Inclusive Banking, Financial Regulation and Bank Performance: Cross-Country Evidence

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ABSTRACT

The global financial crisis has emphasised the importance of identifying well-designed bank regulation that would work for promoting inclusive finance and bank performance. In this paper, we contribute to this ongoing policy debate by analyzing whether greater financial inclusion can help improve bank efficiency using an international sample of banks. We, first, document a strong positive association between financial inclusion and bank efficiency, and then show that this association is stronger in countries with limited restrictions on banking activities, less barriers on foreign bank entry, and more capital regulation stringency. Exploring plausible channels, we find that greater financial inclusion helps banks reduce the volatility of their deposit-funding share, implying inclusive banking providing more stable long-term funds while also mitigating the negative effects of return volatility. We also show that banks operating in less developed financial markets benefit more from inclusive financial development compared to banks in developed economies. The results are robust to an array of robustness tests, and have significant ramifications for contemporary regulatory reform debate.

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1. Introduction

The seminal paper by King and Levine (1993) and the subsequent literature underscore the important link between financial development and economic growth – a link that has spurred further exploration into various aspects of financial development, and documents not only positive correlations but also causal effect of finance on growth in cross-country regressions.[1] More recent literature, however, has revealed that finance has a non-linear relationship with growth which is stronger among emerging market economies (Aghion et al., 2005; Law and Singh, 2014; Arcand et al., 2015). The recent global financial crisis in 2007-08 has demonstrated the extent of malfunctioning of financial systems in misallocation of resources. Therefore, it has made academics and policymakers to emphasise more on inclusive finance for economic prosperity and growth. In an inclusive financial sector, all economic agents have unfettered access to basic financial services and are able to use them effectively. Despite the optimism about inclusive finance, it is yet to be explored how it impacts the arbiters of financial service providers, especially whether greater financial inclusion is complementary to bank performance.[2]

The global financial crisis has underscored the importance of replacing ill-tailored regulatory framework with the appropriate bank regulation that would aid in promoting inclusive finance and bank performance. A well-functioning, better performing, and efficient financial system can affect real growth by increasing savings rate (e.g., Jappelli and Pagano, 1994) and by channelling funds efficiently (Fries and Taci, 2005; Levine, 2005). Therefore, taking bank regulation and supervision surveys data of Barth et al. (2013a), we also examine whether the relationship between financial inclusion and bank performance differs across countries with varied regulatory and supervisory practices, such as restrictions on banking

[1] See, for example: Levine (1999); Wurgler (2000); Beck et al. (2000); and Bekaert et al. (2005). Most of the studies show that various aspects of financial development causally impact economic growth. For a detailed review of the literature see Levine (2005) and Pasalı (2013).

[2] Throughout this paper, we use the term "inclusive finance" to refer to "financial inclusion" and "inclusive banking".

activities, severe limitations on foreign bank entry/ownership to stifle competition, capital regulation stringency, stronger corporate governance focusing more financial transparency and more official supervisory power, tenure, and independence.

In this paper, unlike many existing studies that use a conventional measure of financial development namely the ratio of private credit to GDP (see Beck et al., 2014; Sahay et al., 2015), we use a composite measure of financial development, that is, financial inclusion. This indicator is constructed based on both demographic and geographic financial sector outreach as well as number of bank accounts, which is then used to investigate how it impacts bank-level performance – bank efficiency. Bank-level productive efficiency scores are obtained from non-parametric Data Envelopment Analysis (DEA). This technique is used to gauging the extent to which performance of individual banks moves away from that optimal standard ("best practice") banks (Assaf et al., 2011; Chortareas et al., 2011; Chortareas et al., 2012; Barth et al., 2013b; Chortareas et al., 2013; Halkos and Tzeremes, 2013; Ayadi et al., 2016; Halkos et al., 2016).

Existing literature, on the one hand, argue that inclusive finance with more extensive financial sector outreach and access to financial instruments could reduce information asymmetries and agency problems between lenders and borrowers (Beck et al., 2014), reduce volatility of funding as banks are able to extract deposits from a large customer base (Han and Melecky, 2013), and also reduce return volatility as banks rely less on risky and costly money market funds (Kacperczyk and Schnabl, 2013). On the other hand, inclusive finance could also increase agency problems due to large product mix and organisational structure and reduce operating efficiency of banks as monitoring a distant bank branch by headquarters becomes more problematic (see Brickley et al., 2003). These competing effects imply that inclusive finance could increase or decrease operating efficiency of banks. However, if the benefits

associated with inclusive finance outweigh the costs, one would expect to see an overall positive relation between inclusive finance and bank efficiency.

By linking country-level supply-side data of Financial Access Survey (FAS) with bank-level data of 2207 banks for the period 2004-2015, we investigate the association between financial inclusion and bank efficiency. Our results indicate that there is a strong positive association between these variables. In particular, the higher the degree of financial inclusion, the better the bank efficiency. We show that this association is stronger in countries with limited restriction on banking activities, less barriers on foreign bank entry/ownership, more capital regulation stringency, more official supervisory power, and stronger corporate governance through market-based monitoring of banks. Exploring plausible channels, we find that greater financial inclusion helps banks reduce return volatility and volatility of customer deposits funding share. We also show that banks operating in less developed financial markets benefit more from inclusive financial development compared to banks in developed economies. We subject our findings to an array of sensitivity checks. Our findings are robust to (i) using 'fractional logit' quasi-likelihood estimator proposed by Papke and Wooldridge (1996); (ii) using instrumental variable approach; (iii) using alternative demand-side measures of financial inclusion extracted from Global Findex Database of the World Bank; (iv) running regressions only for the sample of developing and emerging market economies; and finally (v) controlling for the levels of economic development, inflation, and institutional development.

This paper aims at contributing to the existing empirical analyses in two important ways. First, we fill an important gap in the literature by providing new evidence on the impact of financial inclusion on bank efficiency using an international sample. We contribute to the literature that explores the determinants of bank efficiency (e.g., Berger et al., 1999; Rossi et al., 2009; Barth et al., 2013b; Chortareas et al., 2013; Ayadi et al., 2016). Despite the extensive literature on bank efficiency (see Berger, 2007, for reviews of the literature), a systematic study

on whether financial inclusion increases or decreases efficient operation of banks does not yet exist. This is mainly due to limited data availability for a long period of time across countries and lack of development of reliable quantitative index of financial inclusion. Furthermore, with the recent technological advancement, a new frontier of financial intermediation emerges (e.g., mobile banking, agent banking) which allows banks to reduce transaction costs, acquire effective information, and enforce loan repayment (Bruhn and Love, 2014). The process of structural change and accompanying drive for new banking business have therefore manifested a desire for bank managers to concentrate on improving operating efficiency, particularly considering low-cost technology-driven financial products and services that reach to unbanked/underbanked adult population effectively and efficiently. The emergence of new frontier of financial intermediation has discernible impact on bank performance, and therefore on their operating efficiency.[3] Over the last decade, more financial institutions are increasingly focusing on microfinance style of operation realising the implications of access to finance on their performances as well as on the society in general.[4] Reviewing a body of recent studies, Cull et al. (2014) conclude that including unbanked people into the formal financial system is an important component for economic and social progress. Therefore, identifying policy areas that have a first-order effect on increasing efficiency of financial institutions is critical for policymakers to spur inclusive economic growth, as efficiency gains increase availability of more productive loans and overall economic development (Fries and Taci, 2005).

[3] See Cull and Spreng (2011) for a study on the privatisation of the National Bank of Commerce (NBC) of Tanzania which was split into two banks namely New NBC and the National Microfinance Bank (NMB). While the former had only 35 bank branches and had business lines targeted to commercial enterprises and individuals, mostly located in urban centres, the latter had 95 bank branches and had the objectives of fostering financial access of the disadvantaged groups in the rural and urban centres. Both breakaway banks were able to improve their profitability and the share of performing loans eventually. However, the initial growth of credit of New NBC was slow whereas NMB had decent growth. This is an example that shows how broadening access of the poor people to financial services does not reduce efficiency of banks.

[4] For example: Grameen Bank of Bangladesh, Bank Rakyat Indonesia, Khushhali Bank in Pakistan, BancoSol in Bolivia, Banco Solidario in Ecuador, MiBanco in Peru, Banco Azteca in Mexico, and K-Rep Bank in Kenya are most of the recent success stories that show how commercially-oriented microfinance banks can achieve high operating efficiency and become profitable while serving the poor. For more on commercially-minded microfinance bank see Harper and Arora (2005) and Bruhn and Love (2014).

Second, we contribute to the literature on finance and growth by exploring the role of regulatory and supervisory practices across countries on the link between inclusive financial development and performance of banks. Literature suggests that a well-functioning and efficient financial system exerts a first-order impact on economic growth and development (see e.g., Levine, 2005). Therefore, by identifying regulations that are important for expediting inclusive financial development, we aim to contribute to an ongoing policy debate, which would be useful to researchers and policymakers alike for making informed decisions on access policies; a well-designed regulatory framework would be important for ushering efficient intermediation of banking sector.

Third, we provide a modified spatial model to incorporate bank heterogeneity and financial outreach in order to motivate the empirical analysis. Inclusive finance can help weaker banks to increase deposit taking, but those less stable or inefficient banks may not benefit because their marginal cost of providing banking services is very high relative to more stable or efficient banks. It can also be argued that people may not have confidence in keeping their money with low-tier banks or they will keep the amount that is insured by the government as part of deposit insurance. It is possible that more efficient banks benefiting more from inclusive banking could change the market structure of the banking industry giving rise to higher concentration that would require enabling regulatory intervention to help banks who face high restrictions and capital requirements. Thus, greater inclusive banking and enabling regulatory intervention can jointly help banks perform better. It is important therefore to examine whether inclusive banking is effective even in the presence of high regulatory capital requirement and other restrictions across the efficiency distribution.

The remaining part of the paper is organised as follows: Section 2 discusses the related literature and hypothesis. Section 3 provides the analytical model on inclusive banking and bank performance. Section 4 describes the data and methodology. Section 5 discusses the

empirical results. Section 6 discusses the sensitivity analyses. Section 7 provides evidence on the mechanisms through which inclusive finance may enhance banks' operating efficiency, and Section 8 concludes with some policy implications.

2. Literature review and hypothesis development

This section discusses the associated literature and formulate the hypothesis on the relation between inclusive finance and bank efficiency.

Levine (2005), reviewing a large body of literature, shows that supply of financial services exerts a first-order impact on real economic growth. Financial intermediaries are vital to economic prosperity and growth as they mobilise savings, facilitate information sharing, help growing small and medium-sized firms in allocating funds efficiently. In an inclusive financial sector with more extensive bank branches/ATMs and with more people having access to financial services, banks are able to reduce information asymmetry and agency problems between borrowers (see Beck et al., 2014). Beck et al. (2007) find that greater banking sector outreach reduces firms' financial obstacles.

Existing literature suggests several channels through which an inclusive financial sector might influence efficient intermediation of the financial institutions. First, higher financial inclusion increases the opportunity for banks to reduce volatility of their funds as they are able to extract deposits from a large number of people, which is often the principal source of funds for banks (Calomiris and Kahn, 1991). It is often dubbed that retail deposits are sluggish, insensitive to risk and provide stable cheaper source of long-term funding compared to wholesale funding that are sophisticated, relatively risky and expensive as wholesale funders possess critical information about the prospects of bank projects (see Song and Thakor, 2007; Huang and Ratnovski, 2011).[5] Rajan (1992) compares informed and arm's length debt and

[5] See for example Shin (2009) and Goldsmith-Pinkham and Yorulmazer (2010).

shows that former debt holders (i.e., wholesale funders) could ask for higher compensation for further funding if they sense any negative prospects of bank projects. Using a sample of European Union countries, Poghosyan and Čihak (2011) also confirm that banks depending extensively on wholesale funding are more exposed to distress than those banks that are mostly depending on retail deposits. Overall, greater financial inclusion would imply opportunities for banks to access more customer deposits, ensuring a stable source of funding, which then result in more operating efficiency for banks.[6]

Second, as inclusive financial sector allows banks to reduce funding volatility, it has also implications on reducing return volatility. Investigating risk-taking incentives of money market funds, Kacperczyk and Schnabl (2013) show that money market funds have strong incentives to take more risk as they chase for higher yields. Due to reduction of market discipline on financial institutions, it makes them more susceptible to financial shocks. A plethora of empirical evidence shows that banks that relied substantially more on non-deposit sources of funds during global financial crisis (GFC) have experienced significantly large negative effect on their stock returns, exacerbating their risk-taking attitudes (Demirgüç-Kunt and Huizinga, 2010; Raddatz, 2010). On the contrary, banks with stable funding sources, particularly U.S. banks, continued lending relative to other banks (Cornett et al., 2011), and had lower probability of failure (Bologna, 2011). Demirgüç-Kunt and Huizinga (2010), using a sample of listed banks in 101 countries for the period 1995-2007, show that higher level of non-deposit/wholesale funding shares lowers the rate of return on assets and/or bank

[6] Most of the emerging economies are continuously adopting pro-access policies to broaden financial inclusion. For instance: to get rid of financial untouchability, Indian government launched a scheme called the '*Pradhan Mantri Jan Dhan Yojana*' (Prime Minister's People Money Scheme) on 28 August 2014. Within two weeks of launch of this scheme, banks were able to accumulate *retail deposits* of INR 15 Billion (US$ 240 million), with around 30.2 million new accounts. Over the last 3 years, over 300 million unbanked adults have now access to banking services, and banks have been able to mobilize over INR 670 billion (US$ 10 Billion).

soundness.[7] As inclusive financial sector provides ample opportunities for retail deposits funding, it therefore should reduce return volatility of banks operating in such markets.

However, there may be countervailing effect due to higher distance-related agency problems and organisational structure in financially more inclusive economies. First, in an inclusive financial sector, banks expand branches to unbanked remote areas. As distance increases between headquarters and distant branches, monitoring of the latter by senior managers becomes more difficult (see Brickley et al., 2003). In this case, the farther away a branch is from the headquarters due to broadening access of the unbanked people to finance, the more difficult it gets to transmit efficiencies and aptitude of the senior managers to branches for enhancing overall operating efficiency.[8] Second, another offsetting effect may stem from complex organisational and product structure associated with financial inclusion. Broadening access of the scattered and all income groups to financial services requires banks to maintain a large branch network and diverse product lines targeted to all customers. Inefficiency may arise due to lack of managerial and technical expertise, agency problems related to complex organisational and product structure. Therefore, in the end, whether inclusive financial sector is associated with bank performance becomes an empirical question.

Hypothesis *1*: *Financial Inclusion is positively associated with bank performance.*

3. Analytical model

We consider a modified spatial model to incorporate firm heterogeneity and customer's locational preferences for banking services (see Ali and Greenbaum, 1977; Chiappori et al.,

[7] Beltratti and Stulz (2012) analyse overall performance of large banks around the World over the recent financial crisis period (i.e., July 2007 to December 2008). They find that banks financed with less (more) short-terms funds in the money markets (deposits) performed better.
[8] Berger and DeYoung (2001) find that the extent of parent's control over the efficiency of affiliates decline as their distance increases.

1995; Ho and Ishii, 2011). Banks are different in their locations and in efficiency. We assume that there is a continuum of potential consumers who are uniformly distributed over a street and have different wealth endowments, which are not fully observed by banks.

Before banking inclusion, only customers with sufficient "observable" wealth (as collaterals) are able to open an account and apply for a loan. With banking inclusion, every potential consumer can open an account, which allows the bank to retrieve information about their endowments, although there could also be more agency costs with these previously excluded customers. The banks will benefit by the increase in deposits from these customers, and the customers have the chance to earn interests or to apply for a loan.

We first characterize the equilibrium of the industry before banking inclusion and before regulating bank activities and capital adequacy ratio (see Barth et al., 2013a). Then we analyze how these two regulations can affect bank efficiency. Finally, we examine the impact of banking inclusion and its interaction effects with the two regulations on bank efficiency.

3.1 Before Inclusive Banking

Following the literature, we assume that there are two banks: A and B, located on points a and b of a unit street with $0 < a < b < 1$. There is a continuum of potential customers located uniformly on $[0,1]$, and let $x \in [0,1]$ denote a customer who is located at point x. Each potential customer is endowed with an observable wealth ϖ and a privately known random income ε^{ϖ}. For simplification, we assume that ϖ is uniformly distributed over $[0,1]$. The privately known income ε^{ϖ} can be interpreted as the harvests from crops, which due to weather uncertainty, is uniformly distributed over $[-1,1]$ with a mean 0.

3.1.1 Customer's Payoff

A customer with a total wealth $(\varpi+\varepsilon^{\varpi})$ will keep her wealth at home if there is no access to banking. On the other hand, if she deposits her wealth in a bank, she needs to calculate

the expected return and the transaction cost associated with the customer's locational difference with the bank.

Specifically, let θ and $(1-\theta)$ be a customer's weight on her locational preference and the expected return from depositing, respectively. First, for customer located at x, the locational preference for depositing in bank A is $-\delta|x-a|$, and the locational preference for depositing in bank B is $-\delta|x-b|$. This setup implies that ceteris paribus, customers prefer depositing with nearby banks.

Second, once opening an account, a customer has two options and therefore two possible returns. (1) She can keep all her wealth $(\varpi+\varepsilon^{\varpi})$ in the bank and earn interest, provided that the bank does not go bankrupt. Let P_a and P_b be bank A and B's survival probabilities. This is the probability that a bank's profit remains positive (see Freixas and Rochet, 1997, p.24). As will be demonstrated, the bank efficiency is positively related to a bank's profit, and hence P_i is positively related to bank i's efficiency. In sum, a customer's expected payoff for this case is $P_i(1+r_i)(\varpi+\varepsilon^{\varpi})$, where r_i is bank i's interest rate.

(2) She can borrow L, invest in a risky project and gain $[E(\rho)-(1+\phi)]L$. Here $E(\rho)$ is the expected rate of return from investment and ϕ is the interest charged for this loan L. Without loss of generality, we assume that this loan is greater than a customer's wealth $\varpi+\varepsilon^{\varpi}$. To simplify notations, let V_i be the maximum of these two payoffs, where

$$V_i(\varpi+\varepsilon^{\varpi}) \equiv \max\{P_i(1+r_i)(\varpi+\varepsilon^{\varpi}), [E(\rho)-(1+\phi)]L+\varpi+\varepsilon^{\varpi}\}. \quad (1)$$

Notice that during financial crisis, the expected return from risky investment will be relatively low, and customers tend to keep their money with the bank. That is, when $E(\rho)$ is low, we have $V_i(\varpi+\varepsilon^{\varpi}) \equiv P_i(1+r_i)(\varpi+\varepsilon^{\varpi})$.

Overall, a customer's payoff for opening an account in bank $i=A,B$ is:

$$(1-\theta)V_i(\varpi+\varepsilon^{\varpi})-\theta(\delta\,|\,x-i\,|),\ \ i=a,b.$$

To have a non-trivial result, we assume that this value is higher than the endowments $\varpi+\varepsilon^{\varpi}$, so that every potential customer has the incentive to access banking.

3.1.2 Bank's Demand

For simplification, we assume that before banking inclusion, only customers with sufficient "observable" wealth, are able to open an account and apply for a loan. In our setup, only customers with observable wealth $\varpi > \underline{\varpi}$, can open an account. This wealth restriction $\underline{\varpi}$ is the required collateral for lending a fixed loan L. Hence, before inclusion, only $(1-\underline{\varpi})$ of potential customers can open an account.

For every $\varpi > \underline{\varpi}$, there exists a customer $\hat{x}$ who is indifferent between depositing in bank A and B; namely,

$$(1-\theta)V_a(\varpi+\varepsilon^{\varpi})-\theta(\delta(\hat{x}-a))=(1-\theta)V_b(\varpi+\varepsilon^{\varpi})-\theta(\delta(b-\hat{x})).$$

Hence

$$\hat{x}=\frac{(1-\theta)}{2\theta\delta}[V_a(\varpi+\varepsilon^{\varpi})-V_b(\varpi+\varepsilon^{\varpi})+(b-a)$$

It is obvious that $\hat{x}$ increases with $V_a(\varpi+\varepsilon^{\varpi})$ and b, and decreases with $V_b(\varpi+\varepsilon^{\varpi})$ and a.

Therefore, there will be a proportion $\hat{x}$ of the customers with $\varpi > \underline{\varpi}$, who will deposit in bank A, and $(1-\hat{x})$ of customers will deposit in bank B. In other words, let D_i^0 denote bank i's deposit before financial inclusion, we have $D_a^0=(1-\underline{\varpi})\hat{x}$, and $D_b^0=(1-\underline{\varpi})(1-\hat{x})$.

3.1.3 Bank's Payoff

After receiving the deposit, each bank makes a portfolio choice between risky and safe assets. To simplify, let I_i denote bank i's investment in risky assets, and let L_i be the total sum of loans made to their customers. Bank i's expected return will be:

$$\pi_i = \int_1 \{(1+R)I_i\} dF(R) + \overline{P}(1+\phi)L_i + (D_i^0 - I_i - L_i) - c(D_i^0).$$

The first term is the expected return from risky investment I_i, and R is the rate of return and we assume that the distribution of R is $F(R)$. The second term is the expected return from making loans to customers, where $\overline{P}$ is the probability that $E(\rho) \geq (P_i(1+r_i)-1)(\varpi+\varepsilon^{\varpi})/L+(1+\phi)$, when depositors choose to borrow L from the bank. The third term is the return for safe asset whose return is normalized to be one. Finally, there is a convex cost function for managing the deposit $c(D_i^0)$.

Following Li et al. (2001), Marcus (2001), Forster and Shaffer (2005), and Liebscher (2005), the bank efficiency ratio is defined as the ratio of 'non-interest expenses divided by revenue', that is,

$$c_i(D_i^0)/\{\int_R \{(1+R)I_i\} dF(R) + \overline{P}(1+\phi)L_i + (D_i^0 - I_i - L_i)\}. \quad (2)$$

As π_i increases, this ratio will decrease and the bank efficiency will increase. Likewise, as D_i^0 increases, if the marginal cost $c'(D_i^0)$ is relatively small, then the bank efficiency will increase.

3.1.4 Impact of Regulations

With this framework, we can provide a simple analysis on the impact of two regulations on banking activities and on the capital adequacy ratio. First, according to Barth et al. (2013b), regulations on bank activities include: (a) underwriting, brokering and dealing in securities, and all aspects of the mutual fund industry; (b) insurance underwriting and selling; and (c) real estate investment, development and management.

Prohibiting these activities will reduce the investment risk and the expected return. Hence in our setup, let $F^r(R)$ be the return distribution associated with regulations on these activities. The mean of $F^r(R)$ is smaller than the mean of $F(R)$, and hence the term $\int_R \{(1+R)I_i^r\}dF^r(R)$ is smaller than $\int_R \{(1+R)I_i\}dF(R)$. Notice that since the mean of $F^r(R)$ is smaller, the investment in risky asset I_i^r is smaller under regulations. Thus from (2), we expect that the efficiency ratio will increase and hence the bank efficiency will decrease under the regulations on bank activities.

Second, under Basel III,[9] the minimum capital adequacy ratio that banks must maintain is 8%. The capital adequacy ratio measures a bank's capital in relation to its risk-weighted assets. In our terminology,

$$\overline{P}(1+\phi)L_i + (D_i^0 - I_i - L_i) / \int_R \{(1+R)I_i\}dF(R) \geq 8\%,$$

or alternatively,

$$\int_R \{(1+R)I_i\}dF(R) \leq 12.5\{\overline{P}(1+\phi)L_i + (D_i^0 - I_i - L_i)\}.$$

In this case, there will be an upper bound on the risky investment I_i^0, given by

$$\int_R \{(1+R)I_i^0\}dF(R) + 12.5I_i^0 = 2.5\{\overline{P}(1+\phi)L_i + (D_i^0 - L_i)\}.$$

For further use, note that I_i^0 will increase with D_i^0.

If this upper bound is binding, then the bank's risky investment will be cut down to I_i^0. From (2), we expect that the efficiency ratio will increase and hence the bank efficiency will decrease under the regulations on capital adequacy ratio. We have the following result regarding the impact of the two regulations.

Proposition *1*. *Both the regulations on bank activities and CAR will reduce bank efficiency.*

[9] The Basel Committee on Banking Supervision published the first version of Basel III in late 2009.

Since inclusive banking will change each bank's received deposits (i.e., D_i^0), there can be interactive effects which we will discuss next.

3.2 With Inclusive Banking

With inclusive banking, every potential customer including those with $\varpi < \underline{\varpi}$, is now able to open an account. Since these customers are not eligible to borrow as their observable wealth is not enough for collaterals, they can only deposit and earn interest (in the beginning), in which case $V_i(\varpi + \varepsilon^{\varpi}) \equiv P_i(1+r_i)(\varpi + \varepsilon^{\varpi})$ in equation (1). Hence for customers with $\varpi < \underline{\varpi}$, there exists a customer $\bar{x}$ who is indifferent between depositing in bank A and B, and

$$\bar{x} = \frac{(1-\theta)}{2\theta\delta}[P_a(1+r_a)(\varpi + \varepsilon^{\varpi}) - P_b(1+r_b)(\varpi + \varepsilon^{\varpi})] + (b-a). \tag{3}$$

It is obvious that $\bar{x}$ increases with P_a, r_a, b and decreases with P_b, r_b, a.

In other words, there will be a proportion $\bar{x}$ of the customers with $\varpi < \underline{\varpi}$ who will deposit in bank A, and $(1-\bar{x})$ of these customers will deposit in bank B. Hence with inclusive banking, there will an increase ΔD_i in bank i's deposit, where $\Delta D_a = \underline{\varpi}\bar{x}$, and $\Delta D_b = \underline{\varpi}(1-\bar{x})$.

3.2.1 Without Regulations

First, the deposit increase (i.e., ΔD_i) will vary with a bank's survival probability and the bank efficiency. If $P_a > P_b$, and if P_a is sufficiently high such that $\bar{x} > 1$, then there is no deposit increase in the inefficient bank after financial inclusion. In this case, the inefficient bank may not benefit from financial inclusion. Alternatively, if P_a is not so high such that

$\bar{x}<1$, then it follows from equation (3) that $\Delta D_a > \Delta D_b$. That is, the deposit increase in efficient bank is higher after inclusive banking.

However, as deposit increases from D_i^0 to $D_i^0 + \Delta D_i$, the total amount of loan made to the customers remains the same (because customers with $\varpi < \underline{\varpi}$ are not eligible for borrowing), and hence the denominator of the efficiency ratio will increase. Since $\Delta D_a > \Delta D_b$, the increase in bank A's denominator is higher than that of bank B.

Next, more customers may also increase the agency costs and the operation costs. If the more efficient banks also own better skills in investigation (so that $c_a^{'} < c_b^{'}$), then the increase in bank A's operation cost will be lower after banking inclusiveness. Together with the increase in the denominator, we have the following results.

Proposition 2. *(1) Inclusive banking increases the efficiency of more efficient banks ; (2) If the increase in agency cost is sufficiently high, then inclusive banking may reduce the efficiency of inefficient banks.*

Finally, we examine the impact from financial crisis. During financial crisis, the expected return from risky investment is relatively low, and customers tend to keep their money with the bank. That is, when $E(\rho)$ is low, we have $V_i(\varpi + \varepsilon^{\varpi}) \equiv P_i(1+r_i)(\varpi + \varepsilon^{\varpi})$. Hence, following our argument in Proposition 2, financial inclusion will benefit the efficient bank more, and the efficient bank's efficiency will increase, during the financial crisis.

Corollary 3. *During the financial crisis, inclusive banking will benefit the efficient bank more, and the efficient bank's efficiency will increase.*

3.2.2 With Regulations

Proposition 1 describes that both the regulations on bank activities and the CAR will reduce bank efficiency, while Proposition 2 says that inclusive banking will increase the efficient bank's efficiency, and may reduce the inefficient bank's efficiency if the increase in

agency cost is sufficiently high. The net effects on bank efficiency will depend on the relative magnitudes of these two effects.

Nevertheless, we can provide some results on the interaction effects. First, recall that restricting bank activities will reduce the expected return, and hence we replace $F(R)$ with $F^r(R)$, whose mean is smaller. This will also reduce bank investment in risky assets to I_i^r . Inclusive banking will increase deposits from D_i^0 to $D_i^0 + \Delta D_i$. But since the risky asset's expected return does not change with the increase in deposits, there is no interaction effect in this case.

Second, as we noted earlier that with regulations on CAR, the upper bound of risky investment I_i^0 will increase with D_i^0 . So, when deposit increases to $D_i^0 + \Delta D_i$, the upper bound for risky investment will increase, and hence the reduction in bank efficiency will be lessened.

Proposition 4 *(1) There is no interaction effect between inclusive banking and regulations on bank activities. (2) Inclusive banking will lessen the negative effect of CAR regulation.*

4. Data and Methodology

To test the relationship between financial inclusion and bank performance, we combine bank- and country-level data from various sources. This section discusses the assorted data sources, variables and methodology that we use in this paper. Appendix Table A1 provides definitions and sources of all variables.

4.1 Data sources

We compile data from a number of sources: (a) the bank level dataset is compiled from BankScope database provided by Bureau van Dijk and Fitch Ratings; (b) the country-level data compiled from the World Bank World Development Indicators (WDI); (c) the country-year level data on bank regulation and supervision compiled from Barth et al. (2004); Barth et al. (2008); and Barth et al. (2013a); (d) the instruments for IV regressions are collected

from Doing Business database; (e) the indicators used to measure financial inclusion index are collected from the International Monetary Fund's (IMF) Financial Access Survey (FAS) database.

Given the trade-off between data availability (e.g., availability of required dimensions of financial inclusion) and cross-country sample coverage, we manage to measure financial inclusion index for 123 countries over the period 2004 to 2015, and match the country-year of FAS data with that of bank-level data. Our dataset comprises of 2,207 commercial banks, cooperative banks and Islamic banks (15,445 bank-year observations) operating in 123 countries over the time period 2004-15, which represent, respectively 46%, 52%, and 2% of the sample.[10] Considering the objective of this paper, we exclude countries for which we have no information on different dimensions of FII.[11] We deflate all monetary values to 2015 (2015 = 100) prices using the GDP deflator of U.S. obtained from the Federal Reserve Economic Data. The deflated series are reported in millions of U.S. dollar ($).

4.2 Measuring bank performance: bank efficiency scores

To examine the impact of financial inclusion on bank performance, we use two-stage approach. In the first-stage, we employ the widely used input-oriented non-parametric Data Envelopment Analysis (DEA) to measure the efficient frontier and estimate efficiency scores. Then in the second-stage, we use these efficiency scores as a measure of bank performance and regress them on financial inclusion indicators while controlling for bank- and country-specific characteristics.[12]

[10] Bank-level data are sourced from unconsolidated reports of banks. However, we discard unconsolidated reports of banks whenever consolidated one of the same group is available in order to avoid any double counting of institutions.

[11] In particular, as FAS does not have information for Australia, Germany and USA, these countries are not included in the analysis.

[12] Since the seminal work of Leibenstein (1966) introducing the concept of x-inefficiency (the gap between ideal and actual efficiency), the analysis of firm performance using frontier approach has been employed in numerous recent studies as it helps summarising performance in a single statistic (for more, see Ayadi et al., 2016).

The advantages of using non-parametric linear programming (LP) framework like DEA compared to parametric technique, such as the Stochastic Frontier Analysis (SFA) are: (i) as frontier analysis requires to assume a particular functional form, failure to choose accurate functional form yields biased efficiency scores, which is not the case for DEA methods because of its non-parametric nature and they do not require any functional form assumption (Drake et al., 2006); (ii) frontier approach is based on the central-tendency properties with strong semi-structural assumptions and they do nothing on how to measure the efficient frontier, whereas DEA evaluates bank performance to the revealed best-practice frontier (Barth et al., 2013b).

Let's assume the sample size is n and there are p inputs and q outputs for each bank i.[13] Denote $x_i = (x_{1i}, x_{2i}, ..., x_{pi})$ as a $p \times 1$ vector of inputs for bank i, $X = (x_1, x_2, ..., x_n)$ as a $p \times n$ matrix of inputs, $y_i = (\mathrm{y}_{1i}, \mathrm{y}_{2i}, ..., \mathrm{y}_{qi})$ as a $q \times 1$ vector of outputs for bank i, and $Y = (\mathrm{y}_1, \mathrm{y}_2, ..., \mathrm{y}_n)$ as a $q \times n$ matrix of outputs, respectively. The variable returns to scale (VRS) DEA model for each bank i $(i = 1, 2, ..., n)$ can be expressed with the following linear programming problem:

$$\mathrm{Max}(\varphi_i \geq 1 \mid x_i, y_i, XY) = \mathrm{Max}(\varphi_i \geq 1 \mid \varphi_i y_i \leq Y\lambda_i, X\lambda_i \leq x_i, \lambda_i \geq 0, \mathrm{I}_1' \ \lambda_i = 1), \tag{4}$$

where I_1 represents a $n \times 1$ vector of ones, φ_i represents a scalar parameter, and λ_i $(\lambda_{1i}, \lambda_{2i}, ..., \lambda_{ni})'$ represents a $n \times 1$ non-negative vector of parameters.

The interpretation of DEA model is intuitive. For each bank i, a simulated output $(Y\lambda_i)$ is created as a weighted output of all banks by taking some non-negative weights $\lambda_i \geq 0, \mathrm{I}_1' \lambda_i = 1$. The simulated outputs $(Y\lambda_i)$ are maximized as much as possible, subject to the inputs constraint of bank i $(\mathrm{X}\lambda_i \leq x_i)$, which is then evaluated with the real outputs (y_i) of

[13] See Barth et al. (2013b).

bank i. Bank i is considered inefficient if the expanded simulated outputs $(Y\lambda_i)$ are above the real outputs (y_i) of bank i by a scalar factor of $\varphi_i > 1$ or else the bank is considered to be situated at the efficient frontier as $\varphi_i = 1$. An input-oriented efficiency score of bank i is defined as $e_i = 1/\varphi_i$ $(0 \le e_i \le 1)$. With DEA method, an efficiency score of one means that the bank is situated at the efficient frontier and is unable to produce further outputs without increasing its inputs, whereas an efficiency score of less than one means that the bank is comparatively inefficient, and should produce the current level of outputs with fewer inputs.

Banks' efficiencies are calculated relative to a common frontier separately for each year by pooling data across countries. The advantage of this approach is that it allows us to estimate efficiency differentials not only between banks within countries but across countries as well due to same benchmark (see Chortareas et al., 2013). Intermediation approach of Sealey and Lindley (1977) is followed where financial institutions use deposits, labour, and physical capital as inputs to produce interest-earning assets, that is, loans and investments. We use an intermediation model that has three inputs (i.e., *total deposits, money market and other funds; personnel expenses;* and *total fixed assets)* and three outputs *(total loans; total other earning assets,* and *total non-interest income*). Appendix Table A1 shows the descriptive statistics of the inputs and outputs used in the measurement of DEA efficiency score.

4.3 Constructing financial inclusion index

Policymakers identified financial outreach and usage as the main indicators for financial inclusion. Following Ahamed and Mallick (2017), we use these two dimensions to construct our financial inclusion index (FII).[14] Financial outreach dimension is used to account

[14] Adding more dimensions such as the affordability that may reflect the "transaction costs" and "ease of transaction" would make financial inclusion index more comprehensive. However, we could not incorporate affordability dimension due to the limitations of comparable macro data across economies. Certainly, incorporating information, that is, 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), would have improved the quality of financial inclusion index.

for the pervasiveness of outreach of the financial sector in terms of banks' physical outlets, as physical distance to physical point of financial services deems to be an important impediment to financial inclusion (see Allen et al., 2014). Following Beck et al. (2007), we use two classes of penetration of banking services, i.e., demographic and geographic penetration of bank branch and ATM, and create four sub-indices. 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 number of ATMs per 1,000 square kilometres. For the usage dimension, we use the number of bank accounts per 1,000 populations in order to integrate the depth of the financial access.[15] Since financial inclusion is a multidimensional concept, using standalone indicators of financial inclusion would provide incomprehensive picture of inclusiveness of the financial sectors, and hence implications on bank efficiency. We therefore build upon Beck et al. (2007) to construct a composite weighted index of financial inclusion using principal component analysis (PCA) as follows:[16]

$$FII = \sum_{i=1}^{n} w_{ij} X_i \tag{5}$$

where w_{ij} are the component's loadings or weights; and X_i are the original variables. First, we apply PCA to estimate the financial outreach dimension from a group of four sub-indices related to outreach mentioned above. Second, we apply again PCA to estimate the overall FII by using financial outreach and usage as causal variables.[17] In PCA, the first principal component is the single linear combination of the financial inclusion indicators that explains the most of the variation.

[15] Measuring penetration dimension, the number of accounts per capita is used, as data on the number of people having bank accounts is limited. In the former case there is a possibility of double counting same person having multiple accounts.

[16] For details on principal component analysis (see also e.g., Tetlock, 2007).

[17] Before using PCA, first, we winsorise each indicator at the 95th percentile levels to reduce the influence at the upper tail. Second, we normalise each indicator to have values between zero and one to ascertain the scale in which they are measured is immaterial.

In case of financial outreach dimension, the first principal component (PC) explains about 69% variations with the eigenvalue of more than one, that is, 2.74. This dimension is calculated using weights (i.e., 0.53, 0.53, 0.45, and 0.49) assigned to the first PC. Constructing FII, we find two PCs with eigenvalues of 1.57 and 0.43. Again, the first PC explains about 78% of the corresponding sample variance (see Panel B). Since only the first PC has eigenvalue that is more than one, according to the Kaiser rule, we assume that it sufficiently explains the common variation among these dimensions.[18] The parametric methods that we have applied for constructing FII assigns factor loadings (weights) on each dimension. We use these weights to construct FII as in equation (5). It is noted that usage dimension has relatively much lower weights than the financial outreach dimension.[19] We normalise FII and assign each country along a 0-1 scale for ease of interpretation in the subsequent analyses, where zero indicates financial exclusion and one indicates financial inclusion.[20]

4.4 Bank-specific and macro control variables

Following banking literature, we use a number of bank- and country-characteristics that can be correlated with the bank efficiency. Specifically, we use logarithm of total asset (*LogTA*) to account for scale economies of individual banks. To account for liquidity risk, capital risk, and loan portfolio risk, the ratio of total loans to deposits (*LIQ*), the ratio of shareholder's equity to total assets (*EQA*), and the ratio of loan loss provision to total loans (*LLP*) are used respectively. Next, there are two macroeconomic control variables. First, real GDP growth rate (*GDP*) is used to control for economic growth. Second, population growth

[18] Dropping some PCs may help reducing a portion of noise components from our data, and ensures reliability of the subsequent analyses in this paper.
[19] In the spirit of Tetlock (2007), we check the stability and robustness of our financial inclusion index. In this effort, we use PCA 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. 0.99), indicating the robustness of our index irrespective of how loadings are determined.
[20] Our primary objective in this paper is to explore the effects of inclusive financial sector on bank efficiency for the period 2004-15, therefore, FII is constructed across countries and period considering the evolution of financial inclusiveness.

(*Pop_gr*) is used to account for the demand of financial services. We also check the sensitivity of baseline results using an array of additional country-level variables related to the levels of economic development, inflation, and institutional development. The latter is compiled from Kaufmann et al. (2010) Governance Index database.

4.5 Bank regulatory and supervisory indicators

Though the primary objective of this study is to investigate whether financial inclusion impedes or improves bank performance, it is also important to see how different regulatory and supervisory practices across countries play a role in this relationship. We have used three key indicators related to banking regulation and supervision surveys of Barth et al. (2004); Barth et al. (2008), and Barth et al. (2013a) for the period 2004-2007, 2008-2011, and 2012-2015, respectively. These variables have been defined in Barth et al. (2004). AR (activity restrictions) measures the degree of restrictions imposed on a bank's activity. LF (limitations of foreign bank entry/ownership) measures the degree of regulation that is in place to reduce competition through limiting foreign bank entry/ownership. Finally, CS (capital stringency) measures the degree of capital risk management restrictions that incorporates certain risk elements and also deducts market losses in setting up capital adequacy.

4.5 Descriptive statistics

Table 1 reports descriptive statistics of all variables, while the Appendix Table A3 presents the correlations between the different variables. The average technical efficiency is 0.35 with a standard deviation of 0.21. The higher standard deviation suggests that there is substantial variation in the levels of efficiency scores. The average *LogTA* is 6.86 with standard deviation of 1.59, indicating heterogeneous sizes of banks. The averages of *LIQ* and *EQA* are 0.76 and 0.11 respectively. *LLP* has a standard deviation of 0.02 with an average of just 0.01. The average of the volatility of customer deposits (σ_{CDEP}) is 0.04 with a standard deviation of

0.06, indicating that there is substantial variation in the volatility of deposit funding among banks.

The average of return volatility (σ_{roa}) is 0.01 with a standard deviation of also 0.01. The average of the variable of interest, financial inclusion index, is 0.26 with standard deviation of 0.21, indicating a considerable heterogeneity in the inclusiveness of financial sectors across 123 countries. The variation in financial outreach and usage dimensions is also considerably high. Table 2 reports the average values of technical efficiency and financial inclusion indicators. While Japan, Malta, and Portugal have the most inclusive financial sector, Central African Republic, Chad, Sudan have the least inclusive financial sector. Figure 1 shows the evolution of financial inclusion and its associated dimensions, indicating a clear uptrend for the sample period.

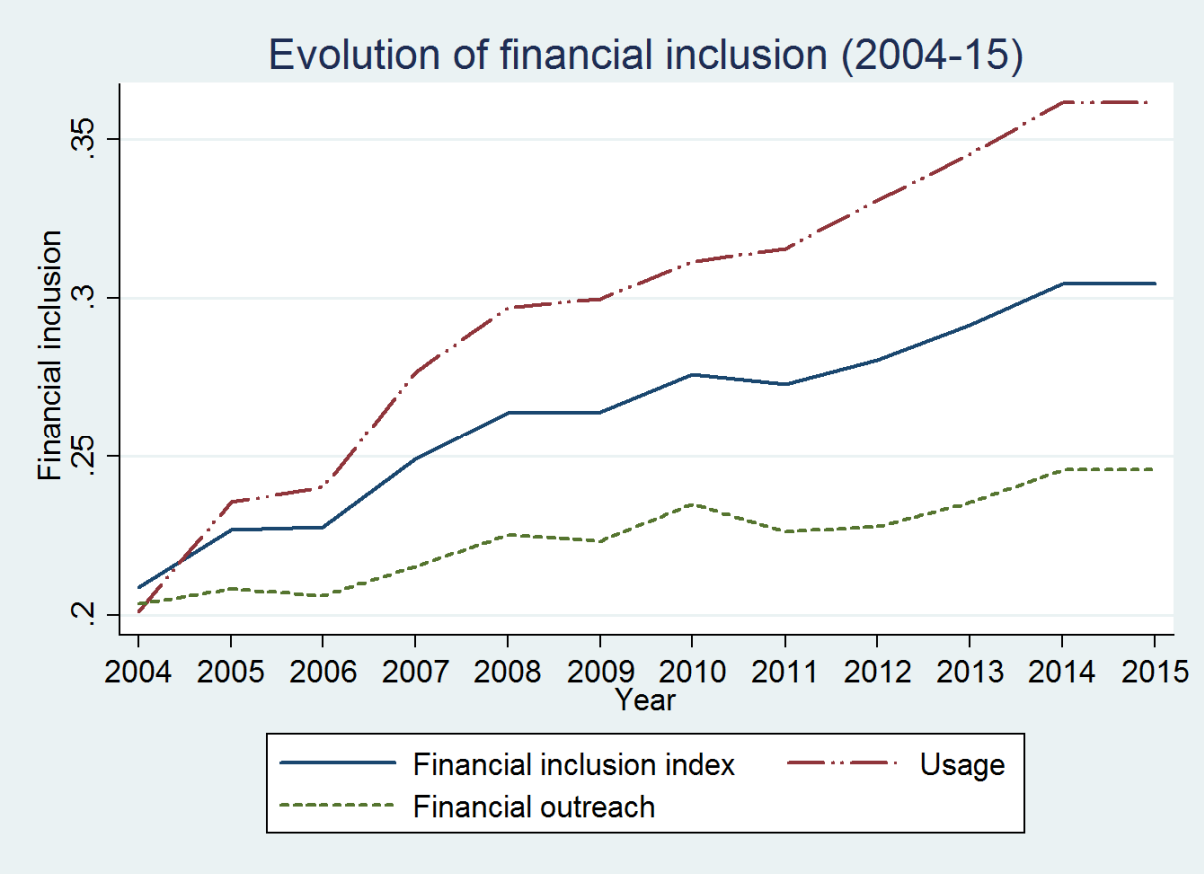

Figure 1: Evolution of financial inclusion indicators

4.6 Methodology

In the second-stage, to examine the impact of financial inclusion on bank performance, we run several regressions using the following baseline model:

$$Eff_{ijt} = \beta_0 + \beta_1 Financial\ Inclusion_{jt} + \beta_2 BC_{ijt} + \beta_3 KC_{jt} + Year_t + \varepsilon_{ijt} \quad (6)$$

where the *i, j* and *t* subscripts indicate bank, country and year, respectively. *Eff* is bank-level technical efficiency, measured considering an efficient frontier, as a performance indicator. *BC* and *KC* are bank- and country-specific control variables, respectively. Our main explanatory variable of interest is *financial inclusion* and its associated dimensions, measured at the country level. *Year* is a yearly dummy variable controlling inter alia for other macroeconomic and time varying global business cycle effects. Equation (6) is estimated employing the Simar and Wilson (2007) parametric regression bootstrap, which incorporates the parametric structure and distributional assumptions of the equations, to estimate bootstrap confidence intervals for the parameter estimates $\hat{\beta}_1 - \hat{\beta}_3$. This is achieved by using 2,000 bootstrap replications. As a sensitivity analysis, we also estimate Equation (6) using fractional logit estimator proposed by Papke and Wooldridge (1996). Given the possibility that our results might suffer from endogeneity and omitted variable biases, we also estimate instrumental variable (IV) and random effects Tobit regressions, discussed in great length later.

5. Empirical results

5.1. Financial inclusion and bank performance

In this section, combining both bank- and country-level variables, we test whether greater financial inclusion enhances or impedes bank-level efficiency using truncated

regression model proposed by Simar and Wilson (2007), in which confidence intervals are estimated employing 2,000 bootstrap replications.

Table 3 reports the estimated parameters.[21] Column 1 shows the relation between financial inclusion index and bank efficiency, whereas columns 2 (3) show the association between financial outreach (usage) dimension and bank efficiency. *Financial inclusion* coefficient is positive at the 1% level of statistical significance, suggesting that inclusive financial sector can have significant role in enhancing bank efficiency scores. The effect is also economically significant. A one standard deviation (0.21) increase in *FII* increases bank efficiency scores by 1.9%.[22] It is obvious that when financial intermediaries operate in a more inclusive environment, they are more likely to attract stable customer deposits, reducing return volatility, which help them to operate more efficiently. Taking the individual constituents of *FII*, we also find that *financial outreach* and *usage* are positive and significant at 1% level. These results are also supported by the recent empirical evidence which showed that by expanding bank branches and/or reaching out to customers banks can improve operating efficiency (e.g., Grabowski et al., 1993; Berger and DeYoung, 2001; Bos and Kolari, 2005; Deng and Elyasiani, 2008; Rossi et al., 2009) and bank stability (e.g., Ahamed and Mallick, 2017).

Turning to the control variables, we find larger banks, more liquid and capitalised banks are more efficient, whereas banks that have higher loan portfolio risks are less efficient. Regarding country-level macro controls, the results suggest that banks' operating efficiency is positively associated with economic growth and population growth.

[21] We confirm our results using ordinary least square regressions that include year dummies while using heteroskedasticity-robust standard errors clustered at the country level to calculate *t*-statistics. The results are quantitatively similar, and available from the authors.

[22] As a robustness test, we also find that the results are similar when we clustered the standard errors at the country level using OLS regression.

6. Sensitivity analyses

In this section, we discuss various robustness tests of our study. We use alternative estimators including instrumental variable (IV) regression, exploited bank-specific heterogeneity, and demand-side measures of financial inclusion extracted from the Global Findex Database of the World Bank. We re-run regressions splitting the sample into groups based on development status of the sample countries, while adding additional macro controls along with institutional indicators.

6.1 Alternative estimators, exploiting bank-specific heterogeneity

So far, we have estimated Equation (6) using truncated regression model as suggested by Simar and Wilson (2007) that efficiency scores in DEA are generated by a truncated data generating process. However, McDonald (2009) argues that the efficiency scores are not the result of a truncated process but rather the result of a fractional logit process, and thus it is not a latent variable. Therefore, when efficiency scores are generated by a fractional logit process, to check the robustness of our results, we re-estimate Equation (6) using a 'fractional logit' quasi-likelihood estimator proposed by Papke and Wooldridge (1996). Table 3 columns 4-6 report the results from a fractional logit quasi-likelihood estimator. The results corroborate our earlier findings. In particular, we find a positive and significant association between financial inclusion indicators and banks' operating efficiency. Similarly, greater financial inclusion and/or banking sector outreach and/or depth of financial services increase bank efficiency.

Until now, we have estimated pooled cross-sectional truncated regression model assuming that there is no bank-specific heterogeneity. To control for bank unobserved heterogeneity, we use random effects Tobit model as we are not aware of any truncated regression model that can accommodate bank-specific heterogeneity in the estimation.[23]

[23] We use Random effects Tobit model as we could not use truncated regression model to account for bank-specific heterogeneity due to large number of bank dummies. Furthermore, by collapsing our data at the bank-

Random effects Tobit model is employed, as panel Tobit estimates with fixed effects tend to be biased (Greene, 2004). The consistency of the random effects Tobit model requires the strict exogeneity assumption, that is, the error term has to be uncorrelated with the covariates across all time periods, and the unobserved bank-level heterogeneity should be uncorrelated with all covariates (Czarnitzki and Toole, 2011). However, the unreported likelihood-ratio test indicates that unobserved heterogeneity plays an important role in depicting the relationship between the variables of interest. Table 4 reports the results. The estimation results of random effect model also corroborate the pooled estimations that *FII* and *usage* dimension are positively associated with banks' operating efficiency.

6.2 Instrumental variable (IV) regression

It is possible that the results of our study may be biased because of endogeneity problem between financial inclusion and bank efficiency. Endogeneity can arise if banks engage in less efficient activities in the current set-up and venture into unbanked areas and/or if they self-select into inclusive financial activities because these reward them with greater access to customer deposits and/or allow them to reduce income volatility. In addition, despite controlling for an array of bank- and country-specific variables, as our regressions link country-level financial inclusion to bank-level efficiency, omitted variable bias could still be of concern. It may be the case that the composite index that we construct to proxy for financial inclusion may be subject to measurement error. Therefore, to alleviate any endogeneity and omitted variable biases, and measurement errors, we employ the Tobit model with instrumental variables, using Newey's minimum chi-squared two step estimator.

level, we re-run pooled cross-sectional truncated regression. The results are also consistent with the earlier findings (available from the authors upon request).

To run IV regression, we search extensively for instrumental variables and find that secondary school enrollment over primary school enrollment (*Sec_primary*) and the depth of credit information (*Credit_info*) are the suitable instruments. While the former is a ratio that measures the proportion of secondary to primary enrollments in a country, the latter is an index that measures rules affecting the scope, accessibility, and quality of credit information available through public or private credit registries. Education is vital for achieving inclusive financial sector as it furthers financial literacy of households, and hence financial management (Cole et al., 2014). According to Allen et al. (2016), on average, adults with tertiary education, in the developing countries, are twice as likely to own a bank account as those with primary education or less. The literature on the depth of credit information shows that better credit information sharing mechanisms not only reduce transaction costs (Miller, 2003) but also enhance credit availability in the market (Brown et al., 2009). Taking country-level data from 129 countries, Djankov et al. (2007) find a positive association between information sharing and private credit to GDP. Recently, Beck et al. (2014) show a positive correlation between depth of credit information and geographic (demographic) bank branch outreach.

Table 5 shows the results of the IV regressions. While Panel A shows the results of the First-stage regressions of financial inclusion on instruments, Panel B shows the Second-stage regressions on bank efficiency. We find that all instruments have statistically significant effects on financial inclusion. In particular, *Sec_primary* and *Credit_info* are associated with higher levels of financial inclusion. Furthermore, we test the relevance and validity of our IVs used in this study. The reported values of the Wald (χ^2) tests statistic for exogeneity indicate financial inclusion variables can be considered as endogenous and therefore instrumenting is appropriate. We also conduct Anderson-Rubin test of under-identification, and find that the null hypothesis of weak instruments is rejected at 1% significance level in all cases. The over-identification test proxied by Amemiya–Lee–Newey minimum χ^2 test shows that the selected

group of instruments is valid as the null hypothesis cannot be rejected at 5% significance level, except column 3. We find strong and consistent evidence that financial inclusion is associated with greater operating efficiency of banks.

6.3 Alternative measures of financial inclusion: Global Findex

Given the limitations of data availability, we try to incorporate as many dimensions as possible in the construction of financial inclusion index. However, it might be the case that inadequate measure of financial inclusion has provided incorrect inference in this study. Therefore, we use two demand-side measures of financial inclusion of Global Findex Database of the World Bank to examine whether our main results hold. The most common variables that are used as the proxy for financial inclusion in the recent studies (see e.g., Demirgüç-Kunt et al., 2013; Allen et al., 2014) are *Adults with an account at a formal financial institution to total adults* (%) (*Account*) and *Adults saving at a financial institution in the past year to total adults* (%) (*Saved*). Since this database is new and just covers the calendar years 2011 and 2014, we collapse our dataset at bank-level to have two data points for each bank for the period 2004-11 and 2012-14. We run truncated regression model while keeping all else exactly same except the financial inclusion indicators. The regression results are reported in Table 6. We find that both indicators of Global Findex are positive and significantly associated with banks' operating efficiency, consistent with our earlier findings. In particular, the more percentage of adults with bank accounts/savings with financial institutions enhances bank efficiency. It stresses the point that greater financial inclusion is complementary for efficient financial intermediation of banks.

6.4 Developing vs. Advanced economies: Who benefits more from financial inclusion?

Our dataset comprises 546 banks from 73 developing market economies, 539 banks from 30 emerging market economies, and 1,122 banks from 20 advanced economies. As

financial inclusion is a developing and emerging market economies phenomena, to delineate differing effects of financial inclusion on bank efficiency, we run separate truncated regression model for these three groups of countries. Table 7 presents the results of fifteen different regressions. While Panel A (B) shows the results of developing (emerging) market economies, Panel C shows the results from advanced economies. Though we have included all controls, for the sake of brevity, we just report the effects of financial inclusion indicators. The results of the sub-sample of developing and emerging market economies are in line with our earlier findings. Regarding advanced economies, though we find a significant positive effect of usage dimension, we do not find a significant effect of financial inclusion index on banks' operating efficiency. We even find a significant negative effect of financial outreach.

To examine why financial outreach might have negative effect on bank efficiency, we divided our sample into two groups based on *private credit to GDP*: (i) High financial deepening – a sample of countries who have a ratio of *private credit to GDP* that is more than the sample average; (ii) Low financial deepening – a sample of countries with a ratio of *private credit to GDP* that is less than or equal to sample average. The estimated results of these two groups are reported in Panel D and Panel E, respectively. This approach should delineate whether financial inclusion indicators indeed influence productive efficiency of banks that operate in those countries that have lower financial deepening in the same way as with those that have greater financial deepening. As the literature embarks that greater financial deepening is not necessarily a reflective of an inclusive financial sector, we should see a differential effect of financial inclusion indicators for these two groups of countries. According to Beck et al. (2014), though *private credit to GDP* has been used as one of the indicators of financial development, it fails to measure the breadth of the financial system properly, that is, it does not show the extent to which financial intermediaries cater services to smaller and geographically more dispersed customers. Though the results of Panel E are consistent with our earlier

findings, Panel D coincides with the results of advanced economies, suggesting a contrasting effect of financial outreach for two groups of countries in terms of the degree of financial deepening. In other words, though greater banking sector outreach enhances banks' operating efficiency in countries that have less-deepened financial system, it reduces banks' operating efficiency in countries that have greater financial deepening, which may be due to an exhaustive level of financial development that has already been materialized in these countries.

6.5 Quantile regression estimates and additional macro controls

Using truncated regression, we find a positive association between financial inclusion and bank efficiency, which is also consistent with the results of OLS regression. As we have a large number of banks from different countries, heterogeneity might be an issue. Therefore, we use quantile regression (QR), as proposed by Koenker and Bassett (1978), to assess whether financial inclusion has homogeneous effect on bank efficiency while illustrating the relation at different points in the conditional distribution of the dependent variable. Table 8 presents the results. As bank efficiency changes across quantiles, the estimate of the financial inclusion varies in sign and magnitude, and significance. While the estimates of the financial inclusion coefficients are positive and increasing in magnitude as well as statistically significant at the 1% level for bank efficiency at quantiles from 0.20 and above, it becomes insignificant for those 0.10 and below – it suggests that financial inclusion increases efficiency of more efficient banks.

So far, we have used real GDP growth rate and population growth rate as macro controls. It may be the case that our results are also influenced by the level of economic development, price stability, and institutional development of a country in which banks operate. Therefore, in addition to our usual macro control, we check the robustness of our results using logarithm of per capita GDP, GDP deflator, and six governance indicators from Kaufmann et

al. (2010) as a proxy for institutional development. As governance indicators are highly correlated with each other, we use them one at a time with the additional macro controls to re-run six truncated regression models. For brevity, we do not report the estimated results, but they are available on request. The results show that even after controlling for all these macro variables, our main results remain unchanged, that is, greater financial inclusion increases banks' efficiency score. In particular, we find that higher level of economic development and inflation are positive and significantly associated with bank efficiency. Though all governance indicators have positive association with bank efficiency, five of them (*Voice and accountability, Government effectiveness, Rule of law, Regulatory quality, Control of corruption*, except *Political stability*) are significant at 1% level, suggesting stronger institutional development is necessary for enhancing banks' efficiency.

7. Exploring channels

7.1. Volatility of retail deposits and bank return

Saving instruments are heavily used by poor households, and it provides an extensive ease to households for making payments and savings (Collins et al., 2009; Allen et al., 2016). Naturally, in an inclusive financial sector banks will have greater access to a large pool of customer deposits, leading to less volatile customer deposit funding for banks. In general, greater volatility of customer deposit funding should have negative effect on banks' operating efficiency. However, as banks have enormous opportunity to attract a large number of customer deposits in an inclusive financial sector, one would expect banks' operating efficiency increasing in such a market. To delineate this effect, we measure standard deviation of customer deposit funding share (σ_{CDEP}) and create three interaction terms between financial inclusion indicators and σ_{CDEP}. We re-run our augmented truncated regression model by adding interaction term and σ_{CDEP} as an additional independent variable.

Table 9 Panel A reports the results. In column 1, though the direct effect of σ_{CDEP} is negative and significant, their interaction term enters positively and significant at 1% level, indicating that banks operating in an inclusive financial sector are able to wither away negative effects of σ_{CDEP} and can improve productive efficiency. These results are somewhat in tandem with the arguments made elsewhere 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; Ahamed and Mallick, 2017), 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).

Similarly, if banks operating in an inclusive financial sector are able to reduce reliance on costly wholesale funding as they have access to cheaper retail deposits, one would expect that in such set ups banks are also able to reduce their return volatility (σ_{roa}), and operate more efficiently. Using the similar procedures as above, we create three interaction terms between financial inclusion indicators and σ_{roa} and re-run the augmented truncated regression model while using σ_{roa} as an additional independent variable. Panel B presents the results. Though the direct effect of σ_{roa} is negative and significant, their interaction term enters positively and significant at 5% level except column 3, suggesting that banks operating in an inclusive financial sector are able to reduce return volatility and become more efficient.

7.2. The role of bank regulation, supervision, and monitoring

Financial regulation is considered to be key to well-functioning banking sector. An appropriate regulatory and supervisory framework can help mitigate excessive risk taking and bring about efficient financial intermediation. Since regulators around the world are still grappling with identifying financial regulations that are supportive to inclusive finance agenda, in this section, we provide some evidence as to how differing regulatory and supervisory

framework across countries can play a role in the relation between financial inclusion and bank efficiency.

We augment our baseline regression by adding interaction terms of financial inclusion index and each of the three regulatory and supervisory indicators that are discussed earlier. All control variables are analogous. For the sake of comparability and for economic significance, the regulatory variables involved in the interaction terms are normalized to have a zero mean and unit variance. We present the results in Table 10. In general, even after introducing interactions terms, the relationship between financial inclusion and bank efficiency remains positive and significant. In column 1, the interaction term of financial inclusion and activities restrictions is negative and statistically significant at the 1% level, implying that an inclusive financial sector enhances bank efficiency in countries with less stringent bank activity restrictions. In other words, a one standard deviation increase in activities restrictions reduces the positive impact of financial inclusion on bank efficiency by 3.9%.[24] Similarly, the negative and significant interaction term of financial inclusion and controls on foreign bank entry/ownership suggests that the positive effect of financial inclusion in improving bank efficiency is more when a country does not stifle competition by severely limiting foreign bank entry/ownership. As like ours, Ayadi et al. (2016) also find that stifling bank competition decreases bank efficiency. Taking column 3, the positive and significant interaction term of financial inclusion and overall capital stringency suggests that the relationship between financial inclusion and bank efficiency is stronger in countries where there is stringent capital regulation. Barth et al. (2013b) also find that capital stringency enhances bank efficiency.

[24] The unreported marginal effect graph suggests that with more than average levels of activities restrictions, the impact of financial inclusion is not significant, but in the case of a lower activities restrictions regime the impact can be negative and significant.

Taking the interactions term, a one standard deviation increase in overall capital stringency leads to a 5.4% increase in bank efficiency in an inclusive financial sector.

8. Conclusions

This paper investigates the impact of financial inclusion on bank performance using an international sample of 2,207 banks across 123 countries for the period 2004-15. We find strong evidence that banks in countries with greater inclusive banking sector tend to have higher levels of operating efficiency. This effect is particularly strong for banks operating in the developing and emerging market economies, and for the banks where financial sector is less developed in terms of private credit to GDP. We also find that banking regulation plays an important role in the relationship between financial inclusion and bank performance as the association is stronger in countries with less restrictions on banking activities, less limitations on foreign bank entry, and more capital regulation stringency.

As banks operating in an inclusive financial sector have enormous opportunities to attract cheaper and less volatile customer deposits compared with wholesale funding, we find that operating efficiency of such banks increases as they are able to reduce volatility of retail deposits funding and also return volatility. This underscores the importance of conducive inclusive environment in broadening access to finance and its complementary effects on the efficient intermediation of financial institutions.

The results are robust to using alternative measures of financial inclusion that is extracted from the Global Findex Database of the World Bank, to keeping only developing and emerging market economies, to employing IV analysis, to controlling for bank unobserved heterogeneity, and finally, to controlling for the levels of economic development, price stability, and institutional development. For all of these alternative setups, we find that greater financial inclusion increases the levels of banks' operating efficiency. Our findings suggest a financial system that provides easier access to finance increases efficiency in the financial

intermediation of the banks, and hence makes them more operationally efficient. They also show that financial inclusion is an important policy lever to bring more people into the formal economy, and concurrently set an environment for efficient financial operation.

These results are novel in the literature. While previous papers show the effect of financial inclusion on various socio-economic indicators (e.g., Butler and Cornaggia, 2011; Allen et al., 2013; Demirgüç-Kunt et al., 2013), this paper is the first to show the explicit link between a key ingredient of financial development strategy and cross-bank and cross-country variation in the levels of bank efficiency, a topic that deserves more theoretical and empirical attention for establishing a robust link between these variables. While previous studies focus on the relationship between bank branch penetration and firm's tax avoidance (see Beck et al., 2014), firm's financing obstacle (see Beck et al., 2007), this is the first paper to relate cross-country variation in inclusive banking sector and operating efficiency of the financial institutions, and simultaneously contribute to the bank efficiency literature.

The policy implications of our results are many folds. Since the greater is the banked population the higher is the bank efficiency, policymakers should introduce more policies that are conducive for access to finance aiming at ensuring efficient financial intermediation. They should continuously make efforts to provide a regulatory environment that is conducive for increasing financial inclusion and bank performance.

We see this paper as a first attempt finding the link between financial inclusion and bank efficiency. As more data covering both supply and demand-side become available, other dimensions of the financial inclusion can be incorporated in the construction of the composite index and explore the relationship between inclusive financial sector and bank efficiency in a systematic manner.

Appendix A

See Table A1, A2, A3.

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Table A1
Bank inputs and outputs (US$ million)

	2004			2015		
	Mean	Median	Std.dev.	Mean	Median	Std.dev.
Inputs						
Total deposits, money market and other funds	636.14	128.94	1869.81	1603.62	202.25	6219.07
Personnel expenses	8.31	2.28	21.02	18.44	3.57	58.58
Total fixed assets	10.56	2.48	29.40	17.04	3.30	57.23
Outputs						
Total loans	422.25	92.35	1229.46	1107.32	145.02	4181.70
Total other earning assets	170.02	29.08	544.80	374.00	44.19	1530.86
Total non-interest income	7.45	0.97	28.45	20.02	1.40	80.19

Table A2
Variable Definitions and Sources

Variables	Definition	Source
Bank-specific variables		
EFF	Data Envelopment Analysis (DEA) efficiency scores	Own
LogTA	Logarithm of total assets	BankScopre
LIQ	Total loans/total deposits	BankScopre
EQA	Shareholder's equity/total assets	BankScopre
LLP	Total loan loss provision divided by total loans	BankScopre
σ_{CDEP}	Standard deviation of Share of customer deposits of total deposits and short-term funding (calculated using a rolling window)	BankScopre
σ_{roa}	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)	BankScopre
Country-specific variables		
Financial inclusion index	Financial inclusion index is constructed using PCA from the financial outreach and usage dimensions.	IMF FAS
Financial outreach	The outreach dimension constructed using principal component analysis (PCA) from the variables related to geographic and demographic availability of branches and ATMs	IMF FAS
Usage	The number of deposit and loan accounts per 1000 adults	IMF FAS
Account	Account at a financial institution (% age 15+)	Global Findex
Saved	Saved at a financial institution (% age 15+)	Global Findex
GDP	The growth rate of GDP	WDI
Pop_gr	Population growth (Annual %)	WDI
Activities restrictions	The score for this variable is determined on the basis of the level of regulatory restrictiveness for bank participation in: (1) securities activities, (2) insurance activities, (3) real estate activities, and (4) bank ownership of non-financial firms. These activities can be unrestricted, permitted, restricted or prohibited and are assigned the values of 1, 2, 3 or 4, respectively. This index takes a value from 0 to 16, with larger values denoting more stringent activity restrictions.	Barth et al. (2004; 2008; 2013a)
Limitations on foreign bank entry/ownership	Whether foreign banks may own domestic banks and whether foreign banks may enter a country's banking industry. This index takes a value from 0 to 4, with higher value indicates severe limitations.	Barth et al. (2004; 2008; 2013a)
Overall capital stringency	Whether the capital requirement reflects certain risk elements and deducts certain market value losses from capital adequacy is determined. Specifically, it is an indicator developed based on the following questions (Yes = 1, No = 0): 1. Is the minimum capital-asset ratio requirement risk weighted in line with the Basle guidelines? 2. Does the minimum ratio vary as a function of an individual bank's credit risk? 3. Does the minimum ratio vary as a function of market risk? 4. Before minimum capital adequacy is determined, which of the following are deducted from the book value of capital: (a) market value of loan losses not realized in accounting books; (b) unrealized losses in securities portfolios? (c) Unrealized foreign exchange losses? Higher values indicating greater stringency	Barth et al. (2004; 2008; 2013a)
Instrumental variables		
Sec_primary	Secondary school enrolment over primary school enrolment	WDI
Credit_info	Depth of credit information index	DB, WDI

Note: IMF FAS = IMF Financial Access Survey; WDI = World Development Indicators; Global Findex = World Bank Global Financial Inclusion Database; DB, WDI = World Bank Doing Business Database.

Table A3
This table provides information on the correlation between the bank- and country-specific variables used throughout the paper.

Panel A: Bank-specific variables	Item	A	B	C	D	E	F		
LogTA	A	1							
LIQ	B	-0.16***	1						
EQA	C	-0.43***	0.31***	1					
LLP	D	-0.16***	0.08***	0.19***	1				
σ_{CDEP}	E	-0.17***	0.19***	0.28***	0.20***	1			
σ_{roa}	F	-0.24***	0.04***	0.33***	0.41***	0.18***	1		
Panel B: Country-specific variables		G	H	I	J	K	L	M	N
Financial inclusion	G	1							
Financial outreach	H	0.85***	1						
Usage	I	0.86***	0.47***	1					
GDP	J	-0.36***	-0.31***	-0.30***	1				
Pop_gr	K	-0.40***	-0.31***	-0.38***	0.25***	1			
Activities restrictions	L	-0.24***	-0.28***	-0.12***	0.15***	0.10**	1		
Limitations on foreign bank entry/ownership	M	0.15***	0.19***	0.07*	-0.11***	-0.09**	-0.05	1	
Overall capital stringency	N	0.10**	0.12***	0.05	-0.11***	0.02	-0.09**	-0.03	1

Table 1
Summary Statistics

This table shows the total sample summary statistics for the bank-specific variables, macroeconomic variables and the variables that are used as instruments in the instrumental variable regressions throughout the paper. Detailed definitions and the sources of the variables are provided in Appendix Table A1. The full sample contains 15,445 bank-year observations. This table consists of three parts. The descriptive statistics of the dependent variable, that is, EFF, is used to proxy for technical efficiency of individual banks is in the first part along with all bank-specific controls. Country-specific variables are in the second part following by the instrumental variables in the final part.

Variables	Mean	Median	Std.dev.	Min.	Max.	# of countries	# of obs
Bank-specific variables							
EFF	0.35	0.30	0.21	0.01	1.00	123	15445
LogTA	6.86	6.79	1.59	3.07	10.76	123	15445
LIQ	0.76	0.66	0.41	0.11	2.50	123	15445
EQA	0.11	0.09	0.08	0.02	0.49	123	15445
LLP	0.01	0.01	0.02	-0.01	0.12	123	15445
σ_{CDEP}	0.04	0.01	0.06	0.00	0.57	122	14635
σ_{roa}	0.01	0.00	0.01	0.00	0.04	122	14774
Country-specific variables							
Financial Inclusion Index	0.26	0.21	0.21	0.01	0.91	123	123
Financial outreach	0.22	0.17	0.21	0.00	0.88	123	123
Usage	0.30	0.25	0.28	0.00	1.00	123	123
Account	0.04	0.04	0.02	-0.03	0.09	105	105
Saved	8.43	8.41	1.38	6.27	11.23	105	105
GDP	0.05	0.05	0.03	-0.02	0.14	123	123
Pop_gr	-0.09	-0.08	0.86	-2.02	1.67	123	123
Activities restrictions	7.67	7.67	1.83	3.00	12.00	111	111
Limitations on foreign bank entry/ownership	3.73	4.00	0.53	1.33	4.00	108	108
Overall capital stringency	4.14	4.26	1.42	1.00	7.00	109	109
Instrumental variables							
Sec_primary	0.73	0.80	0.28	0.18	1.31	116	116
Credit_info	3.42	4.35	2.58	0.00	7.43	122	122

Table 2
The estimation results for the bank efficiency and financial inclusion

This table reports the mean of technical efficiency and the major macro variables across countries. It also reports the number of banks in each countries with the geographic regional average of each variables.

Country	Technical efficiency	Financial inclusion index	Financial outreach	Usage	# of banks	Country	Technical efficiency	Financial inclusion index	Financial outreach	Usage	# of banks
China	0.51	0.13	0.21	0.01	57	Jamaica	0.35	0.39	0.18	0.65	3
Fiji	0.03	0.18	0.09	0.28	1	Mexico	0.46	0.23	0.18	0.29	7
Federated States of Micronesia	0.16	0.12	0.09	0.16	1	Nicaragua	0.17	0.08	0.05	0.12	4
Hong Kong	0.54	0.41	0.71	0.00	3	Panama	0.34	0.31	0.19	0.45	24
Indonesia	0.27	0.18	0.13	0.25	72	Peru	0.14	0.24	0.17	0.31	12
Japan	0.35	0.91	0.79	1.00	452	Paraguay	0.19	0.06	0.07	0.05	14
Cambodia	0.33	0.09	0.12	0.05	11	El Salvador	0.29	0.28	0.22	0.35	9
Lao People'S Democratic Republic	0.21	0.07	0.05	0.09	3	Trinidad And Tobago	0.31	0.39	0.22	0.59	4
Mongolia	0.18	0.32	0.27	0.36	4	Venezuela	0.39	0.30	0.13	0.50	24
Macao	0.49	0.52	0.88	0.00	1	***Average (Latin America & Caribbean)***	***0.31***	***0.29***	***0.19***	***0.40***	***317***
Malaysia	0.54	0.49	0.18	0.86	21	United Arab Emirates	0.63	0.25	0.22	0.27	20
Papua New Guinea	0.49	0.05	0.02	0.09	2	Djibouti	0.27	0.04	0.03	0.06	2
Philippines	0.24	0.13	0.12	0.13	9	Algeria	0.21	0.09	0.03	0.17	7
Singapore	0.61	0.40	0.68	0.00	6	Egypt	0.51	0.09	0.05	0.14	17
Thailand	0.64	0.41	0.32	0.51	7	Jordan	0.40	0.21	0.15	0.27	7
Tonga	0.18	0.20	0.19	0.21	1	Kuwait	0.67	0.29	0.24	0.33	8
Vanuatu	0.24	0.20	0.15	0.26	1	Lebanon	0.36	0.49	0.46	0.50	27
Samoa	0.18	0.19	0.13	0.25	1	Libya	0.25	0.04	0.04	0.04	1
Average (East Asia & Pacific)	***0.34***	***0.28***	***0.28***	***0.25***	***653***	Morocco	0.78	0.17	0.14	0.20	3
Albania	0.32	0.11	0.19	0.00	11	Malta	0.41	0.90	0.77	1.00	2
Armenia	0.20	0.24	0.20	0.28	13	Saudi Arabia	0.82	0.23	0.15	0.31	12
Austria	0.23	0.39	0.40	0.36	2	Syrian Arab Republic	0.02	0.05	0.02	0.08	1
Azerbaijan	0.19	0.19	0.13	0.25	17	Yemen	0.29	0.02	0.02	0.03	2
Bosnia And Herzegovina	0.21	0.30	0.22	0.38	16	***Average (Middle East & North Africa)***	***0.43***	***0.22***	***0.18***	***0.26***	***109***
Bulgaria	0.29	0.59	0.50	0.66	8	Afghanistan	0.21	0.02	0.01	0.03	3
Switzerland	0.37	0.76	0.65	0.84	85	Bangladesh	0.28	0.50	0.58	0.36	12
Cyprus	0.48	0.35	0.60	0.00	7	India	0.55	0.33	0.34	0.29	54
Czech Republic	0.56	0.37	0.25	0.51	9	Maldives	0.20	0.42	0.48	0.32	2
Estonia	0.24	0.52	0.23	0.88	3	Nepal	0.33	0.11	0.07	0.14	26
Spain	0.46	0.80	0.70	0.88	40	Pakistan	0.34	0.08	0.07	0.09	15
Finland	0.86	0.53	0.18	0.95	3	***Average (South Asia)***	***0.32***	***0.24***	***0.26***	***0.21***	***112***
United Kingdom	0.36	0.40	0.66	0.03	38	Angola	0.25	0.08	0.06	0.11	10
Georgia	0.24	0.30	0.21	0.40	9	Burkina Faso	0.25	0.04	0.04	0.04	3
Greece	0.24	0.57	0.36	0.82	1	Burundi	0.18	0.05	0.05	0.05	1
Croatia	0.26	0.41	0.43	0.35	16	Benin	0.32	0.05	0.08	0.01	2
Hungary	0.48	0.43	0.33	0.53	4	Botswana	0.23	0.17	0.08	0.27	3
Ireland	0.69	0.54	0.50	0.55	4	Democratic Republic of Congo	0.12	0.01	0.00	0.01	5
Iceland	0.64	0.18	0.31	0.00	4	Central African Republic	0.21	0.01	0.00	0.01	2
Italy	0.30	0.61	0.77	0.35	431	Congo	0.16	0.02	0.01	0.03	1
Latvia	0.30	0.53	0.26	0.85	2	Cameroon	0.18	0.03	0.03	0.02	5
Republic of Moldova	0.21	0.26	0.13	0.43	11	Gabon	0.17	0.11	0.06	0.17	2
Montenegro	0.21	0.46	0.31	0.63	5	Ghana	0.22	0.08	0.04	0.12	11
Macedonia (Fyrom)	0.21	0.41	0.22	0.64	11	Guinea	0.12	0.02	0.02	0.02	2
Netherlands	0.72	0.63	0.55	0.68	5	Kenya	0.22	0.10	0.04	0.17	20
Norway	0.45	0.08	0.14	0.00	8	Liberia	0.16	0.04	0.01	0.06	2
Poland	0.50	0.28	0.44	0.04	9	Lesotho	0.12	0.07	0.04	0.12	3
Portugal	0.33	0.83	0.75	0.86	13	Madagascar	0.20	0.02	0.01	0.02	4
Romania	0.26	0.23	0.32	0.10	12	Mauritania	0.27	0.03	0.03	0.04	2
Serbia	0.26	0.21	0.27	0.12	14	Mauritius	0.35	0.63	0.51	0.74	10
Turkey	0.47	0.49	0.24	0.79	7	Malawi	0.16	0.03	0.03	0.04	2
Ukraine	0.27	0.52	0.21	0.89	9	Mozambique	0.18	0.04	0.03	0.05	10
Uzbekistan	0.21	0.12	0.19	0.02	6	Namibia	0.25	0.19	0.12	0.28	2
Average (Europe & Central Asia)	***0.36***	***0.41***	***0.36***	***0.46***	***833***	Niger	0.24	0.01	0.01	0.01	4
Argentina	0.30	0.26	0.13	0.42	25	Rwanda	0.11	0.15	0.15	0.14	5
Bolivia	0.32	0.13	0.08	0.18	12	Seychelles	0.26	0.56	0.46	0.66	2
Brazil	0.50	0.43	0.37	0.49	72	South Sudan	0.19	0.01	0.00	0.01	2
Bahamas	0.40	0.49	0.31	0.71	6	Swaziland	0.17	0.13	0.09	0.19	3
Chile	0.67	0.44	0.17	0.77	3	Chad	0.23	0.01	0.00	0.01	2
Colombia	0.30	0.46	0.39	0.53	13	United Republic of Tanzania	0.18	0.03	0.02	0.05	24
Costa Rica	0.43	0.41	0.24	0.61	35	Uganda	0.17	0.04	0.02	0.06	14
Dominican Republic	0.17	0.19	0.20	0.15	17	South Africa	0.40	0.28	0.16	0.42	8
Ecuador	0.22	0.25	0.24	0.26	13	Zambia	0.18	0.05	0.04	0.06	9
Guatemala	0.17	0.33	0.22	0.44	2	Zimbabwe	0.11	0.06	0.07	0.05	8
Guyana	0.28	0.16	0.06	0.29	3	***Average (Sub-Saharan Africa)***	***0.21***	***0.10***	***0.07***	***0.13***	***183***
Honduras	0.17	0.21	0.13	0.29	15						

Source: Author's calculation.

Note: This table shows the bank efficiency, financial inclusion index and its associated dimensions. Final column shows the number of banks we have in our sample. Regional average of all variables are also reported.

Table 3
The effect of financial inclusion on bank efficiency

While in columns 1-3 we use truncated regression based on Simar and Wilson (2007), Algorithm 1, using 2,000 bootstrap replications for the confidence intervals of the estimated coefficients, the results in columns 4-6 are based on Quasi-Likelihood estimation methods proposed by Papke and Wooldridge (1996) . In all columns, dependent variable is EFF, which is the efficiency scores of banks measured using Data Envelopment Analysis (DEA). Our variables of interest are financial inclusion indicators: *Financial Inclusion index* is a composite index, constructed based on two dimensions, namely *financial outreach* and *usage* dimensions. An array of bank-specific controls is used: *LogTA* is the logarithm of total assets; *LIQ* is the total loans over total deposits; *EQA* is shareholder's equity over total assets; and *LLP* is Loan loss provision, measured as a percentage of total loans. All bank-specific controls are from BankScope. The macro controls used in this study are: *GDP* is the real growth rate of gross domestic products e and *Pop_gr* is the population growth rate (%). Macroeconomic data are obtained from World Development Indicators of the World Bank. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI. Coverage: 2004-15.

Variables	Financial inclusion index	Financial outreach	Usage	Financial inclusion index	Financial outreach	Usage
	1	2	3	4	5	6
Financial inclusion	0.091***	0.070***	0.058***	0.631***	0.367***	0.455***
	[0.006]	[0.007]	[0.004]	[0.039]	[0.042]	[0.026]
LogTA	0.066***	0.067***	0.066***	0.294***	0.298***	0.294***
	[0.001]	[0.001]	[0.001]	[0.005]	[0.005]	[0.005]
LIQ	0.032***	0.024***	0.037***	0.145***	0.098***	0.180***
	[0.003]	[0.003]	[0.003]	[0.019]	[0.019]	[0.019]
EQA	0.457***	0.441***	0.431***	3.278***	3.120***	3.143***
	[0.020]	[0.020]	[0.020]	[0.117]	[0.119]	[0.114]
LLP	-0.290***	-0.330***	-0.364***	-0.605	-1.123***	-0.904**
	[0.069]	[0.069]	[0.069]	[0.411]	[0.419]	[0.403]
GDP	0.180***	0.148***	-0.038	1.844***	1.092***	0.447*
	[0.052]	[0.055]	[0.045]	[0.309]	[0.339]	[0.271]
Pop_gr	0.014***	0.011***	0.012***	0.074***	0.045***	0.064***
	[0.001]	[0.001]	[0.001]	[0.008]	[0.007]	[0.007]
Constant	-0.253***	-0.231***	-0.225***	-3.532***	-3.261***	-3.394***
	[0.011]	[0.011]	[0.010]	[0.064]	[0.065]	[0.058]
Observations	15,445	15,445	15,445	15,445	15,445	15,445
# of countries	123	123	123	123	123	123
Year	Yes	Yes	Yes	Yes	Yes	Yes

Table 4
Exploiting bank unobserved heterogeneity

The results in this table are based on Random-effects Panel Tobit regressions. In all columns, dependent variable is *EFF*. Our variables of interest are financial inclusion indicators: *Financial Inclusion index* is a composite index, constructed based on two dimensions, namely *Financial outreach* and *Usage* dimensions. The bank-specific controls are: *LogTA* is the logarithm of total assets; *LIQ* is the total loans over total deposits; *EQA* is shareholder's equity over total assets; and *LLP* is Loan loss provision, measured as a percentage of total loans. All bank-specific controls are from BankScope. The macro controls are: *GDP* is the real growth rate of gross domestic products e and *Pop_gr* is the population growth rate (%). Macroeconomic data are obtained from World Development Indicators of the World Bank. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI. Coverage: 2004-15.

Variables	Financial inclusion index	Financial outreach	Usage
	1	2	3
Financial inclusion	0.052***	-0.012	0.065***
	[0.012]	[0.013]	[0.009]
LogTA	0.058***	0.060***	0.057***
	[0.002]	[0.002]	[0.002]
LIQ	-0.023***	-0.021***	-0.020***
	[0.004]	[0.004]	[0.004]
EQA	0.432***	0.409***	0.437***
	[0.027]	[0.027]	[0.027]
LLP	0.180***	0.154**	0.170***
	[0.061]	[0.061]	[0.060]
GDP	-0.077*	-0.137***	-0.066
	[0.044]	[0.044]	[0.043]
Pop gr	0.006***	0.004***	0.006***
	[0.001]	[0.001]	[0.001]
Constant	-0.087***	-0.064***	-0.088***
	[0.016]	[0.016]	[0.016]
Observations	15,445	15,445	15,445
# of countries	123	123	123
Bank fixed effects	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes

Table 5
The effect of financial inclusion on bank efficiency using ivtobit

This table reports the results of instrumental variables regressions of IV-Tobit regression using Newey's minimum chi-squared two step estimator. The results of the First-stage regressions are presented in Panel A, in which dependent variables are the financial inclusion indicators: *Financial inclusion index, financial outreach,* and *usage*. The results of the second-stage regressions are reported in Panel B, in which the dependent variable is *EFF*. The under-identification and over-identification results of the Anderson-Rubin test and the Amemiya–Lee–Newey minimum χ^2 test are reported at the bottom of the table, respectively. The bank-specific controls are: *LogTA* is the logarithm of total assets; *LIQ* is the total loans over total deposits; *EQA* is shareholder's equity over total assets; and *LLP* is Loan loss provision*,* measured as a percentage of total loans. All bank-specific controls are from BankScope. The macro controls are: *GDP* is the real growth rate of gross domestic products e and *Pop_gr* is the population growth rate (%). Macroeconomic data are obtained from World Development Indicators of the World Bank. Each financial inclusion indicator is treated as endogenous variable, and it is instrumented via the ratio of secondary over primary school enrolment (*Sec_Primary*) and depth of credit information (*Credit_info*). The latter is an index measures rules affecting the scope, accessibility, and quality of credit information available through public or private credit registries. The index ranges from 0 to 8, with higher values indicating the availability of more credit information, from either a public registry or a private bureau, to facilitate lending decisions. Log transformed values (added 1 prior log transformation) are used as instrument. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively.

Panel A: First stage regression - dependent variables ⇒	Financial inclusion index	Financial outreach	Usage
Variables	1	2	3
Secondary/Primary school enrolment	0.449***	0.379***	0.511***
	[0.012]	[0.011]	[0.018]
Depth of credit information	0.049***	0.051***	0.041***
	[0.003]	[0.003]	[0.005]
Constant	0.454***	0.437***	0.445***
	[0.014]	[0.014]	[0.022]
Observations	14,650	14,650	14,650
Bank and Macro controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
# of countries	116	116	116
Adjusted R^2	0.70	0.72	0.51
Panel B: Dependent variable - **EFF**	Financial inclusion index	Financial outreach	Usage
Variables	1	2	3
Financial inclusion	0.313***	0.350***	0.289***
	[0.021]	[0.024]	[0.020]
LogTA	0.069***	0.071***	0.066***
	[0.001]	[0.001]	[0.001]
LIQ	0.045***	0.010**	0.084***
	[0.004]	[0.004]	[0.006]
EQA	0.841***	0.871***	0.806***
	[0.028]	[0.030]	[0.028]
LLP	-0.063	-0.024	-0.112
	[0.103]	[0.106]	[0.104]
GDP	1.076***	1.537***	0.562***
	[0.098]	[0.127]	[0.075]
Pop_gr	0.037***	0.035***	0.040***
	[0.003]	[0.003]	[0.003]
Constant	-0.498***	-0.506***	-0.487***
	[0.022]	[0.023]	[0.022]
Observations	14,650	14,650	14,650
# of countries	116	116	116
Year	Yes	Yes	Yes
Wald χ^2 test: exogeneity	131.2***	196.6***	143.7***
Anderson canonical correlation LM statistic	240.7***	240.8***	240.8***
Anderson canonical correlation LM statistic (*p*-value)	0.00	0.00	0.00
Amemiya-Lee-Newey test	1.16	0.03	4.05
Amemiya-Lee-Newey test (*p*-value)	0.28	0.87	0.04

Table 6
The effect of global financial inclusion on bank efficiency

This table reports the results of truncated regression based on Simar and Wilson (2007), Algorithm 1. In all columns, dependent variable is *EFF*. As financial inclusion indicator, we used two demand-side measures of financial inclusion (i.e., *Account* and *Saved*) extracted from Global Findex Database of the World Bank. Since Global Findex indicators are available only for two survey waves of years 2011 and 2014, we, first, collapsed our data for the period 2004-11, and then for the period 2012-14 in order to have two data points for each bank for the period 2011 and 2014, respectively. Instead of running regression on the whole sample period, we run truncated regression model using averaged values of these two periods. In this table, the only difference is that we use demand-side measure of financial inclusion in lieu of our earlier supply-side measures of financial inclusion indicators. The bank-specific controls are: *LogTA* is the logarithm of total assets; *LIQ* is the total loans over total deposits; *EQA* is shareholder's equity over total assets; and *LLP* is Loan loss provision, measured as a percentage of total loans. All bank-specific controls are from BankScope. The macro controls are: *GDP* is the real growth rate of gross domestic products e and *Pop_gr* is the population growth rate (%). Macroeconomic data are obtained from World Development Indicators of the World Bank. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and Global Findex Database of the World Bank.

Dependent variable: **EFF**	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 (%)
Variables	1	2
Global Findex	0.001***	0.001***
	[0.000]	[0.000]
LogTA	0.061***	0.063***
	[0.002]	[0.002]
LIQ	0.023***	0.028***
	[0.007]	[0.007]
EQA	0.523***	0.539***
	[0.045]	[0.036]
LLP	0.064	0.072
	[0.151]	[0.139]
GDP	0.004***	-0.001
	[0.001]	[0.001]
Pop_gr	0.015***	0.011***
	[0.002]	[0.002]
Constant	-0.277***	-0.229***
	[0.020]	[0.015]
Observations	3,678	3,678
# of countries	105	105
Year	Yes	Yes

Table 7
The effect of financial inclusion in the developing and emerging market economies

We use truncated regression based on Simar and Wilson (2007), Algorithm 1, using bootstrap replications for the confidence intervals of the estimated coefficients. In all columns, dependent variable is EFF, which is the efficiency scores of banks measured using Data Envelopment Analysis (DEA). Our variables of interest are financial inclusion indicators: *Financial Inclusion index* is a composite index, constructed based on two dimensions, namely *financial outreach* and *usage* dimensions. The unreported bank-specific controls are: *LogTA* is the logarithm of total assets; *LIQ* is the total loans over total deposits; *EQA* is shareholder's equity over total assets; and *LLP* is Loan loss provision, measured as a percentage of total loans. The unreported macro controls are: *GDP* is the real growth rate of gross domestic products e and *Pop_gr* is the population growth rate (%). While Panel A reports the estimated results of 70 developing market economies, Panel B reports the estimated results of 30 emerging market economies. Panel C presents the estimated results of 20 advanced economies. In Panel D, we report the results of those countries that have a ratio of *private credit to GDP* that is more than the sample average. In Panel E, we report the estimated results of those countries that have a ratio of *private credit to GDP* that is less than or equal to the sample average. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI. Coverage: 2004-15.

Variables	Financial inclusion index	Financial outreach	Usage
Panel A: Developing market economies	1	2	3
Financial inclusion	0.317***	0.307***	0.219***
	[0.016]	[0.021]	[0.012]
Observations	3,062	3,062	3,062
# of countries	73	73	73
All bank and macro controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Panel B: Emerging market economies			
Financial inclusion	0.217***	0.250***	0.091***
	[0.024]	[0.028]	[0.015]
Observations	3,003	3,003	3,003
# of countries	30	30	30
All bank and macro controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Panel C: Advanced economies			
Financial inclusion	0.004	-0.163***	0.030***
	[0.015]	[0.016]	[0.007]
Observations	9,380	9,380	9,380
# of countries	20	20	20
All bank and macro controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Panel D: Countries those have a ratio of private credit to GDP that is more than the sample average			
Financial inclusion	0.022*	-0.058***	0.032***
	[0.014]	[0.019]	[0.010]
Observations	6,241	6,241	6,241
# of countries	22	22	22
All bank and macro controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Panel E: Countries those have a ratio of private credit to GDP that is less than or equal to sample average			
Financial inclusion	0.211***	0.113***	0.155***
	[0.011]	[0.008]	[0.009]
Observations	9,204	9,204	9,204
# of countries	110	110	110
All bank and macro controls	Yes	Yes	Yes
Year	Yes	Yes	Yes

Note: *Developing market economies:* Afghanistan, Albania, Algeria, Angola, Armenia, Azerbaijan, Benin, Bolivia, Bosnia and Herzegovina, Botswana, Burkina Faso, Burundi, Cambodia, Cameroon, Central African Republic, Chad, Congo, Costa Rica, Croatia, Democratic Republic Of Congo, Djibouti, Dominican Republic, Ecuador, El Salvador, Federated States Of Micronesia, Fiji, Gabon, Georgia, Ghana, Guatemala, Guinea, Guyana, Honduras, Jamaica, Kenya, Lao People's Democratic Republic, Lebanon, Lesotho, Liberia, Libya, Macao, Macedonia (FYR), Madagascar, Malawi, Maldives, Mauritania, Mongolia, Montenegro, Mozambique, Namibia, Nepal, Nicaragua, Niger, Panama, Papua New Guinea, Paraguay, Republic Of Moldova, Rwanda, Samoa, Serbia, Seychelles, South Sudan, Swaziland, Syrian Arab Republic, Tonga, Trinidad And Tobago, Uganda, United Republic Of Tanzania, Uzbekistan, Vanuatu, Yemen, Zambia, and Zimbabwe.
Emerging market economies: Argentina, Bangladesh, Brazil, Bulgaria, Chile, China, Colombia, Egypt, Hungary, India, Indonesia, Jordan, Kuwait, Latvia, Malaysia, Mauritius, Mexico, Morocco, Pakistan, Peru, Philippines, Poland, Romania, Saudi Arabia, South Africa, Thailand, Turkey, Ukraine, United Arab Emirates, and Venezuela.
Advanced economies: Austria, Bahamas, Cyprus, Czech Republic, Estonia, Finland, Greece, Hong Kong, Iceland, Ireland, Italy, Japan, Malta, Netherlands, Norway, Portugal, Singapore, Spain, Switzerland, and United Kingdom.

Table 8
Quantile regression approach

The dependent variable is EFF, which is the efficiency scores of banks measured using Data Envelopment Analysis (DEA). The results are based on quantile regression approach. We use bootstrapping to obtain consistent standard errors, which are reported in the brackets. ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI.

VARIABLES	Bank performance								
Quantile ⇒	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Financial inclusion	0.01	0.032***	0.046***	0.059***	0.062***	0.061***	0.067***	0.068***	0.116***
	[0.007]	[0.006]	[0.006]	[0.007]	[0.007]	[0.009]	[0.010]	[0.014]	[0.022]
LogTA	0.059***	0.061***	0.062***	0.066***	0.069***	0.077***	0.083***	0.091***	0.097***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.003]
LIQ	-0.009**	0.011***	0.014***	0.009**	0.002	0.005	0.009*	0.01	0.014
	[0.004]	[0.003]	[0.003]	[0.003]	[0.004]	[0.005]	[0.005]	[0.007]	[0.012]
EQA	0.189***	0.286***	0.374***	0.503***	0.627***	0.792***	0.935***	1.174***	1.534***
	[0.022]	[0.021]	[0.020]	[0.021]	[0.023]	[0.028]	[0.032]	[0.044]	[0.072]
LLP	0.013	-0.013	-0.076	-0.039	-0.026	0.115	0.337***	0.247	0.334
	[0.078]	[0.073]	[0.071]	[0.075]	[0.080]	[0.099]	[0.111]	[0.154]	[0.254]
GDP	-0.426***	-0.402***	-0.328***	-0.287***	-0.289***	-0.247***	-0.082	0.239***	0.984***
	[0.046]	[0.043]	[0.042]	[0.044]	[0.047]	[0.059]	[0.066]	[0.091]	[0.150]
Pop_gr	0.000	0.004***	0.005***	0.008***	0.011***	0.015***	0.019***	0.020***	0.015***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.002]	[0.003]	[0.005]
Constant	-0.257***	-0.260***	-0.255***	-0.267***	-0.273***	-0.314***	-0.338***	-0.360***	-0.370***
	[0.010]	[0.009]	[0.009]	[0.009]	[0.010]	[0.012]	[0.014]	[0.019]	[0.031]
Observations	15,445	15,445	15,445	15,445	15,445	15,445	15,445	15,445	15,445

Table 9
Exploring channels: volatility of retail deposits and bank return

We use truncated regression based on Simar and Wilson (2007), Algorithm 1, using bootstrap replications for the confidence intervals of the estimated coefficients. In all columns, dependent variable is EFF, which is the efficiency scores of banks measured using Data Envelopment Analysis (DEA). The variables of interest are: *Financial inclusion index, Financial outreach, and Usage.* The unreported bank-specific controls are: *LogTA* is the logarithm of total assets; *LIQ* is the total loans over total deposits; *EQA* is shareholder's equity over total assets; and *LLP* is Loan loss provision, measured as a percentage of total loans. The unreported macro controls are: *GDP* is the real growth rate of gross domestic products and *Pop_gr* is the population growth rate (%). In Panel A, we use interaction term of financial inclusion indicators and Volatility of customer deposit share (σ_{CDEP}). σ_{CDEP} is standard deviation of the share of customer deposits of total deposits and short-term funding (calculated using 3 year rolling window). In Panel B, we use interaction term of financial inclusion indicators and Return volatility (σ_{roa}). σ_{roa} is standard deviation of the return-on-assets (calculated using 3 year rolling window). ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI. Coverage: 2004-15.

Variables	Financial inclusion index	Financial outreach	Usage
Panel A: Volatility of customer deposit funds	1	2	3
Financial inclusion	0.094***	0.072***	0.057***
	[0.006]	[0.007]	[0.006]
σ_{CDEP}	-0.117**	0.043	-0.025
	[0.049]	[0.039]	[0.041]
Financial inclusion x σ_{CDEP}	0.641***	0.204***	0.534***
	[0.081]	[0.074]	[0.089]
Constant	-0.271***	-0.243***	-0.236***
	[0.012]	[0.013]	[0.008]
Observations	14,635	14,635	14,635
# of countries	122	122	122
All bank and macro controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Panel B: Return volatility (σ_{roa})			
Financial inclusion	0.089***	0.067***	0.057***
	[0.005]	[0.007]	[0.003]
σ_{roa}	-1.338***	-1.190***	-1.295***
	[0.235]	[0.193]	[0.318]
Financial inclusion x σ_{roa}	1.278**	1.223**	0.595
	[0.507]	[0.501]	[0.682]
Constant	-0.253***	-0.230***	-0.225***
	[0.009]	[0.009]	[0.008]
Observations	14,774	14,774	14,774
# of countries	122	122	122
All bank and macro controls	Yes	Yes	Yes
Year	Yes	Yes	Yes

Table 10
The role of bank regulation and supervision on financial inclusion and bank performance

We use truncated regression based on Simar and Wilson (2007), Algorithm 1, using bootstrap replications for the confidence intervals of the estimated coefficients. In all columns, dependent variable is EFF, which is the efficiency scores of banks measured using Data Envelopment Analysis (DEA). The variables of interest are interaction term of *financial inclusion* and *regulatory and supervisory indicators.* The bank-specific controls are: *LogTA* is the logarithm of total assets; *LIQ* is the total loans over total deposits; *EQA* is shareholder's equity over total assets; and *LLP* is Loan loss provision*,* measured as a percentage of total loans. The macro controls are: *GDP* is the real growth rate of gross domestic products and *Pop_gr* is the population growth rate (%). ***, **, and * indicate statistical significance at the 1%, 5% and 10% levels respectively. Source: BankScope and WDI. Coverage: 2004-15.

	Bank performance		
Financial inclusion	0.112***	0.143***	0.119***
	[0.009]	[0.008]	[0.007]
Activities restrictions	0.016***		
	[0.003]		
Financial inclusion x Activities restrictions	-0.039***		
	[0.006]		
Limits on foreign bank entry/ownership		0.026***	
		[0.003]	
Financial inclusion x Limits on foreign bank entry/ownership		-0.126***	
		[0.008]	
Overall capital stringency			-0.015***
			[0.003]
Financial inclusion x Overall capital stringency			0.054***
			[0.007]
LogTA	0.079***	0.078***	0.080***
	[0.001]	[0.001]	[0.001]
LIQ	0.039***	0.041***	0.037***
	[0.004]	[0.004]	[0.004]
EQA	0.530***	0.481***	0.521***
	[0.025]	[0.029]	[0.027]
LLP	-0.380***	-0.341***	-0.407***
	[0.082]	[0.096]	[0.095]
GDP	0.169**	0.160***	0.247***
	[0.070]	[0.061]	[0.060]
Pop_gr	0.015***	0.017***	0.013***
	[0.001]	[0.001]	[0.002]
Constant	-0.380***	-0.374***	-0.377***
	[0.013]	[0.014]	[0.013]
Observations	15,266	15,117	15,202
All bank- and country-level controls	Yes	Yes	Yes
Year	Yes	Yes	Yes
Number of countries	111	108	109