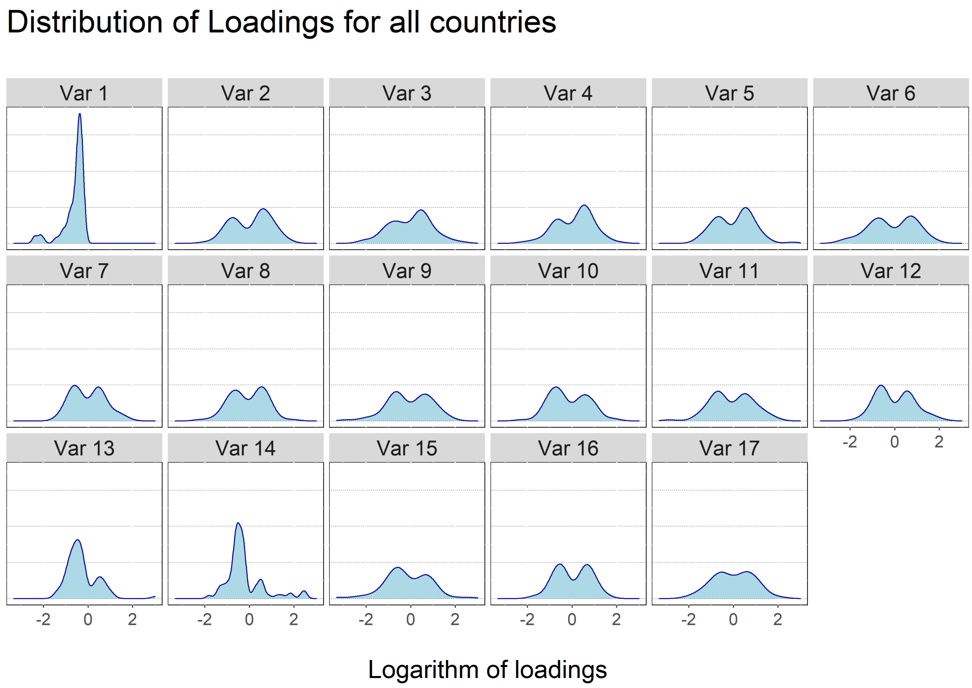

Fig. A2. Loadings distribution over all countries for each independent variable. On x-axis is reported the logarithm of loading values. Variables' legend is below:
1 'Emerging Markets Bond (EMB) Capital to assets', 2 'Customer deposits to total non interbank loans', 3 'EMB Foreign currency liabilities to total liabilities', 4 'EMB Foreign currency loans to total loans', 5 'EMB Personnel expenses to non interest expenses', 6 'Interest margin to gross income', 7 'Liquid assets to short term liabilities', 8 'Liquid assets to total assets', 9 'Net open position of forex to capital', 10 'Non interest expenses to total income', 11 'Non performing loans net of capital provisions', 12 'Non performing loans to total gross loans', 13 'Regulatory capital to risk weighted assets', 14 'Regulatory tier 1 capital to risk weighted assets', 15 'Return on assets', 16 'Return on equity' and 17 'Sectorial distribution of loans residents'.

Fig. A3. Contribution of independent variables on loadings for all countries. Blue shaded points represent the positive contribution of the variables to each loading while red shaded points represent the negative one. The bigger the points the more the independent variable contributes to the loading. Variables' legend is below:

1 'Emerging Markets Bond (EMB) Capital to assets', 2 'Customer deposits to total non interbank loans', 3 'EMB Foreign currency liabilities to total liabilities', 4 'EMB Foreign currency loans to total loans', 5 'EMB Personnel expenses to non interest expenses', 6 'Interest margin to gross income', 7 'Liquid assets to short term liabilities', 8 'Liquid assets to total assets', 9 'Net open position of forex to capital', 10 'Non interest expenses to total income', 11 'Non performing loans net of capital provisions', 12 'Non performing loans to total gross loans', 13 'Regulatory capital to risk weighted assets', 14 'Regulatory tier 1 capital to risk weighted assets', 15 'Return on assets', 16 'Return on equity' and 17 'Sectorial distribution of loans residents'.

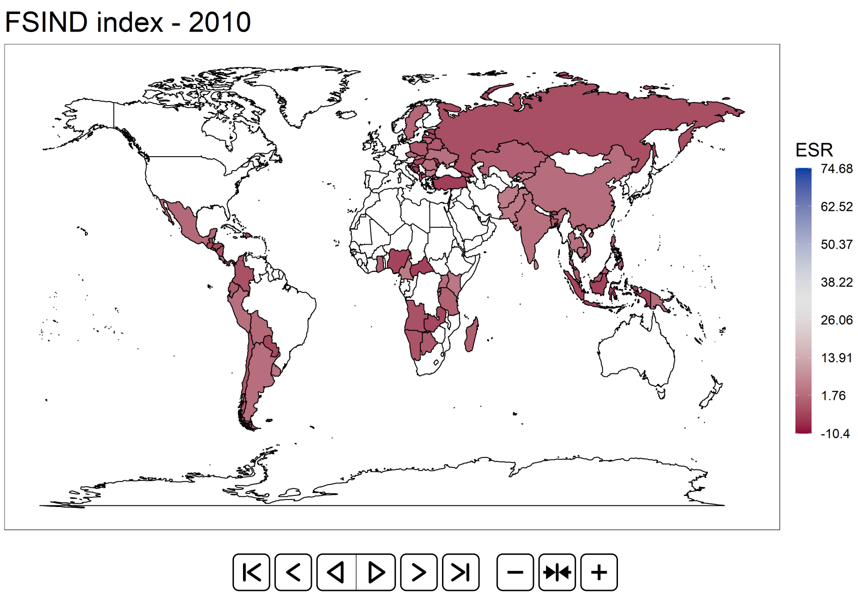

Fig. A4. FSIND index evolution over years. Shades of red color refer to riskier countries, while shades of blue to safer ones.

Table A6
Predicting ACCESS with ordinal probit model with instrumental variables and macro-economic controls - CMP.

Variable	1	2	3	4	5	6	7	8
FSIND	-0.1119***	-0.0335**	-0.0312***	-0.0118*	-0.091***	-0.074**	-0.0897***	-0.0298*
	(0.0169)	(0.0181)	(0.0169)	(0.0181)	(0.0170)	(0.0182)	(0.0169)	(0.0181)
LISTED	-0.0757***	-0.039***	-0.0134***	-0.0423***	-0.0884***	-0.027***	-0.0536***	-0.0169***
	(0.00821)	(0.00821)	(0.00825)	(0.00825)	(0.00822)	(0.00822)	(0.00824)	(0.00824)
AGE	-0.1875***	-0.3031***	-0.389***	-0.1519***	-0.1283***	-0.4007***	-0.1875***	-0.0183***
	(0.0301)	(0.0301)	(0.0309)	(0.0309)	(0.0300)	(0.0301)	(0.0309)	(0.0309)
SUBSID	-0.011***	-0.0055***	-0.0363***	-0.001***	-0.0228***	-0.0096***	-9e-04***	-0.0064***
	(0.00414)	(0.00414)	(0.00418)	(0.00419)	(0.00413)	(0.00414)	(0.00419)	(0.00419)
LOCATION	0.0044***	0.103***	0.0546***	0.0595***	0.0396***	0.0555***	0.0216***	0.0057***
	(0.00744)	(0.00756)	(0.00745)	(0.00757)	(0.00745)	(0.00757)	(0.00745)	(0.00757)
EXPORT	-0.0558***	-0.0906***	-0.0481***	-0.0324***	-0.0172***	-0.0119***	-0.0312***	-0.0693***
	(0.00709)	(0.00709)	(0.00718)	(0.00718)	(0.00703)	(0.00703)	(0.00723)	(0.00723)
OWNFOR	-0.0499***	-0.1327***	-0.1206***	-0.0423***	-0.0158***	-0.0212***	-0.1576***	-0.0818***
	(0.00645)	(0.00645)	(0.00652)	(0.00652)	(0.00646)	(0.00646)	(0.00651)	(0.00651)
OWNGOV	-0.2248***	-0.1236***	-0.0363***	-0.1805***	-0.1278***	-0.0722***	-0.0851***	-0.1911***
	(0.0249)	(0.0249)	(0.0249)	(0.0249)	(0.0249)	(0.0249)	(0.0249)	(0.0249)
GDPCAP		0.0258		0.0471		0.0725		0.0632
		(0.0334)		(0.0335)		(0.0335)		(0.0334)
INFLDFL		0.081		0.0626		0.0132		0.0712
		(0.0343)		(0.0343)		(0.0343)		(0.0343)
LENDINT		-0.5656*		-0.1841		-0.2102		-0.0901*
		(0.136)		(0.136)		(0.136)		(0.136)
NUMBRW	18.0828***	12.9832***	4.2844***	13.5466***	11.9256***	1.9514***	13.7929***	2.4601***
	(0.142)	(0.112)	(0.142)	(0.112)	(0.142)	(0.112)	(0.142)	(0.112)
Observations	39,383	39,383	39,383	39,383	39,383	39,383	39,383	39,383
Pseudo R^2	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
F-stat	96.88	93.11	95.24	91.57	96.83	93	95.59	91.97
ρ	0.0137*	0.0089	0.0125*	0.0082	0.0125*	0.0086	0.0138*	0.0084
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector effects	Yes	Yes	No	No	No	No	Yes	Yes
Size effects	No	No	Yes	Yes	No	No	Yes	Yes
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table reports coefficients and their standard error (in parentheses). The outcome variable is ACCESS and all variables are defined in Table 2. Data span over the period 2010-2018 for 76 countries. Estimation method is OLS with standard errors clustered by firm's country and Conditional Mixed Process for instrumental variables. The bottom part of the table reports which fixed effects are used in each model specification. Specifications (1), (3), (5) and (7) report the results for the model without the control variables and different combinations of fixed effects. Specifications (2), (4), (6) and (8) report the results for the model with control variables and different combinations of fixed effects. Arellano-Bond ρ indicates the magnitude of auto-correlation and its significance level. The *, ** and *** symbols denote the p-values at 10^{th}, 5^{th} and 1^{st} significance level, respectively.

Table A7

Predicting ACCESS with ordinal probit model with instrumental variables and financial access controls - CMP.

Variable	1	2	3	4	5	6	7	8
FSIND	-0.1197***	-0.0914***	-0.1086***	-0.1072***	-0.1111***	-0.0795***	-0.0147***	-0.0453***
	(0.0169)	(0.0213)	(0.0169)	(0.0213)	(0.0170)	(0.0213)	(0.0169)	(0.0213)
LISTED	-0.0208***	-0.0539***	-0.0157***	-0.0382***	-0.0475***	-0.0333***	-0.0167***	-0.0294***
	(0.00821)	(0.00821)	(0.00825)	(0.00826)	(0.00822)	(0.00822)	(0.00824)	(0.00825)
AGE	-0.1184***	-0.2736***	-0.1316***	-0.3285***	-0.0306***	-0.0458***	-0.0304***	-0.2891***
	(0.0301)	(0.0301)	(0.0309)	(0.0309)	(0.0300)	(0.0301)	(0.0309)	(0.0309)
SUBSID	-0.007***	-0.0182***	-0.0135***	-0.0057***	-0.043***	-0.0223***	-0.0255***	-0.0066***
	(0.00414)	(0.00415)	(0.00418)	(0.00420)	(0.00413)	(0.00414)	(0.00419)	(0.00420)
LOCATION	0.0879***	0.0246***	0.1071***	0.1262***	0.0861***	0.0628***	0.098***	0.0118***
	(0.00744)	(0.00747)	(0.00745)	(0.00748)	(0.00745)	(0.00748)	(0.00745)	(0.00747)
EXPORT	-0.0479***	-0.0045***	-0.0148***	-0.0318***	-0.0286***	-0.0747***	-0.0494***	-0.0415***
	(0.00709)	(0.00710)	(0.00718)	(0.00718)	(0.00703)	(0.00703)	(0.00723)	(0.00723)
OWNFOR	-0.0191***	-0.1141***	-0.0142***	-0.1223***	-0.1403***	-0.0774***	-0.1082***	-0.0324***
	(0.00645)	(0.00645)	(0.00652)	(0.00652)	(0.00646)	(0.00646)	(0.00651)	(0.00651)
OWNGOV	-0.221***	-0.2404***	-0.1825***	-0.1875***	-0.0954***	-0.1727***	-0.0769***	-0.0414***
	(0.0249)	(0.0249)	(0.0249)	(0.0249)	(0.0249)	(0.0249)	(0.0249)	(0.0249)
FININD		-0.3638		-0.1719		-0.3295		-0.2239
		(0.348)		(0.348)		(0.348)		(0.348)
FINDEP		-0.2076		-0.1764		-0.1506		-0.1791
		(0.250)		(0.251)		(0.251)		(0.250)
OUTLOAN		1281.4853		1189.7615		812.5037		388.4608
		(540.2)		(540.4)		(540.7)		(539.7)
NUMBRW	2.0887***	5.9549***	17.4143***	2.3762***	7.4528***	7.386***	5.7145***	10.9275***
	(0.142)	(0.120)	(0.142)	(0.120)	(0.142)	(0.120)	(0.142)	(0.120)
Observations	39,383	39,383	39,383	39,383	39,383	39,383	39,383	39,383
Pseudo R^2	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
F-stat	96.88	93.08	95.24	91.55	96.83	92.98	95.59	91.94
ρ	0.0137*	0.0159**	0.0125*	0.0147*	0.0125*	0.0145*	0.0138*	0.0161**
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector effects	Yes	Yes	No	No	No	No	Yes	Yes
Size effects	No	No	Yes	Yes	No	No	Yes	Yes
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table reports coefficients and their standard error (in parentheses). The outcome variable is ACCESS and all variables are defined in Table 2. Data span over the period 2010-2018 for 76 countries. Estimation method is OLS with standard errors clustered by firm's country and Conditional Mixed Process for instrumental variables. The bottom part of the table reports which fixed effects are used in each model specification. Specifications (1), (3), (5) and (7) report the results for the model without the control variables and different combinations of fixed effects. Specifications (2), (4), (6) and (8) report the results for the model with control variables and different combinations of fixed effects. Arellano-Bond ρ indicates the magnitude of auto-correlation and its significance level. The *, ** and *** symbols denote the p-values at 10^{th}, 5^{th} and 1^{st} significance level, respectively.

Table A8
Predicting ACCESS with ordinal probit model with instrumental variables and institutional governance controls - CMP.

Variable	1	2	3	4	5	6	7	8
FSIND	-0.0705***	-0.1108***	-0.0273***	-0.1161***	-0.1077***	-0.0576***	-0.0603***	-0.1072***
	(0.0169)	(0.0169)	(0.0169)	(0.0169)	(0.0170)	(0.0170)	(0.0169)	(0.0169)
LISTED	-0.0262***	-0.0074***	-0.0617***	-0.0054***	-0.0432***	-0.01***	-0.0231***	-0.0387***
	(0.00821)	(0.00821)	(0.00825)	(0.00826)	(0.00822)	(0.00822)	(0.00824)	(0.00825)
AGE	-0.2608***	-0.6282***	-0.3576***	-0.3919***	-0.3287***	-0.2656***	-0.3228***	-0.287***
	(0.0301)	(0.0301)	(0.0309)	(0.0309)	(0.0300)	(0.0300)	(0.0309)	(0.0309)
SUBSID	-0.0188***	-0.0196***	-0.0381***	-0.0304***	-0.0369***	-0.0424***	-0.0173***	-0.0268***
	(0.00414)	(0.00414)	(0.00418)	(0.00418)	(0.00413)	(0.00413)	(0.00419)	(0.00419)
LOCATION	0.0284***	0.0098***	0.1174***	0.0863***	0.008***	0.0591***	0.0093***	0.0675***
	(0.00744)	(0.00748)	(0.00745)	(0.00749)	(0.00745)	(0.00749)	(0.00745)	(0.00748)
EXPORT	-0.0646***	-0.0372***	-0.0127***	-0.0458***	-0.0336***	-0.0782***	-0.0558***	-0.0472***
	(0.00709)	(0.00709)	(0.00718)	(0.00718)	(0.00703)	(0.00703)	(0.00723)	(0.00723)
OWNFOR	-0.1716***	-0.054***	-0.0085***	-0.1442***	-0.0568***	-0.0422***	-0.1277***	-0.1086***
	(0.00645)	(0.00645)	(0.00652)	(0.00652)	(0.00646)	(0.00646)	(0.00651)	(0.00651)
OWNGOV	-0.1209***	-0.2237***	-0.138***	-0.0584***	-0.2188***	-0.2324***	-0.0836***	-0.1088***
	(0.0249)	(0.0249)	(0.0249)	(0.0249)	(0.0249)	(0.0249)	(0.0249)	(0.0249)
GENDEQ		-0.8597*		-1.3421		-0.8981*		-1.9112*
		(0.582)		(0.582)		(0.583)		(0.582)
BILHUM		-1.1051		-1.4269		-2.9455		-2.6702
		(1.627)		(1.627)		(1.629)		(1.625)
FISPOL		0.5901***		3.6012***		2.8655***		3.1127***
		(0.517)		(0.517)		(0.518)		(0.517)
NUMBRW	3.7613***	11.1949***	16.3328***	16.3608***	11.1223***	19.3083***	5.2505***	3.5525***
	(0.142)	(0.142)	(0.142)	(0.142)	(0.142)	(0.142)	(0.142)	(0.142)
Observations	39,383	39,383	39,383	39,383	39,383	39,383	39,383	39,383
Pseudo R^2	0.15	0.15	0.15	0.15	0.15	0.15	0.15	0.15
F-stat	96.88	95.62	95.24	94	96.83	95.54	95.59	94.38
ρ	0.0137*	0.014*	0.0125*	0.0128*	0.0125*	0.0128*	0.0138*	0.0141*
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector effects	Yes	Yes	No	No	No	No	Yes	Yes
Size effects	No	No	Yes	Yes	No	No	Yes	Yes
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table reports coefficients and their standard error (in parentheses). The outcome variable is ACCESS and all variables are defined in Table 2. Data span over the period 2010-2018 for 76 countries. Estimation method is OLS with standard errors clustered by firm's country and Conditional Mixed Process for instrumental variables. The bottom part of the table reports which fixed effects are used in each model specification. Specifications (1), (3), (5) and (7) report the results for the model without the control variables and different combinations of fixed effects. Specifications (2), (4), (6) and (8) report the results for the model with control variables and different combinations of fixed effects. Arellano-Bond ρ indicates the magnitude of auto-correlation and its significance level. The *, ** and *** symbols denote the p-values at 10^{th}, 5^{th} and 1^{st} significance level, respectively.

Table A9

Predicting ACCESS with ordinal probit model with instrumental variables and political controls - CMP.

Variable	1	2	3	4	5	6	7	8
FSIND	-0.0706***	-0.0138**	-0.087***	-0.0489*	-0.0221***	-0.0767**	-0.0866***	-0.0045*
	(0.0169)	(0.0162)	(0.0169)	(0.0162)	(0.0170)	(0.0162)	(0.0169)	(0.0162)
LISTED	-0.0648***	-0.0561***	-0.0233***	-0.0208***	-0.0216***	-0.0855***	-0.0297***	-0.0033***
	(0.00821)	(0.00841)	(0.00825)	(0.00845)	(0.00822)	(0.00842)	(0.00824)	(0.00844)
AGE	-0.4045***	-0.2139***	-0.0863***	-0.4144***	-0.3044***	-0.088***	-0.1647***	-0.3881***
	(0.0301)	(0.0309)	(0.0309)	(0.0316)	(0.0300)	(0.0308)	(0.0309)	(0.0317)
SUBSID	-0.0379***	-0.0012***	-0.0255***	-0.0025***	-0.0367***	-0.0212***	-0.0273***	-0.0056***
	(0.00414)	(0.00425)	(0.00418)	(0.00431)	(0.00413)	(0.00425)	(0.00419)	(0.00432)
LOCATION	0.0293***	0.1225***	0.0858***	0.1161***	0.0375***	0.0823***	0.0984***	0.0061***
	(0.00744)	(0.00766)	(0.00745)	(0.00767)	(0.00745)	(0.00767)	(0.00745)	(0.00766)
EXPORT	-0.0951***	-0.1007***	-0.0336***	-0.0421***	-0.055***	-0.0131***	-0.0425***	-0.0372***
	(0.00709)	(0.00725)	(0.00718)	(0.00734)	(0.00703)	(0.00718)	(0.00723)	(0.00738)
OWNFOR	-0.1411***	-0.1239***	-0.0329***	-0.0237***	-0.0147***	-0.128***	-0.0392***	-0.0621***
	(0.00645)	(0.00657)	(0.00652)	(0.00665)	(0.00646)	(0.00658)	(0.00651)	(0.00664)
OWNGOV	-0.1625***	-0.0655***	-0.1042***	-0.1225***	-0.1702***	-0.1357***	-0.1383***	-0.0954***
	(0.0249)	(0.0253)	(0.0249)	(0.0253)	(0.0249)	(0.0253)	(0.0249)	(0.0253)
STABDEM		-0.2007*		-0.4422*		-0.1479*		-0.3294*
		(0.101)		(0.101)		(0.101)		(0.100)
LIMLEND		-0.2046		-0.2171		-0.2342		-0.0309
		(0.104)		(0.104)		(0.104)		(0.104)
VETOPWR		0.0504		0.0342		0.0637		0.0574
		(0.0254)		(0.0254)		(0.0255)		(0.0254)
NUMBRW	16.7708***	6.7573***	13.369***	15.4917***	5.8635***	14.2124***	9.3071***	16.6192***
	(0.142)	(0.117)	(0.142)	(0.117)	(0.142)	(0.117)	(0.142)	(0.117)
Observations	39,383	37,739	39,383	37,739	39,383	37,739	39,383	37,739
Pseudo R^2	0.15	0.14	0.15	0.14	0.15	0.14	0.15	0.15
F-stat	96.88	89.34	95.24	87.51	96.83	89.08	95.59	88.08
ρ	0.0137*	0.0028	0.0125*	0.0026	0.0125*	0.0027	0.0138*	0.0026
Year effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector effects	Yes	Yes	No	No	No	No	Yes	Yes
Size effects	No	No	Yes	Yes	No	No	Yes	Yes
Clustered Std. Err.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The table reports coefficients and their standard error (in parentheses). The outcome variable is ACCESS and all variables are defined in Table 2. Data span over the period 2010-2018 for 76 countries. Estimation method is OLS with standard errors clustered by firm's country and Conditional Mixed Process for instrumental variables. The bottom part of the table reports which fixed effects are used in each model specification. Specifications (1), (3), (5) and (7) report the results for the model without the control variables and different combinations of fixed effects. Specifications (2), (4), (6) and (8) report the results for the model with control variables and different combinations of fixed effects. Arellano-Bond ρ indicates the magnitude of auto-correlation and its significance level. The *, ** and *** symbols denote the p-values at 10^{th}, 5^{th} and 1^{st} significance level, respectively.