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Is financial inclusion good for bank stability? International evidence*

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ABSTRACT

Financial inclusion has become an important public policy priority following the recent global financial crisis. Yet, we know very little of how it impacts soundness of the providers of financial services. Using an international sample of 2,600 banks in 86 countries over the period 2004-12, we find that higher level of financial inclusion contributes to greater bank stability. The positive association is particularly pronounced with those banks that have higher customer deposit funding share and lower marginal costs of providing banking services; and also with those that operate in countries with stronger institutional quality. The results are robust to instrumental variables analysis, controlling for bank fixed effects, alternative measures of financial inclusion, among several other robustness tests. Our results highlight that the importance of ensuring inclusive financial system is not only a development goal but also an issue that should be prioritised by banks, as such a policy drive is good for their stability.

JEL Classification: G18; G21; G28

Keywords: Financial inclusion; Bank stability; Institutional quality; Government Policy and Regulation.

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“The stark reality is that most poor people in the world still lack access to sustainable financial services, whether it is savings, credit or insurance. The great challenge before us is to address the constraints that exclude people from full participation in the financial sector. Together, we can and must build inclusive financial sectors that help people improve their lives.”

Former United Nations Secretary-General Kofi Annan

1. Introduction

Financial inclusion, that is, all economic agents have access to formal financial services and can use such services effectively, has become an important public policy priority following the recent global financial crisis. For instance, in the aftermath of the financial crisis, the G20 leaders recognised the mutually reinforcing policy objectives of financial inclusion, stability and consumer protection. As financial exclusion has been identified by policy makers as a key barrier to development globally, expanding banking services to all has been prioritised by governments to make financial inclusion a reality (Demirgüç-Kunt et al., 2015).¹ Over the past decades, the central banks in emerging and developed countries have taken initiatives in conjunction with multilateral agencies including the IMF, G20, the Alliance for Financial Inclusion (AFI), and the Consultative Group to Assist the Poor (CGAP) to enhance the inclusive banking agenda. Recent studies show that greater access has both social and economic benefits.² In particular, greater access to finance: increases savings (e.g., Aportela, 1999; Allen et al., 2016); reduces income inequality and poverty (e.g., Burgess and Pande, 2005; Beck et al., 2007a; Bruhn and Love, 2014); increases employment (e.g., Prasad, 2010); improves mental well-being (e.g., Karlan and Zinman, 2010; Angelucci et al., 2013); favours education (e.g., Flug et al., 1998); helps making better

¹ Recent study suggests that almost 2.5 billion adults, just over half of the world’s adult population, do not use any form of formal financial services, where 19% and 72% of them are from developed and developing countries, respectively (Kendall et al., 2010).

² See, for example: Wurgler (2000); Beck et al. (2000); Klapper et al. (2006); Demirgüç-Kunt et al. (2008); Demirgüç-Kunt et al. (2015); Burgess and Pande (2005), and Banerjee et al. (2013) in India; Bruhn and Love (2009) and Bruhn and Love (2014) in Mexico; Karlan and Zinman (2010) in South Africa; Dupas and Robinson (2009) in Kenya.

decision (e.g., Mani et al., 2013); and enhances new firm creation (e.g., Guiso et al., 2004; Klapper et al., 2006; Banerjee et al., 2013).

While the literature provides evidence on the positive role of financial inclusion in promoting wellbeing of households and economic growth, little attention has been devoted to investigate whether such a development goal has ramifications on soundness of banks: one of the important reasons why banks ‘shy away’ from extending financial services to disadvantaged segments of the society. In recent years, with the advancement of innovative technology, formal financial institutions are increasingly searching for new opportunities and markets and seeing the benefits of micro-finance style of operations.³ By exploiting superior scale, skill and technological capacity (Peachy and Roe, 2006; Demirgüç-Kunt et al., 2008; Beck et al., 2011), banks can provide financial services to a large customer base potentially at a reduced cost, whilst helping reduce risk by having more non-wholesale funding as reliance on higher share of non-deposit funding contributed to the recent demise of investment banking in the US (e.g., Demirgüç-Kunt and Huizinga, 2010; Poghosyan and Čihak, 2011).⁴ Using a large sample of bank-level data on 2600 banks across 86 countries over the period 2004-12, we focus on the impact of this specific dimension of financial development (financial sector inclusiveness) on bank stability as an important regulatory issue at the micro level, and find that inclusive finance and bank stability are indeed complementary.

To our knowledge, there is no direct empirical evidence on the channels through which financial inclusion affects bank stability. Existing literature implicitly indicates several potential

³ See a detailed survey in Harper and Arora (2005) on why commercial banks are so much interested in micro-finance style of operations.

⁴ In this context, it is important to note the growth of venture capital investment in financing small firms in the recent decades. Cole et al. (2016) empirically show that conventional banking still remains an important source of small business finance in the US. Small entrepreneurial activity can therefore benefit from financial inclusion.

channels through which financial inclusion may influence soundness of banks or risk-taking (see Section 2). In particular, by reaching out to more customers, banks may garner ample cheap retail deposits whilst reducing reliance on volatile wholesale funding (Demirgüç-Kunt and Huizinga, 2010). By increasing proximity with customers, they can help reduce informational asymmetry, and by adopting more innovative, affordable and low-cost financial delivery models, they also reduce marginal costs of production. Finally, as greater financial inclusion is associated with stronger legal rights and politically stable environments (Allen et al., 2016), in an inclusive financial sector, stronger institutional quality may facilitate efficient financial intermediation, and hence greater stability (Hawkins, 2006).

This study fills this gap and makes several contributions to the literature. First, while most empirical papers assess the effect of financial inclusion on various socio-economic indicators (e.g., Butler and Cornaggia, 2011; Allen et al., 2013; Demirgüç-Kunt et al., 2013a; Demirgüç-Kunt et al., 2013b) and/or provide evidences that are either anecdotal⁵ or use simple analyses at macro-level (e.g., Hannig and Jansen, 2010; Han and Melecky, 2013; Morgan and Pontines, 2014), this paper is the first, to our knowledge, investigating the impact of financial inclusion on bank-level stability. We specifically focus on bank stability, as banks are responsible for providing the bulk of financial services to households/firms in any economy, and therefore, a clear understanding of this link is of immense managerial and economic importance for inclusive financial development and growth. We use financial outreach and usage dimensions to construct a composite index of financial inclusion at country level, and employ both the index and its associated dimensions to see the effect on bank-level stability in a cross-country analysis while controlling for bank-specific,

⁵ Tetangco, A., “Philippines CBG: the positive influence of financial inclusion”, the Banker, October 1st 2013, <http://www.thebanker.com/Comment/Viewpoint/Philippines-CBG-the-positive-influence-of-financial-inclusion?ct=true>

country-specific, and institutional characteristics that one typically encounters in financial development literature. The time series dimension of this index allows us to exploit within country variation in the inclusiveness of the financial sector, and explore the effect on bank stability in a systematic way, which is hard to get if we use demand-side data, such as the World Bank global financial inclusion index (henceforth Global Findex).

Second, this paper also contributes to the literature that explores the determinants of banking stability (e.g., Berger et al., 2009; Laeven and Levine, 2009; Houston et al., 2010; Beck et al., 2013; Anginer et al., 2014). Finally, this study complements the finance-growth literature in the sense that higher levels of financial inclusion are likely to influence overall supply of credit to small firms (Beck et al., 2008), and to firms in those industries that are in need of more external finance (Rajan and Zingales, 1998), enhancing overall economic growth.

Our results indicate that there is a strong link between financial inclusion and bank stability. In particular, the higher the degree of financial inclusion, the better the bank performance in terms of reducing risks. Taking individual dimensions, we also find a positive and significant relation between financial outreach/usage and bank stability after controlling for an array of control variables. The results remain unchanged in a battery of sensitivity tests, namely instrumental variable two-stage regression to address the endogeneity of financial inclusion, dynamic panel generalized method of moments (GMM) estimator to avoid omitted variable bias, alternative measures of bank stability and financial inclusion, and quantile regression to see impact of financial inclusion at different points in the conditional distribution of the dependent variable.

Besides, we explore the possible channels through which financial inclusion influences bank soundness. We find that the positive association between inclusive financial sector and bank stability is particularly pronounced with those banks that have higher customer deposit funding

share and lower marginal costs, and with those that operate in an institutional environment that is stronger.

The remaining part of the paper is organised as follows: Section 2 discusses the related literature and develops the hypotheses. Section 3 describes the data and descriptive statistics. Section 4 discusses the empirical results with sensitivity analyses on the effect of financial inclusion on bank stability. Section 5 explores the possible channels through which financial inclusion affects the soundness of banks. Section 6 concludes with some policy implications.

2. Literature review and hypothesis development

In this section, we discuss the related literature and formulate hypothesis that inclusive financial sector can influence the degree of bank stability.

2.1. Benefits ensued by greater financial inclusion

In an inclusive financial sector, financial institutions may have more opportunities to garner cheap retail deposits,⁶ and thus reduce marginal costs of producing banking services output. Inclusiveness may also help banks to reduce asymmetric information problem by having more engaged relationship with customers (Petersen and Rajan, 1995), and can be more effective in an environment that is more politically stable (Allen et al., 2016).

2.1.1. Financial inclusion and diversified retail deposit funding

Banks strategically engage in different intermediation activities and select asset mix and funding structures to achieve their business objectives (Roengpitya et al., 2014). Taking an international sample of 222 banks, Roengpitya et al. (2014) identify three distinct business models

⁶ Several governments, especially in the developing countries, are making financial inclusion an essential part of their national plans. For example, on 28 August 2014, government of India has launched the ‘*Pradhan Mantri Jan Dhan Yojana*’ (Prime Minister's People Money Scheme), with the explicit aim of removing financial exclusion. Though this scheme has an option for opening new bank accounts with zero balance, banks were able to garner deposits of ₹1500 crore (US\$240 million) within two weeks of the launch of the scheme, with around 30.2 million new accounts.

of banks by evaluating the asset mix and funding strategies: retail-funded, wholesale-funded, and capital market-oriented. The retail-funded banks are those that rely on large stable funding sources including deposits and have a large share of borrowings on the balance sheet; the wholesale-funded banks are those that have a high share of loan liabilities on the balance sheet (including interbank loans); and finally, capital market-oriented banks are those that have half of their assets in the form of tradable securities and are mostly funded in wholesale markets. Studies also show that the choice of business model, that is, asset mix and funding structures, influences risk and return of banks (Demirgüç-Kunt and Huizinga, 2010; Ayadi and De Groen, 2014; Roengpitya et al., 2014).

The recent literature shows that banks that adopt retail-funded business model can reduce distress relatively more. It is argued that retail deposits are sluggish, insensitive to risks and provide a stable cheaper source of long term funding (e.g., see Calomiris and Kahn, 1991; Song and Thakor, 2007), compared to wholesale funding which is extremely volatile and often costly (e.g., see Demirgüç-Kunt and Huizinga, 2010; Huang and Ratnovski, 2011; Poghosyan and Čihak, 2011).⁷ Huang and Ratnovski (2011) show that wholesale financiers are prone to very mild negative information or rumours on the quality of bank projects, and hence reluctant to rollover short-term funding. While comparing informed and arm's length debt, Rajan (1992) finds that the informed debt holders (i.e., wholesale funders) could discontinue funds for a project with negative present value unless they are compensated with higher interest rate. Recent empirical studies show that banks relying more on wholesale funding rather than retail deposits were less stable during the recent financial crisis (e.g., Demirgüç-Kunt and Huizinga, 2010; Poghosyan and Čihak, 2011).

⁷ The retail deposits are sluggish because the withdrawals are motivated by the individual depositors' liquidity need, and thus it is predictable based on the law of large numbers. In addition, they are insensitive to risk partly because of the deposit insurance provided by governments (e.g., Kim et al., 2003; Song and Thakor, 2007). For example, in all the recent bank failures (e.g., Continental Illinois, Northern Rock, IndyMac), it was short-term wholesale financiers who exited faster than retail depositors without having significant losses. In the case of Northern Rock, retail depositors run on bank took place after it had nearly exhausted its liquid assets to pay short-term wholesale financiers (Shin, 2009; Goldsmith-Pinkham and Yorulmazer, 2010).

In particular, Demirgüç-Kunt and Huizinga (2010), using a sample of listed banks in 101 countries over the period 1995-2007, find that higher level of non-deposit funding shares increases banking fragility. Hannig and Jansen (2010) argue that during the recent credit crunch when the wholesale funding dried up, it was the diversified retail deposit base that cushioned financial institutions from fragility.

In an inclusive financial sector, when banks extend deposit facilities to a large pool of customers, they are able to attract a large number of retail deposits, which are often cheaper than wholesale funding. Collins et al. (2009) find that poor households are intensive users of savings instruments, whereas Allen et al. (2016) argue that savings instruments provide a great deal of flexibility to households for both payments and savings, and therefore savings products are more likely to be demanded by unbanked or underbanked adults relative to loan products. Therefore, in an inclusive financial sector, banks with higher retail deposit funding should be able to reduce funding costs and risks, and thus become more stable.

2.1.2. Financial inclusion, marginal costs, and market power

Recent literature shows that the distance between financial institutions and customers undermines efficacy of financial services through intensification of asymmetric information problem (Degryse and Ongena, 2005; Hauswald and Marquez, 2006; Mian, 2006; Deng and Elyasiani, 2008). Hauswald and Marquez (2006) show that financial institutions get precise signal about customer's quality when distance with them is reduced. By reducing distance, financial institutions are able to build a good relationship, and hence internalise the benefits of supporting informationally opaque customers. With the competitive advantage of better information, banks can make judicious lending decisions, and set prices accordingly while mitigating moral hazards

and adverse selection problems (see Sharpe, 1990; Petersen and Rajan, 1994; Buch et al., 2012).⁸ Banks can exploit scale economies and reduce marginal costs to achieve greater market power. Since market power is the gap between price and marginal cost expressed as a percentage of price, higher market power would reflect whether banks are able to minimise marginal costs. In this line of argument, Petersen and Rajan (1995) and Di Patti and Dell'Ariccia (2004) show that banks disburse more credits to small firms when they have greater market power. Therefore, in an inclusive financial sector, banks with lower marginal costs should be able to reduce excessive risk-taking, and thus become more stable.

2.1.3. Financial inclusion, political stability, and stronger institutions

A large body of literature on the link between governance and economic growth argues that stronger institutions bring about better economic wellbeing (e.g., Barro, 1991; Keefer and Knack, 1997; Acemoglu et al., 2001). Using individual level data, in a recent study, Allen et al. (2016) show that financial inclusion is positively associated with stronger legal rights and more politically stable environments.⁹ Using firm-level data, Beck et al. (2005) show that firms operating in countries with more developed financial systems and with less country-level corruption face lower levels of financing constraints. They also argue that banks operating in countries with strong institutional quality may provide flexibility in terms of enforcing contracts with negligible delay.

⁸ Linking three unique datasets, in a more recent study, Beck et al. (2014) show that relationship lending alleviates SMEs' credit constraints during a cyclical downturn, and this effect is strongest for smaller and more opaque firms, and in regions where the downturn is more severe.

⁹ Bauchet et al. (2011) summarize evidence from randomized evaluations of microfinance. The general findings of these studies are that financial services have positive impact on numerous microeconomic indicators, including self-employment, business activities, household consumption, and well-being.

Using state-level data in India, Burgess and Pande (2005) find that expanding bank branches in the rural areas had a significant positive impact on poverty alleviation.¹⁰ Similarly, using randomized evaluation evidence from Mexico, Bruhn and Love (2014) suggest that facilitating better access to finance to the poorest of the poor has positive impact on poverty alleviation. They also find that access to financial services has positive impact on economic development through the channel of keeping individuals employed and fostering the survival and creation of informal business. As the nature of SMEs operations is labour intensive, Prasad (2010) observes that financial constraint to SMEs has adverse effects on employment growth. On a study of Compartamos borrowers in Mexico, Angelucci et al. (2013) find that access to credit does have a positive impact on mental well-being. Given the benefits of financial inclusion on various key socio-economic indicators, banks operating in an inclusive financial sector along with a stronger institutional quality could experience greater operating efficiency in financial intermediation, and hence their soundness.¹¹

2.2. Hypothesis

Since in an inclusive financial sector, banks will have higher branch/ATM penetration across regions and will have customers of all income groups, it may have two opposing effects on the stability of banks. With regard to the benefits ensued by greater financial inclusion, we assume that when banks operate in an inclusive financial sector they would be able to attract more risk-free cheaper retail deposits and reduce their marginal costs of production. On the other hand, there may be countervailing effects of inclusive financial sector associated with loss of banking stability due to informational asymmetries while dealing with poor households or small firms. It may also

¹⁰ Jayaratne and Strahan (1996), using branching deregulation implemented by different U.S. states over the period mid-1970s to mid-1990s, find that the relaxation of intra- and interstate branching had positive impact on economic growth.

¹¹ See, for instance, Khan (2011), Hannig and Jansen (2010), and Cull et al. (2012).

occur due to lack of managerial and technical expertise, and agency problems related to complex organisational and product structure required to serve a wide ranging customer base in an inclusive financial sector.¹² We therefore argue in this paper that the benefits will outweigh the costs associated with greater financial inclusion, which leads to the Hypothesis.

Hypothesis 1: Financial inclusion is positively associated with bank stability.

3. Data and descriptive statistics

To investigate the relationship between financial inclusion and bank stability, we draw data from a number of sources: (1) the bank level dataset is compiled from BankScope (provided by Bureau van Dijk and Fitch Ratings) that contains detailed balance sheet and income statement information for both public and private banks in any given country; (2) the macro data is compiled from the World Development Indicators (WDI), World Bank; (3) the instruments for IV regressions are collected from the recent empirical studies on financial development, innovative technology, law, institutions, and finance database; (4) the variables used to construct financial inclusion index are compiled from the FAS database; (5) six indicators of institutional quality are taken from Kaufmann et al. (2010) Governance Index; and (6) firm-level indicators are taken from the World Bank Enterprise Survey (WBES) to check the correlation between financial inclusion index and firms' access to finance/firms' financing obstacles. Our dataset comprises of 2,635 commercial banks, cooperative banks and Islamic banks in 86 countries over the time period 2004-12, which represent, respectively 57.4%, 41.3%, and 1.3% of the sample. Since the objective of this study is to investigate the impact of financial inclusion on bank stability, we apply a number of selection criteria to obtain our sample. First, we exclude countries for which we have no information on different dimensions of financial inclusion index. Second, we discard

¹² See Acharya et al. (2006).

unconsolidated reports of banks whenever consolidated ones of the same group are available to offset double counting. Third, we drop banks that had information for fewer than three consecutive years, as the bank stability measures computed in this study are based on rolling windows over the past three years. We deflate all monetary values to 2005 (2005 = 100) prices using the GDP deflator of US obtained from WDI. The deflated series are reported in millions of US dollars (\$). The variable definitions and the data sources are described in Appendix Table A1.

3.1. Measuring bank risk

We follow Laeven and Levine (2009) to measure *Z-score* which is widely used in the literature and considered to be an unbiased indicator of bank riskiness (see, for instance, Houston et al., 2010; Turk Ariss, 2010; Fang et al., 2014). Using assets returns, its volatility and leverage, we calculate *Z-score* as follows:

$$Z - score_{it} = \frac{ROA_{it} + EQA_{it}}{\sigma(ROA)_{it}} \quad (1)$$

Where *ROA* and *EQA* are the average return-on-assets and the equity-to-assets ratio, respectively and $\sigma(ROA)$ is the standard deviation of return-on-assets. We can interpret this score as the number of standard deviation below the mean by which returns would have to drop before all equity in the bank gets depleted (Boyd and Runkle, 1993; Beck et al., 2013). If banks' profitability is normally distributed, the inverse proxy of *Z-score* can be considered as bank's probability of insolvency. In other words, higher returns and capitalisation would increase bank stability, while volatile returns would decrease the stability of banks. To reduce skewness, we use natural logarithm of *Z-score*. To check the sensitivity of our results, we also use volatility of *ROA*. Following Beck et al. (2013),

we transform return volatility to make it directly proportional to banking stability as – $\log(sd(ROA))$.

3.2. Measuring and verifying the strength of the financial inclusion index

3.2.1. Financial inclusion index

In an inclusive financial sector, any member of the economy, irrespective of background, should enjoy the ease of access and effectively use basic financial services. Using FAS database, we measure the index of financial inclusion for 86 countries for the period 2004-12. In general, there is a consensus, at least from the regulator’s perspective, that financial inclusion can be measured using two dimensions, namely the financial outreach and usage.¹³ Given the data availability constraint, the variable we use for each dimension often requires proxies.¹⁴ The financial outreach dimension is used to account for the pervasiveness of outreach of the financial sector in terms of banks’ physical outlets, as the distance to the point of financial services deems to be an important impediment to financial inclusion (see Allen et al., 2014). We use two classes of penetration of banking services i.e., demographic and geographic penetration of bank branch and ATM (Beck et al., 2007b, henceforth BDM). For the demographic penetration, we use the number of bank branches and number of ATMs per 100,000 people, and for the geographic penetration we use the number of bank branches and the number of ATMs per 1,000 square

¹³ See recent paper by Amidžic et al. (2014) on the measure of financial inclusion. In addition, AFI also uses these two dimensions to measure financial inclusion index – <https://blogs.afi-global.org/2016/04/01/measuring-financial-inclusion-in-one-number/>

¹⁴ We also confirm our main findings using alternative measure of financial inclusion that is collected from Global Findex Database: an individual-level database comprised of survey data collected over the 2011 calendar year covering more than 150,000 adults in 148 economies. Since the costs and collection of survey data are demanding, and the availability of such data for longer period is unreasonable, we therefore focus on supply-side data—FAS database—that were collected by Beck et al. (2007b) at the World Bank for 2003-04, and later on extended by the Consultative Group to Assist the Poor (CGAP) and the IMF.

kilometres.¹⁵ For the usage dimension, we use the number of bank accounts per 1,000 populations to integrate the depth of the financial access.¹⁶ BDM (2007) investigate financial sector outreach and its determinants by using cross-country data to identify common trends across the abovementioned indicators. However, it is easier for the general public to comprehend and compare a composite indicator across countries that combines many correlated indicators (OECD, 2008). In this paper, we overcome the shortcomings, and build upon BDM (2007) to introduce a multidimensional weighted index of all variables as a measure of financial inclusion. In our analysis, we use both the composite index and its associated dimensions to explore the relationship between financial inclusion and bank stability.¹⁷

The components used in the construction of financial inclusion are highly correlated with each other. To sufficiently capture the common variation among these correlated components of financial inclusion as a single measure, we develop an index that represents the overall inclusiveness in the financial sector using principal components analysis (henceforth PCA, see online Appendix for details on PCA).¹⁸ The first principal component from PCA has the interpretation of being the single linear combination of the financial inclusion indicators that explains most of the variations we see in these indicators. This index will sufficiently deal with the problem of multicollinearity and over-parameterisation as a single measure of financial

¹⁵ As the distribution of bank branches and ATMs is not always uniform and often concentrated in urban areas of the country and provides access to some individuals using area- and population-based ratios may undermine the true penetration of banking services (BDM, 2007).

¹⁶ The actual representation of penetration dimension would have been with data on the number of people having banking accounts rather than the number of accounts per capita. The caveat is that in the latter case the number of “banked” population might be overestimated due to dormant accounts and/or double count of accounts of the same person.

¹⁷ If data on transaction costs and ease of transaction are available, one can also add such information to improve the quality of financial inclusion index. However, comparable macro data for a large number of countries is hard to get. For example, the annual fees charged to customers for ATM cards and/or accounts i.e. “transaction costs” and the minimum amount and/or document requires opening savings or checking accounts i.e. “ease of transaction”.

¹⁸ Constructing composite index using principal components analysis is well-documented in several papers (see e.g., Ellul and Yerramilli, 2013; Bali et al., 2014).

inclusion. Before using PCA, indicators of each dimension are normalised to have values between zero and one so that the scale in which they are measured is immaterial.¹⁹ Since the financial outreach dimension is comprised of four variables initially we capture common variation among four outreach variables using the PCA and construct this financial outreach dimension. Subsequently, we use the PCA to extract the common principal component (PC) of the two dimensions that capture different aspects of the inclusive financial sector: the financial outreach and usage of the financial services.

The Appendix shows the results of the PCA. Regarding financial outreach dimension, the eigenvalues of the four PCs are 2.76, 0.71, 0.48, and 0.05, respectively, suggesting that the first principal component explains about 69% of the corresponding sample variance (see Panel A).²⁰ Except the first PC, no other PCs have eigenvalue greater than one; so we just take first component and extract the financial outreach dimension using weights (i.e., 0.53, 0.52, 0.46, and 0.48) assigned to first principal component. Regarding financial inclusion, the eigenvalues of the two PCs are 1.61 and 0.39, respectively, indicating that the first principal component explains about 81% of the corresponding sample variance (see Panel B). Similarly, only the first principal component has eigenvalue that is more than one so we can assume that the first component sufficiently explains the common variation among the two dimensions.²¹ As shown in equation (2), we construct a multidimensional index for financial inclusion as follows:²²

$$\text{Financial inclusion index} = \sum_{i=1}^n \omega_{ij} X_i \quad (2)$$

¹⁹ Prior to normalising, we winsorise each indicator at the 95th percentile levels to reduce the influence of outliers at the upper tail.

²⁰ See Vyas and Kumaranayake (2006).

²¹ Since we drop few PCs, it also eliminates a part of the noise components from our data, which ultimately may yield more reliable estimates.

²² Sarma and Pais (2011) measure a weighted index of financial inclusion using manual weights of the dimensions for a sample of 49 countries for the calendar year 2004.

where ω_{ij} are the component's loadings or weights; and X_i are the original variables.²³ We get same weights (i.e., 0.71) for both dimensions. In order to facilitate analysis and interpretation, we further normalise this index assigned to each country along a 0-1 scale, where zero indicates financial exclusion, and unity indicates financial inclusion. Figure 1 displays the level of financial inclusion by two sub-samples: developed and developing countries.

3.2.2. Verifying the strength of the financial inclusion index

Although our paper makes the first systematic attempt to construct a composite index of financial inclusion for a longer panel and then analyse its impact on banking stability, it is not without its limitations. In the construction of the index, affordability dimension, marketing exclusion and self-exclusion have not been addressed. However, despite these shortcomings, we see this construction of composite index and the associated analysis as a useful and important first step towards developing a more robust indicator of financial inclusion. In this section, we borrow ideas from BDM (2007), and also test the validity of financial inclusion index. First, we use the Global Findex survey database, and check the correlation between household-based indicators of financial inclusion and our financial inclusion index. In some recent studies (e.g., Demirgüç-Kunt et al., 2013b; Allen et al., 2014), the most common variables that are used as the indicator of financial inclusion are *adults with an account at a formal financial institution to total adults (%)* (i.e., *Share of household account*) and *adults saving at a financial institution in the past year to total adults (%)* (i.e., *Share of household saving*). We find that our index is positively and significantly correlated at 1% significance level with these Global Findex indicators. We also

²³ In order to check the stability and robustness of our financial inclusion index, we also use principal component analysis on a year-by-year basis in which loadings are determined annually instead of over the entire sample period. The correlation between these two indices (one where the loadings are derived over the entire sample period and the other derived annually) is very high (i.e. 0.98), indicating the robustness of our index irrespective of how loadings are determined.

assess the power of our index to see whether our index is useful in predicting these observable micro-level data.

$$\begin{aligned} \text{Share of household account} &= 0.18 (7.16) + 0.96 (13.61) * \text{Financial inclusion} \\ \text{Share of household saving} &= 0.06 (3.75) + 0.40 (8.83) * \text{Financial inclusion} \end{aligned} \quad (3)$$

We collapse our data at the country level and regress the *share of household account* (the *share of household saving*) on *financial inclusion index* using robust standard errors. The regression yields R^2 of 64% (39%) with 80 observations. T-statistics are reported in the parenthesis of equation (3). Financial inclusion index enters significantly at the 1% level, indicating that greater financial inclusion is positively associated with more households having accounts (savings) at financial institutions. The correlation between predicted share of household account (saving) and the actual share of household account (saving) at financial institution is 80% (63%).

Second, so far we have seen that our index is powerful enough in predicting household-based measure of financial access. Now, we use firm-level data taken from the WBES in order to gauge the relationship between financial inclusion index and firms' access to finance, while controlling for firm-specific characteristics. WBES contains an expansive array of economic data on 130,000 firms in 135 countries over the period 2002-12.²⁴ We run the following estimations at the firm-level:

$$F_{c,k,t} = \beta_0 + \beta_1 \text{Financial Inclusion}_{c,t} + \beta_2 X_{c,k,t} + \varepsilon_{c,k,t} \quad (4)$$

where F is the rating of financing obstacle reported by firm k in country c at time t and X is a set of control variables, which include firm size (employee), a dummy variable for manufacturing firms, a dummy for the firms that are involved in exporting, dummy variables for government and foreign-owned firms, age of the firms in years, GDP growth rate and regional

²⁴ See Love and Martínez Pería (2014) for details on this database. In addition, out of 86, we could only match 63 countries' financial inclusion indices with the WBES database for the period 2004-12.

dummies (see Table A2). We run an ordered probit model to estimate equation (4), as financing obstacle is a polychotomous dependent variable with natural order where higher values indicate greater financing constraints. It is expected that the greater the financial inclusion, the less financing constraints there would be for firms to get access to credit. In addition, following Love and Martínez Pería (2014), we also use an alternative measure of access to finance. In this case, we construct an indicator variable that takes one if firm k in country c at time t has a bank loan, line of credit, or overdraft.²⁵ A positive relationship between financial inclusion index and access to finance is expected as greater inclusive financial system would alleviate financing constraints disbursing more credits to firms.

The findings confirm the expectation that firms tend to report lower (higher) financial constraints (access) in those countries where financial inclusion is greater. In particular, we find that financing obstacles are negatively related to inclusive financial system, whereas access to finance is positively associated at 1% significance level. Therefore, it once again assures the robustness of our index.

3.3 Measuring bank competition

Lerner index is used to measure the degree of bank competition. It is considered to be the most accurate measure of bank-specific competition than the so-called Panzar-Rosse H-statistics or the asset shares of the three largest banks (Carbó-Valverde et al., 2009). The essence of pricing power is reflected through Lerner index because it measures the gap between price and marginal cost expressed as a percentage of price. In other words, it captures the degree to which a bank can

²⁵ Since there is some disparity between the Old (2002-2005) and the New core modules of the surveys, we follow BDM (2007) to construct Financing Obstacle, and Love and Martínez-Peria (2014) to construct Access to Finance.

increase the price beyond its marginal cost. According to Berger et al. (2009), the Lerner index is the only measure of market power calculated at bank level as:

$$Lerner_{it} = \frac{P_{it} - MC_{it}}{P_{it}} \quad (5)$$

where P_{it} is the price of total assets proxied by the ratio of total revenue (interest and non-interest income) to total assets for bank i at time t . MC_{it} is the marginal cost of producing an additional unit of output. The Lerner index is interpreted as inverse of competition; the higher the index, the greater is the pricing power implying less competitive market conditions. Following conventional bank efficiency studies, in this paper we use stochastic frontier analysis (SFA) to estimate marginal cost and hence Lerner Index (as explained in online Appendix).

3.4 Bank-specific and macro control variables

We control for an array of standard bank-specific characteristics and macroeconomic variables. To account for liquidity risk of individual banks, we use ratio of total loans over total assets (*Loan ratio*) (Fang et al., 2014). We use logarithm of total assets (*Bank size*) to account for potential size effect on banking stability, as the too-big-to-fail attitude can destabilize the efficient financial intermediation of the entire banking system. The ratio of loan loss provision to total loans (*Loan loss provision*) is used to account for individual bank's loan portfolio risk. The ambiguous effect of off-balance sheet activities of individual banks on stability necessitates considering the ratio of non-interest income to total operating income (*Income diversification*). The ratio of total earning assets to total assets (*Management quality*) is used as better management quality that can mitigate excessive risk-taking. Since well-capitalised banks are assumed to take less risk, we use the equity ratio (*Capitalisation*) to control for capital risk. In this paper, we also use several macroeconomic variables to control for economic development and business cycle of the economy.

Since, in the last decade, World economies observed substantial volatility, we use GDP to control for economic growth (*GDP growth rate*). As economic development generally coincides with an increase in financial inclusion, it is crucial to control for per capita GDP (*GDP per capita*) when assessing the association between financial inclusion and bank stability. Honohan (2008) argues that it would be interesting to see whether the impact of financial inclusion remains significant after controlling for per capita GDP. We also include the credit-to-deposit (CD) ratio – an important indicator of financial intermediation – as a control variable, as it reflects whether the supply of funds from depositors is being channeled to borrowers by the banks.

3.5. Descriptive statistics

Table 1 presents the descriptive statistics of the variables used in this study. The mean value of $\ln(Z\text{-score})$ is 3.63 with a standard deviation of 1.05, implying that on average *ROA* would have to fall by 3.63 times their standard deviation to wipe out bank equity. The fairly high standard deviation suggests that there is considerable cross-country variation in the level of bank stability. The mean of negative logarithm of return volatility, $-\ln(sd(ROA))$, is 5.90. For the variable of interest, the mean of the *financial inclusion index* is 0.33, where *financial outreach* and *usage* dimensions are 0.30 and 0.35, respectively. The standard deviation of 0.25 indicates considerable heterogeneity in the inclusiveness of financial systems across our broad sample of 86 countries.

Table 2 reports the countries in our sample, ranked according to our index of financial inclusion. In terms of financial inclusion, South Korea (0.99), Belgium (0.98) and Japan (0.98) have the highest inclusive banking system, whereas Afghanistan (0.01), Yemen (0.02) and Malawi (0.03) have the lowest. On average, European countries have the highest financial inclusion (0.52), whereas African countries have the lowest value of 0.11. The average financial inclusion and banking stability of Asian and American countries are almost identical, while there is disparity of

individual constituents across countries. For example: Ukraine ranks 13 in *financial inclusion index* but it ranks 40 in *financial outreach* and 5 in *usage* dimension. Therefore, using individual dimension as a proxy for financial inclusion would provide incomprehensive picture of a country's overall inclusiveness.²⁶

4. Empirical results

4.1 Is financial inclusion good for bank stability?

First, we examine the impact of financial inclusion on bank stability using bank-level data. Our main dependent variable is the $\ln(Z\text{-score})$, and the key independent variables are the *financial inclusion index*, and its two constituents – *financial outreach* and *usage* dimensions. Specifically, we conduct the baseline regression analysis as follows:

$$\text{Bank stability}_{i,j} = f(\text{Financial inclusion}_j, \text{Bank characteristics}_{i,j}, \text{Country characteristics}_j) \quad (6)$$

where i and j subscripts indicate bank and country, respectively. Bank stability is logarithm of Z-score (henceforth as *Z-score*), measured at bank level. α is constant, and β_k is a vector of parameters. The financial inclusion is based on the weighted average of *financial outreach* and *usage* dimensions, measuring the level of inclusiveness of the financial sector of a country as defined in Section 3. It is calculated as the average measure over the sample period (see Allen et al., 2014). Individual constituents of the financial inclusion index are also used to see the impact of each dimensions on bank stability. Bank controls include *Loan ratio*, *Bank size*, *Loan*

²⁶ Since financial inclusion is generally related to per capita income, these two variables tend to be correlated. The unreported correlation matrix of the independent variables used in this paper shows a positive correlation between per capita GDP and financial inclusion which further proves the robustness of our index (see Honohan, 2008). We computed the variance inflation factors (VIF) for each of our model estimates. VIF is equal to $1/(1-r^2)$, where r^2 is from the regression of an independent variable on rest of the independent variables. The average VIF never exceeds 3, indicating that multicollinearity is not a cause of concern for our results (Anginer et al., 2014). Furthermore, following previous studies on the determinants of financial development (e.g., La Porta et al., 1997; Beck et al., 2003), as a robustness test we exclude per capita GDP in all estimations and the results are broadly consistent with the main findings of this study. The results are available from the authors upon request.

*loss provision, Income diversification, Management quality, Capitalisation, and Market power.*²⁷

Section 3 and Table A1 include detailed definitions of these variables. The macro controls include *GDP growth rate* and natural logarithm of *per capita GDP*. In our baseline regressions, all variables are averaged over the period 2004-12.²⁸ The main advantage of averaging data over the sample period is that it allows us to smooth variables that vary over time (Demirgüç-Kunt et al., 2004; Barth et al., 2013b). Furthermore, following Beck et al. (2007b) and Houston et al. (2010), we use heteroskedasticity-robust standard errors clustered at the country level to calculate *t*-statistics. Clustering standard errors at the country-level allows observations to be independent across countries, which restrict error terms to be correlated for banks within the same countries due to omitted country characteristics. Since expanding access of the low yield clienteles to basic financial services may have negative impact on the bottom line of banks, it is natural to check robustness of our results using income volatility of individual banks as an alternative measure of bank stability. Therefore, (negative) logarithm of standard deviation of return-on-assets (ROA) is used as an alternative dependent variable.

The results are presented in Table 3. For each of the specification, it is clear from the results that more inclusive financial system is associated with greater banking stability, as indicated by its positive and significant (at 1% level) coefficients (once again, a greater estimated *Z*-score indicates more stability, i.e., less risk taking). Given the mean *Z*-score of 3.63, the effect is not only statistically significant but also economically important. Since we use the natural logarithm of *Z*-score, the coefficients can be interpreted as semi-elasticity. In column 1, a one standard deviation

²⁷ We calculate average measure of all variables over the sample period. We use lagged values of Lerner indices to mitigate any endogeneity issues that may be associated with market power and stability (see e.g., Turk Ariss, 2010; Love and Martínez Pería, 2014). We also create a country-level market power variable, and re-run all regressions; the results remain unchanged and are available upon request.

²⁸ Initially, taking a balanced panel of our sample, we applied the cross-sectional dependence (CD) test proposed by Pesaran (2004). The CD test rejects the null hypothesis of cross-sectional independence with an average absolute correlation of 0.367, suggesting the presence of cross-sectional dependence.

increase in the index of financial inclusion, which equals 0.25, is associated with an increase in the *Z-score* of 14% (0.56×0.25). The effect is economically important as it suggests that financial inclusion enhances soundness of individual banks. In particular, inclusive financial sector may enable banks to garner adequate cheap retail deposits from a large clientele base. Furthermore, it may also alleviate financing constraints of SMEs and also mitigate the post-lending moral hazard and asset substitutions problems. Therefore, with inclusive financial sector, banks enjoy greater financial stability. To illustrate the effect, we compare the improvement in the banking stability of two countries with different levels of financial inclusion (i.e., at the 25th and 75th of the index). Take the example of column 1. The estimation suggests that banks in Colombia (25th Percentiles; ranks 42 in our sample) would be 27% more stable if it has the financial inclusion of Switzerland (75th Percentiles; ranks 7 in our sample). Considering two individual dimensions of our index separately, we also find that greater bank branch outreach and a financial system with greater access to bank accounts per capita seem to increase bank stability. This result also corroborates with the additional risk measures used in this study. The negative of return volatility – $\log(sd(ROA))$, in columns 4-6, is also positively related to *financial inclusion index and its associated* dimensions, suggesting that higher level of financial inclusion reduces return volatility of banks.

These results are consistent with the view that a system with inclusive financial services tends to reinforce banking stability (e.g., Han and Melecky, 2013; Khan, 2011; Morgan and Pontines, 2014) and that higher degree of financial inclusion mitigates excessive risk-taking of an individual bank. This result is also supported by Agarwal and Hauswald (2007) and DeYoung et al. (2008), who use US data and find that loan default probability increases with the distance between lender and borrowers. Recent empirical evidence also finds positive impact of geographic

diversification on reducing distance between banks and borrowers (e.g., Berger and DeYoung, 2001; Bos and Kolari, 2005; Deng and Elyasiani, 2008; Rossi et al., 2009).

Our results on control variables are also consistent with existing literature. As might be expected, banks with better management, higher equity capital and pricing power are more stable as opposed to banks with higher loan loss provision.²⁹ Both country-level macro controls are statistically insignificant. However, the sign of the coefficient suggests that banks engage in more risk-taking if the economic growth is high. However, they indulge in less risk-taking when they operate in countries where the level of economic development is high.

The robustness of the main results is checked using numerous sensitivity tests. First, we use quantile regression estimates to examine the effects on conditional distribution of *Z-score*. Second, we use an array of instruments to address the potential endogeneity problem while using two stage cross-sectional IV estimations. Finally, we use dynamic GMM panel model to exploit bank-specific unobserved time invariant heterogeneity and also control for time fixed effects.

4.2. Robustness tests: Quantile regression estimates

So far, we have used OLS estimator, and found a robust link between financial inclusion and bank soundness.³⁰ It should be noted that the OLS estimator is based only on the central tendency of probability distributions, which restricts anyone to examine the link between the regressors and the outcome variable in non-central regions. Consequently, our results from OLS regressions might have provided only a partial view of the relation between financial inclusion and

²⁹ We use squared term of bank size and find that there is an inverse U-shaped relationship between bank size and bank risk taking.

³⁰ One concern is that our results may be swayed by the dominance of large banks in some countries or by the large number of banks in a few important countries. To address these issues, we re-estimate the results using weighted OLS regressions (the results are weighted first, by bank assets and second, by total number of banks in each country). The unreported results remain unchanged with somewhat higher values of the estimated coefficients. Furthermore, Japan and Italy constitute a lion share of our sample. Re-estimating regressions by dropping these two countries also does not alter our main findings (unreported). The results are available upon request.

bank soundness. Furthermore, as we include a large number of banks from different countries, heterogeneity may be a cause of concern in our sample. Therefore, we examine whether our measure of financial inclusion index has a homogeneous impact on bank soundness while illustrating the relationship at different points in the conditional distribution of the dependent variable. To accomplish this, we use quantile regression (hereafter, QR) approach, as introduced by Koenker and Bassett (1978). While OLS estimators are sensitive to non-normal errors, QR results are robust to modest deviation from normality and outliers. QR also provides a comprehensive characterisation of the sample, allowing us to examine the impact of *financial inclusion* on the entire distribution of *Z-score*.

Table 4 presents the results of QR estimates. As the *Z-score* changes across quantiles, the estimate of the financial inclusion index varies widely in sign, magnitude, and significance. For instance, at 5% significance level, while the estimates of the *financial inclusion* coefficients are significantly positive for *Z-score* at quantiles from 0.40 and above, they become insignificant for those between 0.2 and 0.3, and then turn negative (insignificant) for those 0.1 and below, implying that inclusive financial sector enhances soundness of more stable banks. It should be noted that the result of the least absolute deviation (i.e., 50th quantile) estimate is also consistent with the OLS regressions. *F* tests of the equality-of-slope parameters across various quantiles are reported at the bottom of Table 4. These parameters show the differences between slope estimates at the θ against $(1-\theta)$ quantiles. The comparison of parameters shows that differences across banks in various *Z-score* quantiles are significant at 1% level for all quantiles.

4.3. Robustness tests: instrumental variable analysis

Endogeneity is a common identification problem in any cross-country study. Possible reverse causality might arise if banks engage in risky activities in the current set-up and venture

into rural areas to offset high risk and/or if they self-select into inclusive financial activities because these reward them with more retail deposits and cost reduction. In our analysis, the potential for reverse causality might be less of a concern as we investigate the impact of a country-level indicator – financial inclusion on bank-level stability. However, we conduct a sensitivity test using an instrumental variable (IV) technique.

To address any potential endogeneity problem, we search extensively for instrumental variables and base the selection of IVs on the recent empirical studies on financial inclusion and financial development (Beck et al., 2007b; Aker and Mbiti, 2010; Mbiti and Weil, 2011; Demirgüç-Kunt and Klapper, 2012; Allen et al., 2014).³¹ Beck et al. (2007b) argue that better communication infrastructure reduce the cost of banking service delivery and makes the broadening of bank branches more cost effective. Allen et al. (2014) show how technological advances, such as mobile phone use, can help overcome infrastructural deficiencies to broaden financial inclusion in Sub-Saharan Africa. Such technological innovation has enabled many countries, especially with limited physical and financial infrastructure, to expedite inclusive financial development agenda via Mobile money transfer (“m-transfer”) systems. M-transfer systems help users, especially underserved people, to execute financial transactions via mobile handsets. Using mobile handsets users can get access to basic financial services allowing them to deposit and withdraw cash from an account. M-transfer systems also allow users to transfer money to each other via text messages, menu commands, and personal identification numbers (Aker and

³¹ We also base the selection of our instrumental variables on the theoretical and empirical studies in the law, institutions, and finance literature (Easterly and Levine, 1997; La Porta et al., 1998; Beck et al., 2003; Acemoglu and Johnson, 2005). In this effort, we use English and German legal origins as instrumental variables for financial inclusion using data from La Porta et al. (1999): it is argued that the historical legal differences around the world determine the present day’s financial systems internationally. Following the endowment theory, we use latitude and ethnic fractionalization as one of the instruments for financial inclusion as well (see Beck et al., 2003). Our results remain significant and unchanged, which are available from the authors.

Mbiti, 2010). As a result, m-transfer systems empower users to make financial transactions at a relatively low cost across much wider geographic areas than is possible using localized informal payment solutions (Beck and Cull, 2013). Aker et al. (2011) report that, since 2005, almost 80 developing countries in Asia, Africa, and Latin America have established m-transfer systems. In this case, we assume that the share of mobile cellular subscription in other neighboring countries in the same geographical region is likely to impact inclusive financial development of a country. We, therefore, collect data on *Mobile cellular subscriptions* (per 100 people) of 86 countries for our sample period. Specifically, the instrumental variable *Mobile phone share* in geographical region j for country i reflecting neighborhood effect is measured as follows:³²

$$Mobile\ phone\ share_i = 1 - \frac{(Mobile\ cellular\ subscriptions)_i}{\sum_{i=1}^N (Mobile\ cellular\ subscriptions)_{i,j}}; \text{ for each } j$$

The measure of *Mobile phone share* is based on how large mobile cellular subscriptions are in the neighboring countries. This captures the intuition that countries that have large mobile cellular subscriptions in the same geographical region are more likely to increase their mobile cellular transactions, and hence facilitate a large number of underbanked people to be included in the formal financial sector via m-transfer systems. We have followed the regional classification of World Bank to determine whether countries are in the same region. These regions are East Asia and the Pacific, Europe and Central Asia, Latin America and the Caribbean, Middle East and North Africa, South Asia, and Sub-Saharan Africa. We treat High income countries as a separate region.

The next instrument that we have used in the study is collected from the Global Findex database 2011. Demirgüç-Kunt and Klapper (2012) found that family and friends are the most

³² Since, m-transfer systems facilitate remittance transfer across countries, the share of *Mobile cellular subscriptions* in other countries in the same region can help extract the exogenous components of the variables of interest in this study. Using data of 109 developing countries for the period 1975-2007, Aggarwal et al. (2011) find evidence of a positive, significant, and robust association between remittances and financial development.

commonly reported source of new loans in developing countries. According to the recent wave of the Global Findex Survey, Demirgüç-Kunt et al. (2015) reported that, overall in developing countries, 29 percent of adults borrowed from family or friends, while only 9 percent borrowed from a financial institution. Therefore, we have used the percentage of adults borrowing from family or friends as an instrument in the IV regression. The intuition to use this variable as an instrument is because of the fact that the higher percentage of adults borrowing from friends or family would influence the level of financial inclusion in a country (see Demirgüç-Kunt and Klapper, 2012; Demirgüç-Kunt et al., 2015), but it should not have any direct influence on the bank-level stability. Countries with higher level of informal borrowing will have lower level of financial inclusion in the formal banking sector. Also we follow Houston et al. (2010) and use religious composition as the final instrument for our IV regression.

We test the validity of our instrumental variables using the under-identification LM test by Kleibergen and Paap (2006) and the over-identification test by Hansen (1982). The results on these tests show that the instruments used are valid as the p-value of the former (latter) requires a value lower (higher) than 0.05 to reject the null hypothesis at the 5% level. The results of the first-stage regressions of financial inclusion on instruments are presented in Table A3. The results show that while greater *mobile phone share* increases the level of financial inclusion, the percentage of adults *borrowed from family or friends* reduces it, whereas *religion* enhances the usage of financial services.

The second-stage results are reported in Table 5. The empirical results of the instrumental variable regressions are rather robust. The coefficient of financial inclusion index, financial outreach and usage remain positive and significant in all specifications, including with the negative return volatility. The results confirm our finding that more inclusive financial sector or greater

banking sector outreach or greater usage of financial services enhances bank stability. The results on other control variables are also qualitatively similar. The magnitudes of the coefficients of IV estimates are relatively larger than the ordinary least squares (OLS) coefficients, indicating the existence of potential measurement error, which tend to attenuate coefficients downward. Though after instrumentation, the magnitude and significance of the coefficients are relatively higher, the results of our regressions should be interpreted as an association not as causal relationships.

4.4. Alternative financial inclusion index

The financial inclusion index is constructed as a combination of geographic and demographic availability of branches and ATMs, as well as the usage of bank accounts in a country. Although we construct financial inclusion index incorporating as many dimension as possible given the data availability constraints, it is possible that our results are inferred incorrectly because of poorly constructed index. Therefore, we use alternative financial inclusion index that is taken from the Global Findex Database, which collects information on how people in 148 countries manage their financial activities. The variables we use as the financial inclusion proxy are the percentage of adults that had an account or savings at a financial institution in the year prior to the survey (see e.g., Demirgüç-Kunt et al., 2013b; Allen et al., 2014). This database is new and just covers the year 2011.³³ As inclusive financial agenda may influence many policies, and many other factors may also jointly affect polices and financial inclusion, following Allen et al. (2016), we run two-stage cross-sectional instrumental variable regressions.³⁴ The regression results are presented in Table 6, showing that the relationship between Global Findex and bank stability is

³³ In 2015, Global Findex database has released second wave survey results on financial inclusion. We did not incorporate financial indicators from this survey as bank-level data are yet to be updated by BankScope.

³⁴ We use religious composition and ethnic fractionalization (see Houston et al., 2010) as instruments. The results of first-stage regressions are available upon request from the authors.

positive and statistically significant, implying that more people having accounts or savings with formal financial institutions enhance bank soundness, corroborating our earlier findings.

4.6. Split samples based on financial inclusion and developing countries

We conduct a battery of sensitivity checks using different sample selection criteria such as splitting samples based on financial inclusion index and also excluding developed countries. First, we split our sample into three terciles according to the financial inclusion index and re-run three separate regressions.³⁵ The results are reported in Table 7 (column 1-3). The low, medium and high terciles of financial inclusion are instrumented using the analogous instruments. The result indicates that the effect of financial inclusion at all terciles is positive and significant with bank stability. However, we can see that the magnitude of the coefficients of the highest terciles increases substantially, supporting our argument that greater inclusive financial sector is good for bank stability. Finally, we also drop all banks of the developed countries keeping only 934 banks that operate in developing countries, and re-run the regressions. The result corroborates our earlier findings, suggesting that inclusive financial system is not only a development goal but also it helps improving soundness of banks operating in developing countries. We also find a positive and significant relation between financial inclusion and bank stability for the sample of developed countries. However, the magnitude of the coefficients of financial inclusion suggests that inclusive finance might be a developing countries' phenomenon, which brings more benefits to their bank stability.³⁶

³⁵ The summary statistics of the group with the lowest financial inclusion index has an average (median) bank stability (Z-score) of 56.6 (38.7), the group with the medium financial inclusion index has an average (median) bank stability of 82.9 (60.3), and the group with the highest financial inclusion index has an average (median) bank stability of 137.4 (71.7).

³⁶ Our main results also remain unchanged for the following robustness tests: (i) using bank activity restrictions as a control, gathered from the bank regulation databases (Barth et al., 2013a); (ii) controlling for individual bank's ownership status, collected from (Claessens and Van Horen, 2014, 2015); (iii) controlling for off-balance sheet items,

4.8. Robustness tests: Dynamic panel model

So far, we run cross-sectional regressions without exploiting panel dimensions of our data. Exploiting panel structure of the data enables us to eradicate the unobserved time-invariant bank-specific heterogeneity. In this section, we use the two-step system generalized method of moments (SYS-GMM) estimator proposed by Blundell and Bond (1998) while specifying the robust estimator of the variance-covariance matrix. We choose to use SYS-GMM to address at least three important econometric issues in the paper: (i) taking the first differences of the explanatory variables eliminate the presence of unobserved bank-specific effects; (ii) using lags of the explanatory variables to eliminate any related plausible endogeneity; and (iii) using a lagged dependent variable model to capture the dynamic nature of the level of financial inclusion and bank stability.³⁷ In particular, we use lags for all explanatory variables. Using SYS-GMM, we are able to estimate a system of two simultaneous equations: one in levels where lagged first differences are used as instruments and the other in first differences where lagged levels are used as instruments – this approach maximises the efficiency of the estimates with increased moment conditions (Arellano and Bond, 1991; Arellano and Bover, 1995; Blundell and Bond, 1998). To test the validity of the instruments, we use the Hansen (1982) test of over-identifying restrictions with a null hypothesis that there is no correlation between instrumental variables and residual. We also use Arellano-Bond (AR) test with a null hypothesis that there is no second-order autocorrelation.

defined as a ratio of off-balance sheet as a percentage of total assets. The results of all these estimations are available upon request.

³⁷ We prefer SYS-GMM over other panel model estimators (e.g., fixed effects or random effects) as it enables us to alleviate the strict exogeneity assumption for explanatory variables and helps incorporating lagged dependent variable in the model.

Table 8 reports the results of the SYS-GMM model. While the Arellano-Bond test confirms that there is no second-order serial correlation, the Hansen test confirms that the over-instrumentation problem is minimised in all regressions. Even after exploiting for time-series variation in the measure of financial inclusion in a panel set up, we find a positive and significant association between financial inclusion and bank-level stability. The results with the associated dimensions of financial inclusion index also remain unchanged. Specifically, the coefficients of financial inclusion indicators are positive and significant at 1% level with bank stability, indicating a robust association between financial inclusion and bank stability.

4.9. The effects of financial inclusion after the global financial crisis

So far, we find a strong association between financial inclusion and bank stability for the period 2004-12. However, in the aftermath of the global financial crisis that took place in 2008, the leaders of the Group of Twenty (G20) recognised the mutually reinforcing policy objectives of financial inclusion, stability and consumer protection.³⁸ They committed to increase access of the disadvantaged groups to financial services through principles for innovative financial inclusion. Therefore, we assume that the relationship between financial inclusion and bank stability might be stronger for the post-crisis period (i.e., 2008-12) compared to the pre-crisis one (i.e., 2004-07). We divided our sample into pre- and post-crisis periods and re-run equation (6) while using analogous controls. Table 9 shows the results, confirming that the relationship between financial inclusion and bank stability is more pronounced for the post-crisis period compared to pre-crisis one.

5. Exploring channels: share of retail deposits, marginal cost, and institutional quality

³⁸ <http://www.afi-global.org/sites/default/files/afi%20g20%20principles.pdf>

Demirgüç-Kunt and Huizinga (2010) show that banks with high level of non-deposit funding share take excessive risk. Accordingly, if bank's funding strategy is a factor for risk taking, one would expect the positive relation between financial inclusion and bank stability to be more prominent with the banks that have high retail deposit funding. We borrow the idea from Demirgüç-Kunt and Huizinga (2010), but measure our deposit funding indicator as the share of customer deposit over customer and short-term deposit funding from BankScope (see Section 2 for details). The dummy variable, *HIGH deposit funding share*, indicates banks that have business model focusing more on deposit funding from customers (i.e., high-deposit-funding banks) with a *deposit funding indicator* that is higher than the sample mean. The variable, *LOW deposit funding share*, captures low-deposit-funding banks or banks that focus less on customer deposits and equals one minus *HIGH deposit funding share*. We create two interaction terms between financial inclusion measures and these dummy variables, *HIGH deposit funding share* and *LOW deposit funding share*. The intuition is to delineate the effects of financial inclusion in high-deposit-funding banks as opposed to low-deposit-funding banks. We augment the baseline model by replacing the financial inclusion measure with the interaction terms *Financial inclusion* \times *HIGH deposit funding share* and *Financial inclusion* \times *LOW deposit funding share* and by adding the dummy variable *HIGH deposit funding share* as an additional independent variable. Financial inclusion is *Financial inclusion index*, *Financial outreach*, or *Usage*. Using analogous control variables, we re-estimate our revised model using OLS regression while calculating heteroskedasticity-robust standard errors clustered at the country level. Table 10, Panel A, reports the results of this analysis. In general, we find that the coefficients on the financial inclusion measures are all positive. Put differently, there is no evidence of a significant negative financial inclusion-stability relation. In particular, the coefficients (β_1) on the interaction term *Financial*

inclusion × *HIGH deposit funding share* are significant in all cases except Usage dimension, indicating a positive inclusive financial sector effect on bank soundness with high-deposit-funding banks.³⁹ The coefficients (β_2) on the other interaction term, *Financial inclusion* × *LOW deposit funding share* are insignificant in all cases and even negative for Usage dimension. Furthermore, according to the Chow tests, we reject the null hypothesis that the coefficients of these interaction terms are similar (i.e., $\beta_1 = \beta_2$). All these empirical findings imply that deposit funding share is a plausible channel through which financial inclusion affects bank stability.

Likewise, if banks attract more diversified funds due to inclusive financial system, it should reduce their marginal cost of production (with reduced marginal costs, banks can inflate market power, see Equation 5). Therefore, on the one hand, banks with high marginal costs should be less active in broadening access to finance and hence become less stable as opposed to banks with low marginal costs. On the other hand, banks with high market power should be more active in broadening access to finance and hence become more stable as opposed to banks with low market power. Recent studies show that market power plays a key role in broadening financial access (e.g., Petersen and Rajan, 1995; Beck et al., 2004; Carbó-Valverde et al., 2009; Chong et al., 2013; Love and Martínez Pería, 2014; Ryan et al., 2014). The information hypothesis argues that greater market power may persuade banks to establish relationship lending and internalise benefits of supporting informationally opaque or risky customers, and hence lead to more credit availability (Petersen and Rajan, 1995; Di Patti and Dell'Ariccia, 2004).⁴⁰ From this line of argument, it is obvious that banks can take advantage of possessing more public information, and thus extend

³⁹ Recently, Han and Melecky (2013) find international evidence for the period 2006-10 that, by dint of the law of large number, correlated deposit withdrawals (i.e., bank run) could be mitigated during stressful times if bank deposits are more diversified i.e., held by more individuals and firms.

⁴⁰ On the other hand, based on the traditional industrial organisation theory, the market power hypothesis argues that higher competition results in more loan supply ensuring lower lending rates, thereby improving credit availability (Beck, Demirguc-Kunt and Maksimovic, 2004; Carbó-Valverde, Rodriguez-Fernandez and Udell, 2009; Ryan, O'Toole and McCann, 2014).

access of firms/households to credit via the channel of reduced marginal costs. Using the similar procedures as above, we categorise high-marginal-cost banks as those with a greater cost of production that is higher than the sample mean of our marginal cost variable. We use the dummy variables *HIGH marginal costs* and *LOW marginal costs* to indicate high-marginal-cost banks and low-marginal-cost banks. Additionally, we also categorise high-market-power banks as those with a greater pricing power that is higher than the sample mean of our market power variable. We use the dummy variables *HIGH market power* and *LOW market power* to indicate high-market-power banks and low-market-power. We re-estimate our revised model as above, and while we report results of the interaction of financial inclusion with marginal costs in Panel B, market power results are reported in Panel C of Table 10. Similarly, the coefficients (β_1) on the interaction term *Financial inclusion* \times *HIGH marginal costs* are insignificant in all cases, and even negative with *Usage* dimension. The coefficients (β_2) on the other interaction term, *Financial inclusion* \times *LOW marginal cost*, are significant in all cases, indicating a positive inclusive financial sector effects on bank soundness with low-marginal-cost banks. Regarding market power, while the coefficients (β_1) on the interaction term *Financial inclusion* \times *HIGH market power* are significant in all cases except *usage* dimension, suggesting a positive inclusive financial sector effect on bank soundness with high-market-power banks, the coefficients (β_2) on the other interaction term, *Financial inclusion* \times *LOW market power* are insignificant in all cases except financial outreach dimension. Based on the Chow tests, we reject the null hypothesis that the coefficients of these interaction terms are similar (i.e., $\beta_1 = \beta_2$). These empirical exercises also suggest that market power via marginal costs is a plausible channel through which financial inclusion affects bank stability.

By the same token, the impact of greater financial inclusion may depend on institutional environment in which a bank operates, and can potentially be fortified through better institutional

quality. For example, better rule of law may limit the extent to which banks can engage in correlated risk taking activities where the financial inclusion is even low. We use Kaufmann et al. (2010) Governance Indices: *Voice and accountability; Political stability; Government effectiveness; Regulatory quality; Rule of law; and Control of corruption*. As these indicators are highly correlated, we capture common variation among these indicators using the principal component analysis and construct a composite index of institutional quality (the only PC with eigenvalue more than one i.e., 5.32 and with 89% variation). Following exactly same procedures described above, this time, we classify strong-institutional-quality countries as those with a high level of institutional environment that is higher than the sample mean of *institutional quality index*. We also follow same procedures as above and re-estimate the revised baseline model. The results of this analysis are presented in Panel D of Table 10. Again, while the coefficients (β_1) on the interaction term *Financial inclusion* \times *HIGH institutional quality* are significantly positive, the coefficients (β_2) on *Financial inclusion* \times *LOW institutional quality*, are insignificant. According to Wald test, rejecting the null hypothesis also demonstrates that these coefficients are dissimilar (i.e., $\beta_1 \neq \beta_2$), indicating that institutional quality is a plausible channel through which financial inclusion affects bank stability.

We subject our findings to a series of additional sensitivity checks. The results are robust to (i) using Quantile regression approach, (ii) using instrumental variable approach, (iii) using alternative measures of financial inclusion that are taken from Global Findex database, (iv) running regressions only for the sample of developing countries, and finally (iv) using dynamic GMM panel model. For all of these alternative setups, the main findings of this study largely remain unaltered.

6. Concluding remarks and policy implications

Financial inclusion, as documented in the literature, brings about more economic wellbeing to individuals and SMEs. Yet, little is known about its impact on stability of banks who are the main arbiters of financial services in any given economy. Using an international sample of 2600 banks across 86 countries, we provide a comprehensive empirical evidence that greater financial inclusion is positively associated with individual bank stability. In this paper, we have also identified, for the first time, the channels through which financial inclusion impacts bank soundness. These results suggest that banks perceive financial inclusion as a mechanism to garner ample risk-free and mostly cheap retail deposits, providing a significant leeway to reduce reliance on volatile and often costly money market funding. Increasing financial inclusion also act as an instrument to reduce marginal cost of producing outputs, which contributes to greater pricing power of banks and makes them more stable. As greater financial inclusion promotes stable socio-political environments, banks operating in an inclusive financial sector and in countries with high levels of institutional quality can improve stability as they get to operate efficiently in those settings.

Our results have important policy implications. The findings suggest that banking stability is strongly influenced by the degree to which households and SMEs have access to financial services, indicating the importance of ensuring an inclusive financial sector for achieving inclusive economic growth. By broadening banking services to unbanked and/or underbanked people, bank managers can not only take early advantage of exploiting the untapped potential of customers and create a ‘lock-in’ effect but also aid an inclusive development agenda while allocating resources in more productive areas.⁴¹ As only 41% people in the developing countries compared to 89% in

⁴¹ Klemperer (1995) argues that in a market with switching costs, a firm’s future profitability is determined by its current market share. Increasing market share at an early stage associated with financial inclusion, efficient bank

developed ones have bank accounts (see Demirgüç-Kunt and Klapper, 2012), additional policies should focus on ensuring access to those excluded from formal financial services, especially in the developing ones. In the end, however, only more empirical research using both supply- and demand-side data on access will provide comprehensive picture of the effects of financial inclusion on bank stability.

Online Appendix

See supplementary material.

Appendix A

Table A1
Variables definitions and sources

Variable	Definitions	Source
<i>Dependent Variables</i>		
Z-score	Sum of return-on-assets (ROA), defined as net profit over assets, and equity ratio (EQA), defined as equity over assets, divided by standard deviation of (ROA) of each bank over past three years (calculated using a rolling window)	BankScope
Volatility of ROA	Standard deviation of ROA for each bank, calculated over past 3 years	BankScope
<i>Financial Inclusion</i>		
Financial inclusion index	Financial inclusion index is constructed using PCA from the financial outreach and usage dimensions.	IMF FAS
Financial outreach dimension	The outreach dimension constructed using principal component analysis (PCA) from the variables related to geographic and demographic availability of branches and ATMs	MF FAS
Usage dimension	The number of deposit and loan accounts per 1000 adults	MF FAS
<i>Bank-specific variables</i>		
Bank size	Logarithm of Total assets	BankScope
Loan ratio	Total performing loans divided by total assets	BankScope
Loan loss provision	Total loan loss provision divided by total assets	BankScope
Income diversification	Non-interest income divided by total operating income	BankScope
Management quality	Total earning assets divided by total assets	BankScope
Capitalisation	Total equity divided by total assets	BankScope
Market power	A bank-level non-structural indicator of bank competition, measured by using a stochastic frontier analysis approach assuming full bank efficiency, with lower values indicating higher competition in the banking sector	Authors' calculation
Marginal costs	Marginal cost is estimated using a translog costs function	Authors'
Customer deposit funding share (CDEP)	Share of customer deposits of total deposits and short-term funding.	BankScope
<i>Firm-specific variables</i>		
Access to finance	Dummy variable equal to 1 if the firm has access to bank finance (loan, overdraft or line of credit)	WBES
Financing Obstacle	Financing obstacle is defined on five point scale how problematic is financing for the operation and growth of business: (0) No obstacle (1) minor obstacle (2) moderate obstacle (3) major obstacle, and (4) very severe obstacle.	WBES
Firm size (employees)	The number of permanent full-time employees	WBES
Manufacturing	Dummy variable equal to 1 if the firm is in the manufacturing sector	WBES
Exporter	Dummy variable equal to 1 if 10 percent or more of sales are exported directly or indirectly by the firm	WBES
Foreign-owned	Dummy variable equal to 1 if 50 percent or more of the firm is owned by foreign organisations	WBES
Government-owned	Dummy variable equal to 1 if 10 percent or more of the firm is owned by the government	WBES
Firm age	Age of the firm in years	WBES
<i>Macroeconomic</i>		
GDP growth rate	The growth rate of GDP	WDI

managers will be able to take advantage of its informational monopoly, and hence increase market power effectively while having a customer 'lock-in' effect.

GDP per capita	The natural logarithm of per capita GDP	WDI
Institutional quality index	Institutional quality index is constructed using principal component analysis by using Kaufmann, Kraay and Mastruzzi's (2010) Governance indicators (e.g., Voice and accountability: measures the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and free media (Higher values mean greater political rights); Political stability: measures the perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including political violence and terrorism (Higher values mean more stable political environment); Government effectiveness: measures the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies (Higher values mean higher quality of public and civil service); Regulatory quality: measures the ability of the government to formulate and implement sound policies and regulations that permit and promote market competition and private-sector development (Higher values mean higher quality of regulation); Rule of law: measures the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, the police, and the courts, as well as the likelihood of crime and violence (Higher values mean stronger law and order); and Control of corruption: measures the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests (Higher values indicate better control of corruption).	Kaufmann, Kraay and Mastruzzi (2010)
<i>IV Instruments</i>		
Proportion of other countries in the same region that have mobile phone	Proportion of other countries in the same region (e.g., Asia, Africa) that have mobile phone (per 100 people).	WDI
Religion	Identifies the percentage of the population of each country that belonged to the three most widely spread religions in the world in 1980. For countries of recent formation, the data is available for 1990-95. The numbers are in percent (scale from 0 to 100). The three religions identified here are: (1) Roman Catholic; (2) Protestant; and (3) Muslim. The residual is called "other religions".	La Porta, Lopez-de-Silanes, Shleifer, and Vishny (1999)
Borrowed from family or friends (% age 15+)	Borrowed money from family or friends (% age 15+)	Demircuc-Kunt and Klapper (2012)

Note: IMF FAS = International Monetary Fund Financial Access Survey; WBES = World Bank Enterprise Survey; WDI = World Development Indicator

Table A2

Inclusive financial system and firm financing obstacle or access to finance, firm level results

We run ordered probit model when *Financing Obstacle* is the dependent variable and logit model for the case of *Access to Finance*. In both cases, robust standard errors are reported in the brackets. Both dependent variables are constructed using the World Bank Enterprise Surveys. In the case of former, firms were asked to rate on a five-point scale how much of an obstacle is access to finance for the operation and growth of the business: (0) No obstacle (1) minor obstacle (2) moderate obstacle (3) major obstacle (4) very severe obstacle. For the latter case, *Access to Finance* is a dummy variable that indicates whether the firm has access to a loan, overdraft, or a line of credit. The *firm size* is the logarithm of the firms' total number of permanent employees. The dummy variable *Exporter* indicates that firms are involved in exporting. The *Manufacturing* dummy indicates that a firm is in the manufacturing sector. *Government-owned* and *Foreign-owned* are dummies that is equal one if the firm has government or foreign ownership, respectively. *Log firm age* is the logarithm of the firm's age in years. *GDP growth rate* is the annual growth rate in percentage. Regional dummies are Sub-Saharan Africa, Asia and Pacific, Europe, Americas, and South Asia, with the Middle East and North Africa being the omitted category. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: World Bank Enterprise Surveys and WDI. Coverage: 2004-12.

VARIABLES	Financing Obstacle		Access to Finance	
	coef	se	coef	se
Financial Inclusion	-0.251***	[0.045]	0.491***	[0.019]
Log firm size (employees)	-0.047***	[0.004]	0.035***	[0.002]
Exporter	-0.027*	[0.015]	0.123***	[0.006]
Manufacturing	0.141***	[0.012]	-0.033***	[0.005]
Foreign-owned (>=50% shares)	-0.247***	[0.020]	-0.047***	[0.008]
Government-owned (>=10% shares)	-0.052	[0.037]	-0.210***	[0.016]
Log Firm Age	-0.082***	[0.011]	0.079***	[0.005]
GDP growth rate	0.002*	[0.001]	-0.012***	[0.001]
<i>Region (Middle East & North Africa omitted)</i>				
Sub-Sahara Africa	0.359***	[0.057]	0.098***	[0.022]
Asia and Pacific	-0.406***	[0.057]	0.113***	[0.022]
Europe	0.208***	[0.059]	0.015	[0.025]
Americas	0.164***	[0.057]	0.259***	[0.021]
South Asia	0.229***	[0.067]	0.119***	[0.025]
Observations	38,850		38,850	
No of countries	63		63	
chi2	2430***		5006***	
Pseudo R-squared	0.02		0.11	

Table A3

First-stage regression: Financial inclusion

This table reports regressions of financial inclusion and its associated dimensions on Mobile phone share in other countries in the region, Borrowed from family or friends, and Religion. All regressions include bank-specific and country-specific controls as in equation (6), except financial inclusion. *P*-values are calculated by the heteroskedasticity-robust standard errors clustered for countries and are presented in brackets. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

VARIABLES	Financial	Financial	Usage
	inclusion index	outreach dimension	dimension
	1	2	3
Mobile phone share in other countries in the region	3.007*** [0.550]	1.291** [0.539]	5.424*** [1.414]
Borrowed from family or friends	-0.003*** [0.000]	-0.007*** [0.000]	
Religion			0.004*** [0.000]
Observations	2,439	2,439	2,564
Adjusted R ²	0.71	0.79	0.53
All control variables	Yes	Yes	Yes

Table 1
Summary Statistics

Variable	Mean	Std. Dev.	Min	Max	# of countries	# of obs.
<i>Bank-level data</i>						
ln(Z-score)	3.63	1.05	0.30	7.29	86	2635
-ln(sd(ROA))	5.90	1.17	1.77	10.45	86	2635
Loan Ratio	0.55	0.19	0.00	0.99	86	2635
Bank size	6.85	1.95	-1.96	14.59	86	2635
Loan Loss Provision	0.01	0.03	-0.16	0.80	86	2635
Income Diversification	0.18	0.28	-3.68	9.15	86	2635
Management Quality	0.89	0.10	0.15	1.00	86	2635
Capitalisation	0.12	0.09	0.01	0.85	86	2635
Market power	0.07	0.29	-1.39	0.80	86	2635
Marginal costs	0.07	0.06	0.00	0.29	86	2635
Customer deposit funding share (CDEP) %	84.87	19.95	0.00	100.00	85	2302
<i>Firm-level data</i>						
Access to finance	0.61	0.49	0.00	1.00	63	38850
Financing Obstacle	1.54	1.36	0.00	4.00	63	38850
Firm size (employees)	2.55	1.50	0.00	11.51	63	38850
Manufacturing	0.20	0.40	0.00	1.00	63	38850
Exporter	0.58	0.49	0.00	1.00	63	38850
Foreign-owned	0.10	0.30	0.00	1.00	63	38850
Government-owned	0.03	0.16	0.00	1.00	63	38850
Firm age	3.01	0.55	0.69	5.37	63	38850
<i>Country-level data</i>						
Financial inclusion index	0.33	0.25	0.02	1.00	86	86
Financial outreach dimension	0.30	0.27	0.01	0.99	86	86
Usage dimension	0.35	0.30	0.00	1.00	86	86
GDP growth rate	0.04	0.03	-0.01	0.11	86	86
ln(Per capita GDP)	8.37	1.51	5.01	11.09	86	86
Institutional quality index	0.50	0.23	0.01	1.00	86	86
<i>Instrumental variables</i>						
Mobile phone share in other countries in the region*	0.99	0.01	0.89	1.00	84	84
Religion (%)	31.47	33.33	0.40	100.00	84	84
Borrowed from family or friends (% age 15+)	14.54	18.69	0.00	90.58	78	78

*Information on these instruments are available for entire sample period (2004-12).

Table 2

Bank stability, financial inclusion and its associated dimensions across countries

Bank stability is the natural logarithm of Z-score. Financial inclusion index is constructed based on financial outreach and usage dimensions. Financial outreach dimension is based on geographic and demographic branch (ATM) penetration: the number of branches per 1,000 km² and the number of ATMs per 1,000 km²; the number of branches per 100,000 adults and the number of ATM per 100,000 adults. The usage dimension refers to the number of deposit and loan accounts per 1000 adults. The rank of each country is in the parenthesis: lower numbers reflecting higher values of the dimensions.

Country	ln(z-score)	Financial inclusion index	Financial outreach dimension	Usage dimension	# of banks	Country	ln(z-score)	Financial inclusion index	Financial outreach dimension	Usage dimension	# of banks
Algeria	3.55	0.09(69)	0.03(81)	0.17(57)	12	India	4.05	0.32(38)	0.38(24)	0.24(50)	59
Angola	3.1	0.05(75)	0.05(71)	0.06(68)	11	Indonesia	3.67	0.14(63)	0.10(66)	0.20(54)	58
Botswana	3.1	0.15(62)	0.09(67)	0.21(53)	6	Japan	3.76	0.96(3)	0.92(3)	0.93(2)	453
Burundi	2.84	0.03(81)	0.03(79)	0.02(76)	4	Jordan	3.94	0.21(55)	0.16(54)	0.26(46)	12
Cameroon	3.17	0.03(82)	0.04(74)	0.01(80)	7	Kazakhstan	3	0.22(53)	0.12(63)	0.33(39)	26
Egypt	3.31	0.08(71)	0.05(72)	0.11(61)	19	Kuwait	2.77	0.33(37)	0.30(31)	0.36(35)	12
Ghana	3.03	0.07(73)	0.04(77)	0.10(63)	16	Lebanon	4.09	0.50(17)	0.54(17)	0.47(26)	30
Kenya	3.6	0.07(74)	0.04(78)	0.10(64)	27	Malaysia	3.73	0.46(22)	0.22(45)	0.73(12)	5
Libya	4.34	0.04(76)	0.05(73)	0.04(73)	5	Mongolia	3.28	0.38(33)	0.25(35)	0.53(23)	3
Malawi	3.06	0.02(85)	0.02(82)	0.02(77)	5	Pakistan	2.98	0.07(72)	0.07(69)	0.07(67)	9
Mauritius	3.33	0.63(9)	0.60(14)	0.67(14)	11	Philippines	3.51	0.13(64)	0.14(62)	0.12(60)	20
Mozambique	2.67	0.04(79)	0.03(80)	0.04(72)	9	Saudi Arabia	3.61	0.23(51)	0.17(53)	0.29(42)	12
Namibia	4.16	0.18(58)	0.11(65)	0.25(47)	6	Singapore	3.97	0.40(31)	0.76(10)	0.00(84)	12
Rwanda	2.75	0.12(66)	0.15(58)	0.09(66)	7	South Korea	3.92	1.00(1)	0.99(1)	0.99(1)	10
South Africa	3.47	0.21(54)	0.16(55)	0.28(45)	13	Thailand	3.51	0.37(35)	0.30(28)	0.46(27)	20
Tanzania	3.22	0.03(83)	0.02(84)	0.04(71)	21	Turkey	3.66	0.42(27)	0.24(38)	0.62(18)	27
Uganda	2.59	0.04(78)	0.02(83)	0.05(70)	14	United Arab	3.69	0.25(45)	0.25(36)	0.25(48)	19
Zambia	2.11	0.03(80)	0.04(76)	0.02(78)	10	Uzbekistan	3.28	0.12(65)	0.22(46)	0.01(81)	8
Africa:	3.19	0.11	0.09	0.13	203	Yemen	3.19	0.02(84)	0.02(85)	0.03(75)	6
Argentina	2.61	0.24(46)	0.14(61)	0.36(36)	32	Asia:	3.41	0.31	0.33	0.29	905
Bahamas	3.74	0.50(16)	0.34(25)	0.69(13)	8	Austria	3.68	0.41(29)	0.44(21)	0.37(33)	153
Bolivia	3.4	0.10(67)	0.08(68)	0.12(59)	10	Belgium	3.35	0.98(2)	0.97(2)	0.99(4)	27
Brazil	2.97	0.44(23)	0.46(19)	0.43(31)	90	Bosnia and	3.88	0.31(40)	0.26(34)	0.37(34)	17
Chile	3.62	0.50(18)	0.22(43)	0.82(9)	23	Bulgaria	3.25	0.59(12)	0.59(16)	0.58(19)	15
Colombia	3.8	0.29(42)	0.15(59)	0.46(28)	19	Croatia	3.66	0.44(24)	0.51(18)	0.35(38)	28
Costa Rica	3.93	0.40(32)	0.26(33)	0.56(21)	39	Estonia	2.99	0.61(10)	0.31(27)	0.95(7)	6
Dominican	3.09	0.17(59)	0.23(42)	0.10(65)	48	Finland	3.62	0.55(15)	0.20(49)	0.96(6)	10
Ecuador	3.78	0.22(52)	0.21(48)	0.24(52)	19	Greece	2.72	0.50(19)	0.45(20)	0.55(22)	9
El Salvador	3.58	0.24(47)	0.23(41)	0.24(51)	10	Hungary	2.78	0.42(25)	0.40(23)	0.45(29)	18
Honduras	3.83	0.16(60)	0.14(60)	0.19(55)	15	Iceland	2.99	0.23(50)	0.43(22)	0.00(84)	5
Jamaica	3.75	0.41(28)	0.22(44)	0.63(17)	4	Ireland	2.22	0.56(14)	0.62(13)	0.50(25)	8
Nicaragua	3.62	0.08(70)	0.05(70)	0.11(62)	5	Italy	3.98	0.60(11)	0.92(4)	0.25(49)	481
Panama	3.61	0.30(41)	0.21(47)	0.40(32)	38	Latvia	2.52	0.47(21)	0.30(29)	0.66(16)	18
Peru	3.71	0.26(44)	0.24(39)	0.28(44)	15	Macedonia	3.48	0.37(36)	0.25(37)	0.52(24)	13
Trinidad and	4.03	0.41(30)	0.27(32)	0.56(20)	6	Malta	3.72	0.92(4)	0.86(7)	0.99(3)	6
Venezuela	2.83	0.28(43)	0.15(57)	0.43(30)	26	Moldova	2.81	0.23(48)	0.12(64)	0.36(37)	10
Americas:	3.52	0.29	0.21	0.39	407	Montenegro	3.22	0.31(39)	0.30(30)	0.32(40)	7
Afghanistan	2.46	0.01(86)	0.01(86)	0.02(79)	8	Netherlands	3.24	0.70(8)	0.73(11)	0.66(15)	24
Armenia	3.61	0.18(57)	0.18(52)	0.18(56)	12	Norway	3.33	0.10(68)	0.18(51)	0.00(84)	12
Azerbaijan	3.16	0.16(61)	0.15(56)	0.16(58)	19	Portugal	3.04	0.84(6)	0.91(5)	0.77(11)	16
Bangladesh	2.59	0.47(20)	0.60(15)	0.32(41)	7	Spain	4.07	0.86(5)	0.86(6)	0.85(8)	86
Cambodia	3.5	0.04(77)	0.03(75)	0.03(74)	10	Switzerland	4.57	0.79(7)	0.78(9)	0.79(10)	119
Cyprus	2.81	0.38(34)	0.72(12)	0.00(84)	13	Ukraine	2.7	0.58(13)	0.23(40)	0.98(5)	14
Georgia	2.49	0.23(49)	0.19(50)	0.28(43)	12	Yugoslavia	2.93	0.20(56)	0.33(26)	0.05(69)	28
Hong Kong	3.92	0.42(26)	0.79(8)	0.00(84)	23	Europe:	3.28	0.52	0.50	0.55	1130

Table 3**Financial inclusion and bank stability: Bank level basic OLS regressions**

The dependent variable is the Z-score—defined as the sum of return-on-assets and equity ratio divided by standard deviation of return-on-assets of each bank over past three years – reported in columns 1-3. As robustness tests, we use alternative bank stability proxy i.e., the (negative of the) standard deviation of a bank’s return-on-assets – reported in columns 4-6. In this case, we follow Beck et al. (2013), and transform standard deviation of return-on-assets to make it directly proportional to bank stability. All variables are averaged over 2004-12. The estimation is based on OLS regressions. p -values are calculated by the heteroskedasticity-robust standard errors clustered for countries and are presented in brackets. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI.

Variable	ln(Z-score)			-ln(sd(ROA))		
	Financial inclusion index	Financial outreach dimension	Usage dimension	Financial inclusion index	Financial outreach dimension	Usage dimension
	1	2	3	4	5	6
Financial inclusion	0.555*** [0.196]	0.507*** [0.187]	0.230* [0.134]	0.953*** [0.246]	0.656** [0.271]	0.504*** [0.149]
Loan Ratio	0.584 [0.481]	0.512 [0.474]	0.55 [0.497]	0.413 [0.449]	0.272 [0.470]	0.392 [0.458]
Bank Size	0.024 [0.031]	0.028 [0.030]	0.023 [0.032]	0.046* [0.026]	0.052* [0.027]	0.043 [0.027]
Loan Loss Provision	-8.852*** [2.740]	-8.760*** [2.710]	-8.955*** [2.786]	-8.832*** [2.702]	-8.751*** [2.687]	-9.016*** [2.795]
Income Diversification	-0.079 [0.125]	-0.094 [0.128]	-0.099 [0.133]	-0.204 [0.179]	-0.24 [0.174]	-0.227 [0.187]
Management Quality	1.434** [0.549]	1.449*** [0.541]	1.538*** [0.551]	1.550*** [0.485]	1.644*** [0.501]	1.693*** [0.493]
Capitalisation	1.808** [0.708]	1.761** [0.687]	1.728** [0.678]	-3.428*** [0.520]	-3.558*** [0.460]	-3.524*** [0.470]
Market power	0.720*** [0.143]	0.655*** [0.140]	0.711*** [0.141]	0.497*** [0.110]	0.384*** [0.115]	0.508*** [0.110]
GDP Growth Rate	-0.248 [2.839]	0.801 [2.917]	-1.425 [2.654]	0.144 [2.676]	1.076 [2.962]	-1.955 [2.560]
Per Capita GDP	0.016 [0.058]	0.02 [0.070]	0.054 [0.059]	0.021 [0.063]	0.053 [0.072]	0.074 [0.056]
Constant	1.297* [0.654]	1.242* [0.711]	1.100* [0.655]	3.810*** [0.636]	3.586*** [0.729]	3.547*** [0.613]
Observations	2,635	2,635	2,635	2,635	2,635	2,635
Adjusted R ²	0.19	0.19	0.19	0.43	0.42	0.42
Countries	86	86	86	86	86	86

Table 4
Robustness tests: Quantile regression approach

The dependent variable is the Z-score—defined as the sum of return-on-assets and equity ratio divided by standard deviation of return-on-assets of each bank over past three years – reported in columns 1-9. All variables are averaged over 2004-12. The results are based on quantile regression approach. We use bootstrapping to obtain consistent standard errors, which are reported in the brackets. *F*-tests of the equality of slope parameters across various quantiles are reported at the bottom of the table. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI.

Dependent variable: ln(Z-score)									
Variable	1	2	3	4	5	6	7	8	9
	Quantile								
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Financial inclusion	-0.033 [0.230]	0.036 [0.168]	0.196 [0.141]	0.311** [0.126]	0.409*** [0.130]	0.620*** [0.125]	0.778*** [0.125]	1.103*** [0.141]	1.292*** [0.228]
Loan Ratio	0.605*** [0.222]	0.879*** [0.162]	0.713*** [0.136]	0.549*** [0.121]	0.525*** [0.126]	0.474*** [0.120]	0.344*** [0.121]	0.306** [0.136]	0.597*** [0.219]
Bank Size	0.025 [0.022]	0.026* [0.016]	0.033** [0.013]	0.040*** [0.012]	0.025** [0.012]	0.027** [0.012]	0.022* [0.012]	0.018 [0.013]	-0.017 [0.022]
Loan Loss Provision	-15.967*** [1.455]	-15.636*** [1.062]	-16.763*** [0.891]	-13.610*** [0.797]	-12.634*** [0.825]	-11.453*** [0.790]	-10.024*** [0.793]	-9.886*** [0.890]	-7.492*** [1.440]
Income Diversification	-0.034 [0.143]	0.035 [0.105]	-0.071 [0.088]	-0.157** [0.079]	-0.231*** [0.081]	-0.078 [0.078]	-0.222*** [0.078]	-0.203** [0.088]	-0.164 [0.142]
Management Quality	1.807*** [0.500]	1.663*** [0.365]	1.473*** [0.306]	1.271*** [0.274]	1.360*** [0.283]	1.300*** [0.271]	1.335*** [0.272]	1.123*** [0.306]	0.471 [0.494]
Capitalisation	2.187*** [0.483]	2.149*** [0.353]	2.414*** [0.296]	2.210*** [0.265]	1.826*** [0.274]	1.736*** [0.262]	1.560*** [0.263]	1.310*** [0.296]	0.578 [0.478]
Market power	1.036*** [0.137]	1.013*** [0.100]	0.943*** [0.084]	0.752*** [0.075]	0.645*** [0.077]	0.555*** [0.074]	0.482*** [0.074]	0.466*** [0.084]	0.394*** [0.135]
GDP Growth Rate	-3.334* [2.015]	-3.406** [1.471]	-2.574** [1.234]	-3.101*** [1.104]	-2.356** [1.142]	-0.903 [1.094]	-0.498 [1.098]	1.018 [1.233]	3.497* [1.994]
Per Capita GDP	0.004 [0.050]	0.006 [0.036]	0.008 [0.031]	-0.019 [0.027]	-0.033 [0.028]	-0.018 [0.027]	-0.02 [0.027]	-0.037 [0.031]	0.036 [0.049]
Constant	0.283 [0.583]	0.629 [0.426]	1.037*** [0.357]	1.733*** [0.320]	2.086*** [0.331]	2.059*** [0.317]	2.294*** [0.318]	2.765*** [0.357]	3.033*** [0.577]
Observations	2,635	2,635	2,635	2,635	2,635	2,635	2,635	2,635	2,635
Cross-equation hypotheses tests:							Quantile	<i>F</i> -statistics	<i>p</i> -value
Equality of slope estimates across different quantiles:							0.1 vs. 0.90	28.86***	0.000
Equality of slope estimates across different quantiles:							0.20 vs. 0.80	25.66***	0.000
Equality of slope estimates across different quantiles:							0.30 vs. 0.70	18.33***	0.000
Equality of slope estimates across different quantiles:							0.40 vs. 0.60	12.86***	0.000

Table 5
Robustness tests: Instrumental variable regressions

The dependent variable is the Z-score—defined as the sum of return-on-assets and equity ratio divided by standard deviation of return-on-assets of each bank over past three years – reported in columns 1-3. As robustness tests, we use alternative bank stability proxy i.e., the (negative of the) standard deviation of a bank’s return-on-assets – reported in columns 4-6. All variables are averaged over 2004-12. The results are based on instrumental variable estimation. Each *financial inclusion* measure is treated as endogenous variable, and it is instrumented via mobile phone share in other countries in the same region (e.g., Asia, Africa), Borrowed from family or friends, and Religion. *P*-values are calculated by the heteroskedasticity-robust standard errors, which are presented in brackets. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI.

Variable	ln(Z-score)			-ln(sd(ROA))		
	Financial inclusion index	Financial outreach dimension	Usage dimension	Financial inclusion index	Financial outreach dimension	Usage dimension
	1	2	3	4	5	6
Financial inclusion	1.780*** [0.539]	1.088*** [0.303]	0.03 [0.159]	1.894*** [0.493]	1.213*** [0.286]	0.743*** [0.145]
Loan Ratio	0.307* [0.163]	0.025 [0.124]	0.457*** [0.132]	0.09 [0.153]	-0.211* [0.120]	0.460*** [0.130]
Bank Size	0.026** [0.011]	0.041*** [0.011]	0.019* [0.011]	0.050*** [0.010]	0.066*** [0.011]	0.035*** [0.011]
Loan Loss Provision	-8.856*** [2.321]	-8.370*** [2.304]	-9.229*** [2.821]	-8.994*** [2.317]	-8.289*** [2.294]	-9.924*** [2.791]
Income Diversification	0.083 [0.099]	-0.012 [0.065]	-0.106 [0.081]	-0.025 [0.082]	-0.122 [0.079]	-0.195** [0.097]
Management Quality	1.405*** [0.350]	1.669*** [0.303]	1.666*** [0.302]	1.539*** [0.333]	1.811*** [0.292]	1.696*** [0.300]
Capitalisation	2.567*** [0.347]	2.260*** [0.302]	1.696*** [0.248]	-2.818*** [0.308]	-3.124*** [0.278]	-3.407*** [0.250]
Market power	1.041*** [0.106]	0.817*** [0.079]	0.707*** [0.089]	0.729*** [0.096]	0.490*** [0.071]	0.581*** [0.079]
GDP Growth Rate	-0.505 [1.406]	0.601 [1.562]	-1.694* [0.975]	-0.355 [1.328]	1.083 [1.496]	-2.359** [0.964]
Per Capita GDP	-0.188*** [0.066]	-0.120*** [0.044]	0.069** [0.028]	-0.139** [0.060]	-0.072* [0.041]	0.039 [0.028]
Constant	2.552*** [0.507]	2.077*** [0.402]	1.041*** [0.369]	4.832*** [0.469]	4.339*** [0.379]	3.769*** [0.364]
Observations	2,439	2,439	2,564	2,439	2,439	2,564
(Centered) R ²	0.16	0.20	0.19	0.42	0.43	0.41
Under id test: KP LM statistic	102.8	178.5	389.6	102.8	178.5	389.6
Weak id test: KP LM statistic	65.2	129.0	318.1	65.2	129.0	318.1
Over id test: Hansen J statistic	1.61	0.10	0.05	2.75	0.15	0.72
Hansen J-test (p-value)	0.20	0.75	0.83	0.10	0.70	0.40

Table 6**Robustness tests: Alternative measure of financial inclusion**

In this table, we use financial inclusion indicators of Global Findex database based on World Bank for the year 2011. All other variables are averaged over 2004-12. The results are based on instrumental variable estimation. Each Global Findex indicator is treated as endogenous variable, and it is instrumented via Ethnic fractionalization that is collected from Easterly and Levine (1997) and Religion. *P*-values are calculated by the heteroskedasticity-robust standard errors, which are presented in brackets. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI.

Variable	ln(Z-score)	
	Adults with an account at a formal financial institution to total adults	Adults saving at a financial institution in the past year to total adults
	1	2
Global financial inclusion index	0.996*** [0.352]	0.734** [0.321]
Loan Ratio	0.192 [0.135]	0.215 [0.138]
Bank Size	0.028** [0.012]	0.042*** [0.012]
Loan Loss Provision	-7.565*** [2.746]	-8.223*** [2.452]
Income Diversification	-0.101 [0.075]	-0.032 [0.063]
Management Quality	1.981*** [0.351]	1.987*** [0.334]
Capitalisation	2.113*** [0.352]	2.144*** [0.347]
Market power	0.858*** [0.093]	0.796*** [0.088]
GDP Growth Rate	-0.731 [1.233]	-3.587*** [1.211]
Per Capita GDP	-0.105* [0.057]	-0.042 [0.035]
Constant	1.724*** [0.484]	1.528*** [0.419]
Observations	2,051	2,223
(Centered) R ²	0.17	0.17
Under id test: KP LM statistic	373.2	483.7
Weak id test: KP LM statistic	343.1	464.8
Over id test: Hansen J statistic	0.84	0.08
Hansen J-test (p-value)	0.36	0.78

Table 7
Robustness tests: Alternative sample

This table reports robustness tests of financial inclusion and banking stability. The results are based on instrumental variable estimation. In columns 1-3, we split the sample into three terciles based on financial inclusion index and re-run IV regressions while using Z-score as the dependent variable. All variables are averaged over 2004-12. Each variable of interest is treated as endogenous variable, and it is instrumented via mobile phone share in other countries in the same region (e.g., Asia, Africa), Religion, and Borrowed from family or friends. In column 4 (5), we dropped observations of developed (developing) countries, and re-run regressions as usual. *P*-values are calculated by the heteroskedasticity-robust standard errors, which are presented in brackets. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI.

Variables	ln(Z-score)				
	Tercile 1: the lowest financial inclusion	Tercile 2: medium financial inclusion	Tercile 3: the highest financial inclusion	Only Developing Countries: Developed Countries excluded‡	Only Developed countries: Developing countries excluded
	1	2	3	4	5
Financial inclusion	2.179*** [0.746]	4.186*** [1.498]	5.025*** [1.265]	2.734*** [0.866]	0.535** [0.253]
Loan Ratio	0.553** [0.238]	0.401** [0.184]	-0.297 [0.310]	0.360* [0.199]	-0.099 [0.185]
Bank Size	0.085*** [0.018]	-0.018 [0.015]	0.098*** [0.029]	0.044** [0.020]	0.038** [0.016]
Loan Loss Provision	-9.444*** [1.026]	-10.110*** [2.133]	-7.496** [2.919]	-10.751*** [1.027]	-6.566** [3.027]
Income Diversification	-0.606** [0.239]	-0.284 [0.324]	0.051 [0.103]	-0.216 [0.278]	0.015 [0.067]
Management Quality	0.828** [0.334]	-0.098 [0.457]	3.101*** [1.121]	0.589* [0.320]	2.138*** [0.653]
Capitalisation	2.051*** [0.324]	1.303*** [0.493]	10.035*** [2.417]	1.820*** [0.298]	2.720*** [0.674]
Market power	0.667*** [0.110]	0.763*** [0.151]	1.051*** [0.181]	0.714*** [0.129]	1.114*** [0.152]
GDP Growth Rate	-3.810*** [1.215]	14.919*** [5.670]	-4.221 [7.551]	0.532 [1.476]	-3.445* [1.964]
Per Capita GDP	-0.243*** [0.049]	0.292*** [0.072]	-0.359 [0.222]	-0.235** [0.095]	0.216*** [0.083]
Constant	3.411*** [0.456]	-1.607 [1.483]	-1.212 [1.943]	3.451*** [0.695]	-1.316 [0.873]
Observations	831	937	686	934	1,526
(Centered) R ²	0.27	0.22	0.15	0.14	0.18
Under id test: KP LM statistic	203.7	94.28	59.78	78.35	246.1
Weak id test: KP LM statistic	111.3	26.47	46.24	43.73	342.8
Over id test: Hansen J statistic	2.63	1.92	0.18	0.49	0.03
Hansen J-test (p-value)	0.11	0.17	0.67	0.49	0.86

‡ The countries we dropped are: Austria, Bahamas, Belgium, Croatia, Cyprus, Estonia, Finland, Greece, Hong Kong, Hungary, Iceland, Ireland, Italy, Japan, Korea, Kuwait, Malta, Netherlands, Norway, Portugal, Saudi Arabia, Singapore, Spain, Switzerland, Trinidad and Tobago, United Arab Emirates.

Table 8**Robustness tests: the dynamic panel system GMM estimation results**

The dependent and independent variables are analogous. We employ two-step system GMM panel model. All regressions include year fixed effects. Lagged values of all regressors are used in the estimation. We have treated lagged dependent variable as the endogenous variable in the GMM-style instruments, where for the case of the transformed equation, lags of two and higher; and for the case of levels equation, lags of one are used. AR(2) is the p -value of the test for second-order autocorrelation. Hansen is the p -value of Hansen (1982) test of over-identifying restrictions. t -statistics of system GMM model are reported in brackets, which are based on Windmeijer (2005)-corrected standard errors. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI. Coverage: 2004-12.

Variable	ln(Z-score)			-ln(sd(ROA))		
	Financial inclusion index	Financial outreach dimension	Usage dimension	Financial inclusion index	Financial outreach dimension	Usage dimension
	1	2	3	4	5	6
Lagged dependent	0.619*** [0.027]	0.619*** [0.027]	0.620*** [0.027]	0.561*** [0.030]	0.562*** [0.030]	0.561*** [0.030]
Financial inclusion	0.212*** [0.064]	0.228*** [0.055]	0.072* [0.044]	0.433*** [0.072]	0.347*** [0.061]	0.220*** [0.047]
Loan Ratio	0.202*** [0.068]	0.182*** [0.067]	0.188*** [0.069]	0.199*** [0.072]	0.146** [0.070]	0.190*** [0.073]
Bank Size	0.014** [0.006]	0.016** [0.006]	0.014** [0.006]	0.023*** [0.006]	0.027*** [0.007]	0.022*** [0.007]
Loan Loss Provision	-1.185*** [0.396]	-1.174*** [0.391]	-1.205*** [0.409]	-1.344*** [0.464]	-1.333*** [0.463]	-1.383*** [0.489]
Income Diversification	-0.002 [0.004]	-0.002 [0.004]	-0.002 [0.004]	-0.003 [0.005]	-0.004 [0.005]	-0.004 [0.005]
Management Quality	0.604*** [0.138]	0.595*** [0.137]	0.647*** [0.138]	0.666*** [0.144]	0.684*** [0.142]	0.736*** [0.145]
Capitalisation	0.790*** [0.146]	0.796*** [0.146]	0.758*** [0.144]	-1.329*** [0.172]	-1.342*** [0.173]	-1.376*** [0.171]
Market power	0.126** [0.051]	0.102** [0.049]	0.108** [0.052]	0.011 [0.048]	-0.046 [0.046]	0 [0.050]
GDP Growth Rate	2.484*** [0.386]	2.577*** [0.392]	2.362*** [0.381]	2.454*** [0.375]	2.523*** [0.380]	2.223*** [0.371]
Per Capita GDP	0.040*** [0.014]	0.033** [0.014]	0.063*** [0.012]	0.049*** [0.015]	0.054*** [0.016]	0.086*** [0.013]
Constant	0.158 [0.148]	0.22 [0.149]	-0.0002 [0.138]	1.323*** [0.170]	1.305*** [0.170]	1.056*** [0.156]
Observations	11,339	11,339	11,339	11,339	11,339	11,339
F-statistics	118.1	121.6	115.9	269.3	267	259.1
Bank fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
AR(2)	0.50	0.52	0.50	0.39	0.35	0.40
Hansen (p -value)	0.58	0.58	0.57	0.81	0.79	0.78

Table 9
The effects of financial inclusion after the global financial crisis

The dependent variable is the Z-score—defined as the sum of return-on-assets and equity ratio divided by standard deviation of return-on-assets of each bank over past three years – reported in columns 1-2. As robustness tests, we use alternative bank stability proxy i.e., the (negative of the) standard deviation of a bank’s return-on-assets – reported in columns 3-4. In this case, we follow Beck et al. (2013), and transform standard deviation of return-on-assets to make it directly proportional to bank stability. While for the case of pre-crisis period, all variables are averaged over 2004-07, for the post-crisis period, all variables are averaged over 2008-12. The estimation is based on OLS regressions. *p*-values are calculated by the heteroskedasticity-robust standard errors clustered for countries and are presented in brackets. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI.

Variable	ln(Z-score)		-ln(sd(ROA))	
	Pre-crisis (2004-07)	Post-crisis (2008-12)	Pre-crisis (2004-07)	Post-crisis (2008-12)
	1	2	3	4
Financial inclusion	0.346 [0.311]	0.587*** [0.208]	0.714* [0.377]	0.999*** [0.291]
Loan Ratio	0.857 [0.869]	0.658 [0.522]	0.861 [0.719]	0.505 [0.525]
Bank Size	0.034 [0.045]	0.021 [0.030]	0.062 [0.039]	0.047* [0.026]
Loan Loss Provision	-8.666*** [2.444]	-6.625* [3.725]	-7.825*** [1.976]	-6.696* [3.625]
Income Diversification	-0.016 [0.371]	-0.054** [0.026]	-0.22 [0.514]	-0.077* [0.039]
Management Quality	1.568 [1.197]	1.667*** [0.586]	1.391 [0.956]	1.941*** [0.494]
Capitalisation	1.89 [1.140]	2.023** [0.833]	-3.252*** [0.948]	-3.325*** [0.609]
Market power	0.501*** [0.176]	0.863*** [0.199]	0.355** [0.155]	0.584*** [0.153]
GDP Growth Rate	-2.597 [2.364]	3.975 [2.834]	-5.274** [2.528]	5.235** [2.489]
Per Capita GDP	0.079 [0.071]	0.067 [0.063]	0.073 [0.085]	0.078 [0.057]
Constant	0.654 [1.230]	0.425 [0.698]	3.569*** [1.094]	2.660*** [0.622]
Observations	1,320	2,498	1,320	2,498
Adjusted R ²	0.16	0.18	0.39	0.37
Countries	67	83	67	83

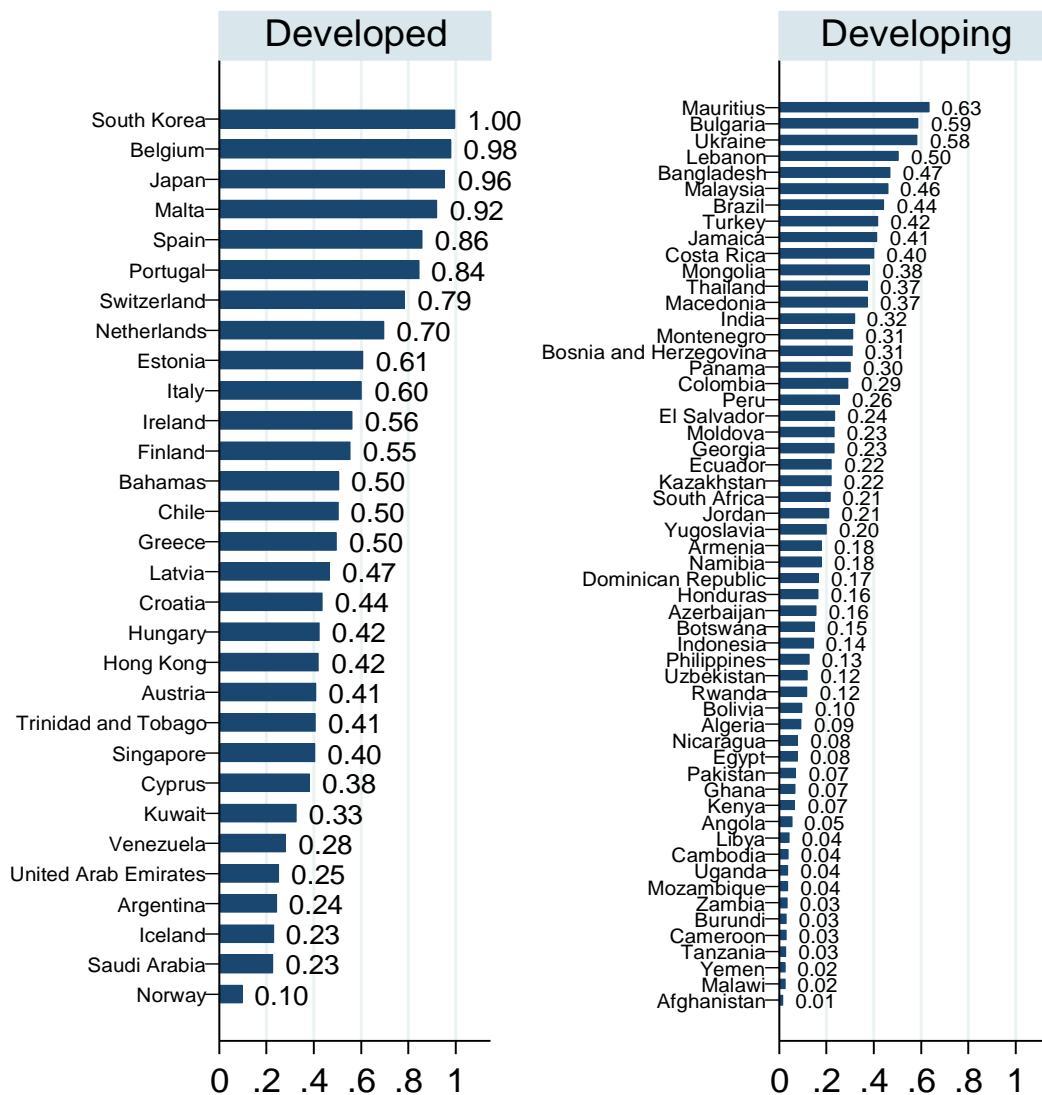
Table 10
The effect of retail deposit funding, market power, and institutional quality on bank stability

The regression model is:

$$Bank\ stability_{i,j} = f(\text{Financial inclusion}_j \times HIGH, \text{Financial inclusion}_j \times LOW, HIGH, \text{Bank characteristics}_{i,j}, \text{Country characteristics}_j)$$

The dependent variable is the Z-score—defined as the sum of return-on-assets and equity ratio divided by standard deviation of return-on-assets of each bank over past three years. All variables are averaged over 2004-12. In Panel A, *HIGH* equals one if the bank’s retail deposit funding share exceeds the sample average and zero otherwise. In Panel B, *HIGH* equals one if the bank’s marginal cost exceeds sample average and zero otherwise. In Panel C, *HIGH* equals one if the bank’s market power exceeds sample average and zero otherwise. In Panel D, *HIGH* equals one if the country’s institutional quality exceeds the sample average and zero otherwise. In all panels, *LOW* is measured as one minus *HIGH*. The estimation is based on OLS regressions. *P*-values are calculated by the heteroskedasticity-robust standard errors clustered for countries and are presented in brackets. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI.

Variable	Financial inclusion index and its dimensions		
	Financial inclusion index	Financial outreach dimension	Usage dimension
Panel A: HIGH indicates banks with HIGH deposit funding share above sample average			
Financial inclusion x HIGH deposit funding share (β_1)	0.391** [0.162]	0.519** [0.206]	0.123 [0.081]
Financial inclusion x LOW deposit funding share (β_2)	0.129 [0.292]	0.316 [0.262]	-0.138 [0.202]
All control variables	Yes	Yes	Yes
F-statistics for test: $\beta_1 = \beta_2$	3.05	3.57	2.73
p-value for test	0.05	0.03	0.07
Adjusted R ²	0.20	0.21	0.20
Number of observations	2,295	2,295	2,295
Panel B: HIGH indicates banks with HIGH marginal costs above sample average			
Financial inclusion x HIGH marginal costs (β_1)	0.041 [0.353]	0.013 [0.365]	-0.077 [0.257]
Financial inclusion x LOW marginal costs (β_2)	0.600*** [0.216]	0.525*** [0.179]	0.281* [0.161]
All control variables	Yes	Yes	Yes
F-statistics for test: $\beta_1 = \beta_2$	0.02	0.06	1.28
p-value for test	0.98	0.94	0.28
Adjusted R ²	0.20	0.20	0.20
Number of observations	2,635	2,635	2,635
Panel C: HIGH indicates banks with HIGH market power above sample average			
Financial inclusion x HIGH market power (β_1)	0.546** [0.242]	0.570** [0.235]	0.102 [0.158]
Financial inclusion x LOW market power (β_2)	0.315 [0.241]	0.405* [0.217]	0.081 [0.187]
All control variables	Yes	Yes	Yes
F-statistics for test: $\beta_1 = \beta_2$	3.31	3.35	1.21
p-value for test	0.04	0.04	0.30
Adjusted R ²	0.16	0.16	0.15
Number of observations	2,635	2,635	2,635
Panel D: HIGH indicates country with HIGH institutional quality above sample average			
Financial inclusion x HIGH institutional quality (β_1)	0.636*** [0.207]	0.594*** [0.204]	0.469*** [0.157]
Financial inclusion x LOW institutional quality (β_2)	0.315 [0.537]	0.429 [0.316]	-0.29 [0.285]
All control variables	Yes	Yes	Yes
F-statistics for test: $\beta_1 = \beta_2$	4.92	4.75	4.67
p-value for test	0.01	0.01	0.01
Adjusted R ²	0.19	0.19	0.19
Number of observations	2,635	2,635	2,635



The (country) average of financial inclusion index = 0.32
 Graphs by developed and developing countries

Figure 1. Financial inclusion index

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