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## Macroprudential Policies and Financial Inclusion

by Corinne Deléchat, Lama Kiyasseh, Margaux MacDonald, and Rui Xu

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# Macroprudential Policies and Financial Inclusion

**Prepared by Corinne Deléchat, Lama Kiyasseh, Margaux MacDonald, and Rui Xu**[1]

Authorized for distribution by Corinne Deléchat

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## Abstract

We analyze the drivers of the use of formal versus informal financial services in emerging and developing countries using the 2017 Global FINDEX data, focusing in particular on whether individuals' choice of financial services correlates with macroprudential policies. We find robust evidence that macroprudential policies aimed at controlling credit supply are associated with greater use of informal financial services, while policy support for mobile money is associated with more formal financial access. The findings highlight the importance for central bankers and financial sector regulators to consider the potential spillovers of monetary and macroprudential policy on financial inclusion.
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Author's E-Mail Address: cdelechat@imf.org, lkiyasseh@imf.org, mmacdonald@imf.org, rxu@imf.org

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# I. INTRODUCTION

Financial inclusion is an important pillar of the agenda to boost inclusive growth in developing countries. A multidimensional concept, financial inclusion can be defined as ease of access to (or lack of barriers to), availability of , and use of formal financial services by all members of the economy (Sarma, 2008; Camara and Tuesta, 2014).

Financial inclusion has become a goal of public policy, which typically aims at reducing financial exclusion and resort to informal financial services, such as moneylenders. Worldwide, about 67 percent of bank regulators are tasked with promoting financial inclusion (Klapper and Singer, 2015). In a similar vein, the Financial Action Task Force supports formal financial inclusion to enhance transparency and traceability of transactions by reducing use of cash or informal financial services (Financial Access Task Force, 2011).

Greater degrees of formal financial inclusion, however, may not necessarily reduce use of informal financial services.[2] Many studies document that formal and informal services tend to coexist as complements, rather than substitutes, although the gradual increase in formal financial inclusion tends to decrease both exclusion and use of informal financial services (Aryeetey 2008, 2008; Soyibo 1996; De Koker and Jentzsch, 2013; Worl Bank Global FINDEX Database, 2017).

In this paper, we investigate the determinants of informal and formal financial inclusion in emerging and developing economies (EMDEs). We are particularly interested in examining whether monetary and financial policies interact with individuals' choice of formal versus informal financial services. This study's main contributions to the existing literature are threefold.

First, we use the 2017 Global FINDEX micro-data world-wide sample to construct a new granular categorization of the various ways individuals combine access to formal and informal financial services. We find that individuals tend to use formal and informal financial services as complements. Mobile banking in particular is used in combination with both (institution-based) formal and informal financial services, highlighting its role as a leapfrogging technology in bridging the gap between informal and more formal finance. To our knowledge, this is one of the first studies to analyze the determinants of formal and informal financial access in a large cross-section of countries, examining mobile banking access separately.

Second, we study the relation between monetary and financial sector policies in a large cross-sectional sample of EMDEs, including a detailed database of macroprudential measures using the IMF 2016-17 Macroprudential Policies Survey, and individual's use of formal and informal financial services. Although there are intuitive reasons monetary policy or measures aimed at increasing financial stability would influence financial inclusion (and vice-versa), this topic remains little explored in the literature. We are particularly interested in the potential relationship between macroprudential policies (which affect formal financial

[2] In this paper, formal financial services are any financial institution or mobile-based form of financial access, including micro-finance institutions, post offices, credit unions and cooperatives. Informal financial services include family and friends or any type of informal credit or savings club.

services and their users) and the persistent use of informal financial services. This relationship would be consistent with empirical findings that macroprudential policies "leak" by creating incentives for individuals or firms to move away from formal toward informal or unregulated financial services (Aiyar, Calomiris, and Wieladek, 2014; Alam and others, 2019; Ayyagari Beck, and Martinez Peria, 2018).

Third, consistent with findings in the literature of differentiated effects of macroprudential policies on firms (Ayyagari et al. 2018), our study documents differentiated interactions between macroprudential policies and individual characteristics. We find that the leakage of macroprudential policies is even more pronounced on individuals with only primary education. This is consistent with macroprudential policies being associated with increased used of informal finance, particularly for less sophisticated borrowers, highlighting the important role of financial literacy. When interacting a broad range of macroprudential policies with gender, on the other hand, we find that women become more likely to be completely excluded from financial services, relative to access to informal financial services.

Our findings suggest that central banks and bank regulators should pay more attention to the interactions between monetary and financial sector policies and financial inclusion. Macroprudential policies in particular are significantly related to individuals' use of informal financial services, relative to formal services and no financial access, after controlling for individual and country characteristics. When exploring potential drivers of this association, we find that the potential leakage of macroprudential policies is stronger in countries with more developed financial systems. Ideally these interactions would be better investigated using time-series data and econometric tools to control for potential endogeneity, but time-series of individuals' choices regarding financial access remain very limited. The World Bank's Global FINDEX data now includes three waves of observations in 2011, 2014 and 2017, but they do not follow the same individuals over time. In our study, the use of individual-level data mitigates the endogeneity concern as it would be difficult to argue that individuals' choices drive country-level structural or policy characteristics. Our results are robust when using the change in macroprudential policies instead of a dummy variable indicating the presence of macroprudential policies.

The rest of the paper is structured as follows. Section II reviews the related literature. Section III presents definitions of formal and informal financial access and key stylized facts. Section IV presents the empirical approach and results, and Section V offers conclusion and policy recommendations.

## II. RELATED LITERATURE

### A. Formal versus Informal Financial Inclusion and Mobile Banking

Our research links to the literature on financial inclusion and its determinants. Theoretical and empirical studies (mostly focusing on a single country) highlight the importance of social capital (Guiso, Sapienza and Zingales, 2004), contract enforcement (Gine, 2011; Karaivanov and Kessler, 2018), and information asymmetries (Armendariz and Morduch, 2005; Dabla-

Norris and Koeda, 2008; Madestam, 2014; Mookherjee and Motta, 2016), in explaining simultaneous resort to formal and informal financial services.

Empirical studies of the drivers of financial inclusion find that use of informal financial services is highly persistent, with policy interventions aimed at increasing formal financial inclusion having limited success (Allen, Qian, and Xie , 2014, 2016, De Koker and Jentsch, 2013, Demirguc-Kunt and Klapper, 2012, Klapper and Singer, 2015, Zins and Weill, 2016).[3] One explanation is that it is preceisely the reasons for which people resort to informal finance (accessing emergency funds and developing social networks) that makes it difficult for them to connect with the more formal financial sector (Johnson et al., 2010). Mobile banking is often seen as a bridge between formal and informal finance, in part because it shares characteristics of informal finance, in terms of accessibility, convenience, affordability and safety. But evidence suggests that the individual-level determinants of mobile banking are the same as those for formal banking and differ from informal finance, raising questions about mobile banking as a path out of informal finance (Zins and Weill, 2016). It is therefore not surprising that government interventions aimed at increasing access to formal finance, such as through cheaper credit, have not reduced the use of informal finance (Gine, 2011).

## B. Monetary and Financial Sector Policies and Financial Inclusion

The literature on monetary policy and financial inclusion is fairly sparse, despite clear links between financial inclusion and monetary policy. First, monetary policy that is focused on core inflation may be ineffective in countries with low levels of financial inclusion because regions with low inclusion tend to be rural and agricultural and thus food prices are particularly important. Second, interest rate policies are likely to become more effective with respect to quantities (money supply) in countries with more informal—i.e. cash-based—financial transactions. Finally, a central bank's interest rate rule may depend on the level of inclusion – the higher the financial inclusion the more effective interest rate tools and the greater monetary policy's focus can be on inflation stabilisation versus output stabilisation (see Yetman, 2017, for details). Qin, Zhong and Zhang (2014) find that in China, informal credit lending rates are highly receptive to monetary policies and that informal lending is substitutive to bank savings in the short term but complementary to bank lending in the long run. This finding suggests that the bank lending channel also operates through the informal financial sector.

Another issue for central bankers and financial market supervisors is the relationship between financial stability and financial inclusion. On the one hand, evidence has shown that better inclusion improves a bank's deposit bases and thereby deepens and diversifies the finanical

[3] On the supply of financial services, the IMF's Financial Access Survey (FAS) provides information on access to and use of financial services for 189 countries and spanning more than 10 years containing 121 time-series on financial access and use. Beck and others, 2007, Honohan and Beck, 2007, Mookerjee and Kalipioni, 2010 analyze financial inclusion using supply-side measures. On the demand side, the FINSCOPE datasets stem from extensive, nationally-representative demand-side surveys conducted in over 30 countries focusing on SSA, while the World Bank's Global FINDEX data base is based on Gallup polls and covers 150 countries using representative samples of a 1,000 individuals per country, providing a battery of financial inclusion indicators. A growing number of empirical studies rely on FINDEX data, among others Allen et al, 2012, Delechat et al, 2018, Demirguc-Kunt and Klapper, 2012, Demirguc-Kunt et al, 2013.

system (Han and Melecky, 2013; Hannig and Jansen, 2010). On the other hand, Sahay and others (2015) find that financial stability is at risk when access to credit is expanded without adequate supervision.

The structure and health of the financial sector might also be associated with financial inclusion, but the evidence is somewhat mixed. Owen and Pereira (2018) find that greater banking industry concentration is associated with more access to deposit accounts and loans, provided that the market power of banks is limited. Yet Mengistu and Perez-Saiz (2018) find the opposite is true in a sample of sub-Saharan African (SSA) countries. Sarma and Pais (2011) find that high non-performing loans and high capital/asset ratios are associated with lower formal financial inclusion.

Macroprudential policies could also interact with financial access.[4] By acting on formal financial intermediaries and households relying on formal credit, macroprudential policies could unintentionally "push" credit activity toward the informal sector. Ayyagari , Beck and Martinez Peria (2018) show that borrower-targeted macroprudential policies are robustly and negatively associated with growth in long-term firm financing. Aiyar, Calomiris, and Wieladek (2014) find that regulated banks reduce lending in response to tighter capital requirements, but that unregulated banks increase lending in response to tighter capital requirements on a relevant reference group of regulated banks. Alam and others (2019) find that the tighter the loan-to-value ratio (LTV), the smaller the per-unit effect on household credit, possibly because a strong tightening could encourage people to seek credit from abroad or from nonbank lenders. Ben Hassine and Rebei (2019) show that informality weakens the impact of macroprudential policies in EMDEs.

Three main take-aways emerge from this brief literature survey. First, financial access takes multiple forms for each individual. The choice of instrument used to gain financial access is influenced by personal characteristics, but also by country-level factors, including measures of institutional quality. Second, the literature suggests that because individuals mix different types of financial services, studying jointly the determinants of formal and informal financial access would be useful. Third, given the still scarce literature, how monetary and financial sector policies, including macroprudential policy tools, are related to formal financial inclusion should be examined. Central banks in countries with large informal sectors would benefit from such an analysis, given their joint objectives of expanding financial inclusion and ensuring macroeconomic and financial stability.

## III. KEY STYLIZED FACTS OF FORMAL AND INFORMAL FINANCIAL ACCESS

### A. Defining Formal and Informal Financial Access

Our categorization of financial inclusion is based on the World Bank's Global Findex Database 2017. The database is a nationally representative survey of more than

[4] Macroprudential policies aim at limiting systemic risk by building buffers to absorb the impact of systemic shocks, and can be directed at financial institutions and affect the supply of credit (e.g. countercyclical capital buffers, liquidity tools) or at borrowers, thus affecting the demand for credit (e.g. loan-to-value ratios or debt-to-income ratios, IMF, 2013).

150,000 adults in over 140 economies, including 34 in sub-Saharan Africa (See Demirguc-Kunt and Klapper, 2012a, 2012b and Demirguc-Kunt and others, 2020 for a detailed description of the database). This database builds on similar 2011 and 2014 surveys by including questions on the use of financial technology (fintech), mobile phones, and the internet to conduct financial transactions.

In order to classify respondents into each category, we interpret their answers to questions on use of different financial services as revealing of their access to and use of financial services. The 2017 Findex Questionnaire asks 48 questions, with additional follow up questions depending on the answer given to certain questions. These questions are aimed at obtaining information about access to a particular type of financial services, for *e.g.*:

*Do you currently have an account at a bank or another type of formal financial institution? Yes or No?*

We would classify a positive answer to this question as indicative of the respondant having formal financial access. Questions can also be indirectly revealing of access, for e.g. :

*In the past 12 months, has an employer paid your salary or wages in any of the following ways? (i) You received payments directly into an account at a bank or another type of formal financial institution; (i) You received payments through a mobile phone.*

In this case we consider a positive answer to the part (i) of the question as revealing that the respondent has an account at a formal financial institution, while a positive answer to part (ii) as revealing they have access to mobile financial services.

We examine each individual's responses to all question and first classify them into one of five mutually exclusive categories. Our criteria for each category are as follows:

a. **Complete exclusion**: answer negatively to *all* questions regarding the use of formal, informal, *and* mobile services.
b. **Informal access only**: answers positively to *any* question regarding the use of informal services *and* answers negatively to *all* questions regarding the use of formal *and* mobile services.
c. **Formal access only:** answers positivley to *any* question regarding the use of formal services *and* answers negatively to *all* questions regarding the use of informal *and* mobile services.
d. **Formal and informal access:** answers positively to *any* question regarding the use of formal *or* informal services *and* answers negatively to *all* questions regarding the use of mobile services.
e. **Any mobile access**: answers positively to *any* question regarding the use of mobile services, in combination with either no resort to formal and informal financial services, or to both formal and informal financial services or only formal or informal.

Our categorization of individuals combines the extensive and intensive margin of financial service access. That is, we combine pure access or account ownership with intensity of use. There are benefits to taking this approach. First, combining the extensive and intensive margins allows us to answer directly the question on access to financial services, and in particular the role of monetary and macroprudential policies in access. Second, as is the case with any survey data, it is possible that individuals make errors when responding to the FINDEX questions. For instance, they may respond *no* to a direct question about having a formal account but may, for e.g., have their wages paid to a bank account and respond *yes* to a question regarding this. By combining the extensive and intensive margins we do not falsely exclude individuals from the extensive margin of access.

In the econometric analysis we further collapse the index into three categories: access to formal or mobile banking, access to informal financial services only, and complete exclusion (Figure 1). In this exercise we are treating access to mobile services as equivalent to access to formal financial services, since it is often considered as such in both policy and research literature. In robustness checks we show that, personal characteristics associated with use of mobile and formal financial services are indeed similar, so we believe this is a reasonable assumption.

### B. Stylized Facts

**Facets of financial access**

Globally, financial access has improved between 2014 and 2017. The number of individuals completely excluded or with only access to informal services has fallen worldwide, and practically disappeared in advanced economies (Figure 2). While the number of individuals with only access to traditional banking has also fallen, this has been more than made up for by those with access to mobile technology. The adoption of mobile financial services as a means to access formal financial services is particularly pronounced in SSA, where access to informal financial services fell by more than 25% since 2014 while mobile (with or without other types of services) accounted for 65% of total respondents in 2017 (Figure 2). The simultaneous resort to formal and informal financial services by individuals is striking and suggests a complementary relationship, and a further breakdown of the use of mobile accounts together with other services illustrates the complementary relationship they also have (Figure 3).

Looking more specifically at uses of financial services show little recent progress in savings and borrowing through formal means worldwide (Figure 4). Since 2014, the use of only cash for both making and receiving payments has fallen, and users have moved more towards bank accounts and mobile access indicating an increase in financial access (Figure 5). The stagnation in formal borrowing and saving is important as their micro and macro benefits have been found to be the strongest, relative to just having a bank account.

## IV. WHAT DRIVES THE TYPES OF FINANCIAL ACCESS?

### A. Empirical Strategy

The first step in our analysis refines our definitions of access to formal, informal, and mobile financial services. Specifically, as mentioned above, we collapse our index into three categories: complete exclusion, access to informal financial services only, and access to formal or mobile financial services. This last category also includes any combination of access to formal, mobile, and informal financial services. In order to estimate the role of each of our explanatory variables as determinants of these three different levels of access we estimate a multinomial logistic regression. Specifically, the model we estimate is:

$$\Pr(excluded) = \frac{e^{X\beta^{(excluded)}}}{e^{X\beta^{(exclude)}} + e^{X\beta^{(informal)}} + e^{X\beta^{(formal-mobile)}}}$$

$$\Pr(informal) = \frac{e^{X\beta^{(informal)}}}{e^{X\beta^{(exclude)}} + e^{X\beta^{(informal)}} + e^{X\beta^{(formal-mobile)}}} \qquad (1)$$

$$\Pr(formal - mobile) = \frac{e^{X\beta^{(formal-mobile)}}}{e^{X\beta^{(excluded)}} + e^{X\beta^{(informal)}} + e^{X\beta^{(formal-mobile)}}}$$

Where $F(z) = \frac{e^z}{1+e^z}$ is the related cumulative logistic distribution, $\boldsymbol{X}$ is our set of explanatory variables, and the dependent variable is a 3-way index which takes on the value of 0 for complete exclusion, the value of 1 for informal access, and the value of 2 for formal or mobile access (or any combination). We assume these outcomes to be unordered which means we do not assume exclusion to be "less" than informal, or informal to be "less" than mobile or formal access. While it is possible these outcomes could be ordered, the inclusion of mobile financial services and the fact that many individuals make use of multiple types of financial services makes the ordering more ambiguous than it would be otherwise. $\boldsymbol{X}$, is our set of explanatory variables for personal, macroeconomic, monetary and structural, and financial characteristics at the individual and country level. We cluster the standard errors at the country level, to correct for correlation across individuals within the same country.

In the multinomial logit model, we choose "informal access only" as the reference group. The multinomial logit essentially runs two logit models: one on formal access versus informal access and the other on no access versus informal access. The coefficient should be interpreted as follows: for a unit change in the explanatory variable, the logit of formal access (or no access) relative to informal access is expected to change by the parameter estimate while holding all other variables constant.

We also estimate two models analogous to (1) with the left-hand side variable being the probability of saving informally, on the one hand, and with the probability of borrowing informally, on the other, since the determinants of access to formal savings and borrowing may differ and may be confounded in our baseline regression. These estimates aim to shed some light on the specific channels through which financial inclusion and financial/macroprudential variables are related.

The second step in our analysis looks specifically at the determinants of access to mobile financial services. We define an individual as having access to mobile financial services if they are identified as having access to any mobile financial service. With this definition, we estimate the following simple logistic regression:

$$\Pr(mobile = 1) = \frac{e^{z\beta_0+\beta_1 \boldsymbol{X}}}{1+e^{z\beta_0+\beta_1 \boldsymbol{X}}} \qquad (2)$$

Where $F(z) = \frac{e^z}{1+e^z}$ is the related cumulative logistic distribution and $\boldsymbol{X}$ is our set of explanatory variables.

Our analysis is conducted using the 2017 FINDEX micro-data and other independent variables for 2017 (or 2016, depending on data availability). The analysis is limited to a simple but large cross-section, because the three successive FINDEX surveys (2011, 2014, 2017) have not been conducted with the same individuals, so aggregation would be possible only at the country level, which would mean losing the rich individual data and further complicating identification of the model. Some of the explanatory variables also have limited time variation over the period (e.g. presence of macroprudential policies). As the explanatory variables are at the country level, country fixed effects are not introduced, but we use indicator variables for each region to control for time invariant regional heterogeneity.

### B. Choice of Explanatory Variables

The choice of explanatory variables follows the literature reviewed here. Variable definitions and sources can be found in Appendix Tables 2, and their summary statistics in Appendix Table 3.

*Individual characteristics*. From the FINDEX database we use *gender, age, education level, income quintile, and a proxy for being in the workforce* (indicator variable based on FINDEX question on whether the person has received wages in the past 12 months).[5] We expect that being female, younger, less educated, poorer and unemployed to be negatively associated with formal financial inclusion and mobile inclusion.

*Country-level controls*. For parsimony and to avoid multicollinearity, we use a reduced number of country-level controls, namely *the log of real GDP per capita* as a proxy for level of development, the *size of the informal economy,* measured as the share of the informal sector in GDP from Medina and Schneider (2018), *an indicator variable taking the value of 1 if average inflation is greater than 12 percent in the year of the FINDEX survey* (countries with 12 percent and above are in the 90th decile of inflation rates in our sample), as a measure of macroeconomic stability. An *index of regulatory quality* (from the World Governance Indicators from Kaufmann, Kray and Mastruzzi (2003) controls for the quality of institutions. Finally, we include controls for the level of financial sector development, including *domestic credit to GDP* as a proxy for financial depth, the *mobile regulatory support index* from GSMA Mobile Money Metrics,[6] an indicator variable taking the value of 1 if the country has an *inflation targeting* regime and an indicator variable taking the value of 1 if the country has

[5] This variable is generally considered a proxy for formal employment, as self-employed individuals are mostly in the informal sector, though it could be the case that workers employed by informal firms would also receive wages. Nonetheless, given that one of the reasons for involuntary exclusion is lack of income, individuals receiving wages are more likely to be financially included.

[6] Bahia and Muthiora (2019) show that supportive mobile banking regulation is highly correlated with mobile money adoption.

a *credit bureau or registry*. We expect this last group of variables to be positively associated with formal financial inclusion. These variables are included in the baseline regression rather than separately below as it is important to control for more general proxies for financial development and monetary policy regime before introducing separately more specific monetary and financial measures as described below. While measures of aggregate financial development exist (such as the index of financial development constructed by Svirydzenka, 2016), they are highly correlated (collinear) with our other control variables, such as GDP per capita, and thus cannot be included directly.

- *Monetary policy.* We control in all regressions for whether or not a country has an *inflation targeting regime*, which is typically associated with a higher degree of financial development. We also look at additional variables related to monetary policy, in turn. We expect *higher real interest rates* to be negatively associated with formal financial inclusion. We also include an indicator variable taking the value of 1 if there are *interest rate controls* in place in the country. Although the literature finds that interest rate controls tend to have effects opposite than intended (that is, reduce the cost of credit and increase financial access), a number of countries in the world still have interest controls in place (Munzele Maimbo and Henriquez Gallegos, 2014).
- *Financial sector health and structure.* Regarding financial sector structure, we use a measure of *banking sector concentration*, with greater concentration expected to be associated with lower formal financial inclusion (Mengistu and Perez Saiz, 2011); as well as the *log of bank capital to total assets ratio*, a measure of financial sector health, which we expect to be positively associated with formal financial inclusion (World Bank Global Financial Development Database).
- *Macroprudential policies.* We use data based on a world-wide survey of macroprudential policies in 2016-17 developed at the International Monetary Fund. The dataset catalogues the use of macroprudential tools by individual countries in 2016-17, with 141 countries reporting a total of 1,313 measures for an average number of 9.3 measures by country (9.9 for advanced economies and 9.1 for EMDEs). We use an indicator variable for each of the fifteen macroprudential measures in the survey, taking the value of 1 if the measure is reported to be in place. Specifically, we test if the presence of each of the following policies is correlated with the choice of financial access: *1) limit on leverage ratio; 2) forward-looking loan provision; 3) cap on credit growth; 4) other broad-based measures; 5) household sector capital requirement; 6) cap on credit growth to the household sector; 7) loan restrictions or borrower eligibility criteria; 8) cap on loan-to-value ratio; 9) cap on loan-to-income ratio; 10) cap on debt-service-to-income ratio; 11) limit on amortization periods; 12) restrictions on unsecured loans; 13) other; 14) loan to deposit ratio; and 15) loan to deposit ratio differentiated by currency.* Since for many individual tools the variation is limited, we consider grouping macroprudential measures following the classification in Alam and others (2019), including *all*, *demand (i.e. targeted at borrowers)*, and *supply* measures (i.e. targeted at financial institutions). The supply measures are further subdivided into three

categories, including general-, capital-, and loan-supply tools.[7] For each country, we count the number of macroprudential measures in each group as a rough estimate of "intensity" of use of macroprudential tools, and estimate its correlation with each individual's choice of financial services. We are interested in testing whether measures targeted at formal financial institutions (supply measures) are associated with lower formal (versus informal) financial inclusion. Appendix Table 4 provides a summary of the distribution of macroprudential variables in our dataset.

- *Regional controls.* We control for regional heterogeneity by adding regional indicator variables (East Asia & Pacific, South Asia, Europe and Central Asia, Middle East and North Africa, Latina America and the Caribbean, sub-Saharan Africa).

## C. Results

### Baseline estimates

Individuals' type of financial access is strongly associated with a number of personal, macro, and structural characteristics. Table 1 reports the multinominal logit regression results specified in equation (2) above. The column labeled "No Access" shows determinants of being excluded from financial services relative to informal financial services only, and the column labeled "Formal Access" is on having formal and mobile banking access relative to having informal access.

- **Individual characteristics.** Being female is negatively associated with having no access and with formal access, suggesting women tend to use informal financial services to a higher degree than men. Having only primary education and low income have significant negative association with formal access. Having wage income improves both informal and formal financial access.

- **Country-level controls**. Access to formal financial services is positively and significantly associated with GDP per capita, a measure of development but has little correlation with other country-level variables.

- **Monetary policy.** The monetary policy regime, captured by an indicator variable for whether or not a country targets inflation, is positively associated with formal access and negatively associated with no access, which is consistent with inflation targeting being present in more developed financial markets, though the estimate are not statistically significant.[8]

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[7] "Loan-targeted" group consists of the "Demand" and the "Supply-loans" instruments. "Demand" instruments are the limits to the loan-to-value ratio (LTV) and the limits to the debt-service-to-income (DSTI) ratio. "Supply-loans" measures are limits to credit growth (LCG), loan loss provisions (LLP), loan restrictions (LoanR), limits to the loan to deposit ratio, and limits to foreign currency loans. "Supply-general" instruments are reserve requirements, liquidity requirements, and limits to FX positions. "Supply-capital" instruments are leverage limits (LVR), countercyclical buffers (CCB), conservation buffers, and capital requirements.

[8] Results are robust to using an alternative monetary policy regime control of whether or not countries have an exchange rate peg and are available upon request.

**Adding monetary and financial variables**

After establishing the baseline control variables, we explore the relationship between monetary policy and financial market structure on financial inclusion. We add these monetary and financial variables one by one to the baseline specification considering the high correlation between them. The results, as presented in Table 2, suggest macroprudential policies are significantly associated with individuals' choice of financial services.

- **Financial market structure**. Financial inclusion is significantly associated with banking sector competition. This could be due to the fact that less developed financial markets also tend to be more concentrated, or due to higher lending costs related to lower competition in the banking sector. This is consistent with Mengistu and Perez-Saiz (2018) who find that more competition is related to greater formal financial access in SSA.
- **Macroprudential policies.** Supply-side macroprudential policies, including limits on leverage ratio, cap on credit growth, and loan to deposit ratio, as well as aggregate indicators of supply-side measures (loans, general, and capital-based) are negatively and significantly associated with having access to formal financial services. Demand-side policies, on the other hand, are not significantly associated with choice of financial services. This can be interpreted as supporting the hypothesis that macroprudential measures targeted at formal financial institutions (rather than individuals) are easier to evade by resorting to informal financial services in EMDEs, supporting the notion of "leakages".

We also present the marginal effects of the baseline personal control variables and the macroprudential varaibles on the probability of having formal financial access in Figure 6, to give an idea of the relative size of the impact of each of the dependent variables on the type of financial access. This figure indicates that in terms of their magnitude, the impact of macroprudential variables are only slighlty smaller than personal characteristics.

Mobile banking is also affected by personal, monetary and financial factors. Using a simple logit regression to determine the probability of *any* mobile use, we estimate the coefficients for the same set of variables as shown in Table 2. The coefficients are similar to the ones in the multinomial logit on formal/mobile access, with a few exceptions. Mobile money regulatory support is associated with a significant increase in mobile banking access.

In addition to the type of financial access, the Findex survey enquires about how people borrow and save, which enables separate analyses on borrowing and saving. Applying the same multinominal logit regression on our borrowing index, which is defined as complete exclusion, only informal borrowing, and formal borrowing or formal plus informal borrowing, and with the three categories defined analogously for our saving index, we estimate the model using the same set of control variables and monetary/financial variables. This also serves as a test of the economic relevance of the previous set of results using our grouping of the FINDEX variables. The results are presented in Tables 4 and 5. By comparing Table 4 with Table 1 and Table 5 with Table 2, we can trace out whether a specific factor influences financial access through the borrowing channel, the savings channel or both.

- **Individual characteristics.** Most individual characteristics affect borrowing and saving choices in the same way as they affect overall financial access. One noteworthy difference is in gender: women are more likely to *save* through informal channels but not borrow informally.
- **Country-level controls.** Separating borrowing from saving shows more nuanced effects of country controls. For instance, better regulatory quality is now associated with a higher probability of formal borrowing. Mobile money regulatory support is positively related to formal financial access but for mobile regulation this is only through the savings channel. Similarly, higher GDP per capita is associated with formal borrowing mostly through the savings channel.
- **Macroprudential policies.** Both supply- and demand-side macroprudential measures tend to increase informal borrowing through suppressing the proportions with no access, while it is only supply-side policies (in aggregate) that are associated with lower formal borrowing. Not surprisingly, since most macroprudential policies target borrowing activity rather than saving, there is little impact through the savings channel, though some supply-side policies are still associated with lower formal saving (limits on leverage, loan-to-deposit ratios).

**Exploring possible reasons for the observed "leakage" of macroprudential policies**

In spite of its exploratory nature, the empirical analysis so far has highlighted fairly consistent and statistically significant associations between the use of macroprudential measures and formal financial access, including how individuals save and borrow. This holds after controlling for individual and country-level characteristics. However, it would be important for policy makers in EMDEs to better understand the sources of "leakages" of macroprudential policies, because it could imply reduced effectiveness of these measures. Further, they could also help drive the persistence of resort to informal financial services, which would run counter to the goal of fostering access to formal financial services.

We find that the impact of macroprudential policies differs according to the level of financial development in a country. Table 6 reports estimates for our baseline regression on the full sample of countries, splitting the sample into higher and lower than average levels of financial development.[9] By splitting the sample we are able to estimate the differential impact of personal characteristics, country-level controls, and macroprudential policies on financial access according to the level of financial development, rather than estimating the average effect when we simply control for financial development. The negative association of macroprudential policies with access to formal financial services is primarily in countries with higher levels of financial development (especially for specific supply-side macroprudential variables: limit on leverage ratio, broad-based measures, and loan-to-deposit ratio). This is consistent with the finding in Cizel et al. (2016) that the leakages are stronger for more advanced economies and in the case of restrictions on quantity of credit. In countries with low levels of financial development, macroprudential measures instead are

[9] The index of financial development constructed by Svirydzenka (2016) provides a relative ranking of 176 countries on the depth, access, and efficiency of their financial institutions and financial markets.

generally associated with greater odds of informal access relative to no access, while showing little-to-no leakages from formal to informal.

**Distributional effects of macroprudential policies**

The role of macroprudential policies also differs according to personal characteristics, in particular by the level of education and gender. By interacting these personal characteristics with macroprudential policies we are able to examine whether the impact of macroprudential policies differs according to whether individuals are, for example, male or female, young or old, educated or not educated, low or high income, and employed in the formal or informal sectors. Of all personal characteristics that are available to us in the FINDEX database, only two appear to influence the role of macroprudential policy:the level of education and gender. Results, reported in Table 7, show that the leakage of macroprudential policies—in the sense of our baseline result of an association between supply-side macroprudential policies and informal finance—is even more pronounced on individuals with only primary education. This is consistent with macroprudential policies being associated with increased use of informal finance, particularly for less sophisticated borrowers, and thus highlighting the important role of financial literacy. When interacting macroprudential policies with gender, on the other hand, one sees that women become more likely to be completely excluded from financial services, relative to access to informal financial services. Many policies, both supply and demande side (e.g. loan restrictions, as well as our aggregate indices) are associated with an increase in no access rather than informal access for women, suggesting strong crowding out effects.

## V. CONCLUSIONS

Financial inclusion continues to be a goal of public policy in low-income countries. The benefits of greater financial inclusion are by now well established— allowing individuals to smooth their consumption, efficiently allocating productive resources across the economy, empowering women, reducing poverty and inequality, and supporting growth, among other things. Given these benefits, many countries and international organizations, such as the Financial Action Task Force, have rightly set greater financial inclusion as an important objective.

Across emerging and developing economies, financial inclusion has been improving thanks largely to the adoption of mobile financial services. For instance, although sub-Saharan Africa continues to have the highest rates of informal finance, mobile accounts now make up 17.4 percent of all financial services access on the continent. The growth of the mobile financial services industry has given access to formalized accounts for millions of the world's poorest people, greatly facilitating payments' transactions.

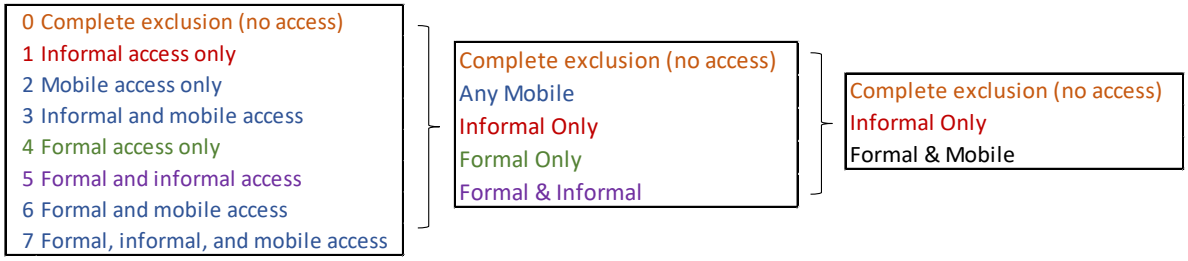
Yet, financial inclusion still has far to go. Although access greatly increased between 2014 and 2017, a large share of individuals are still excluded from the formal financial sector. Access to bank accounts has increased world-wide, too few individuals use the accounts for borrowing and saving. Furthermore, in many countries mobile financial services may only include mobile money, which does not necessarily provide the same benefits that full-fledged mobile banking would. To further increase the use of formal savings and borrowing

instruments, developing mobile-based savings and borrowing instruments along with an appropriately supportive regulatory framework could be the most effective way to continue to boost financial inclusion worldwide.

Macroprudential policies, and the health of the financial sector seem to play a role in financial inclusion. Our results are the first to show a robust association between financial inclusion and monetary, macroprudential and financial sector policies and conditions. In particular, supply-side (institution-based) macroprudential policies seem to be associated with more use of informal finance and with less use of formal and mobile services. The association between limits on credit growth, and greater use of informal financial services, relative to formal ones is particularly strong. These results do not establish causality, yet they suggest a significant relationship between certain policies and individual-level use of certain types of financial services. Although the precise channel for resort to informality remains to be investigated, including the likely complex interactions between the size of the informal sector and financial development, they appear to be stronger for countries at higher levels of financial development. Consistent with findings in the literature of differentiated effects of macroprudential policies on firms, we also find evidence that women and less-educated individuals are more affected by these leakages.

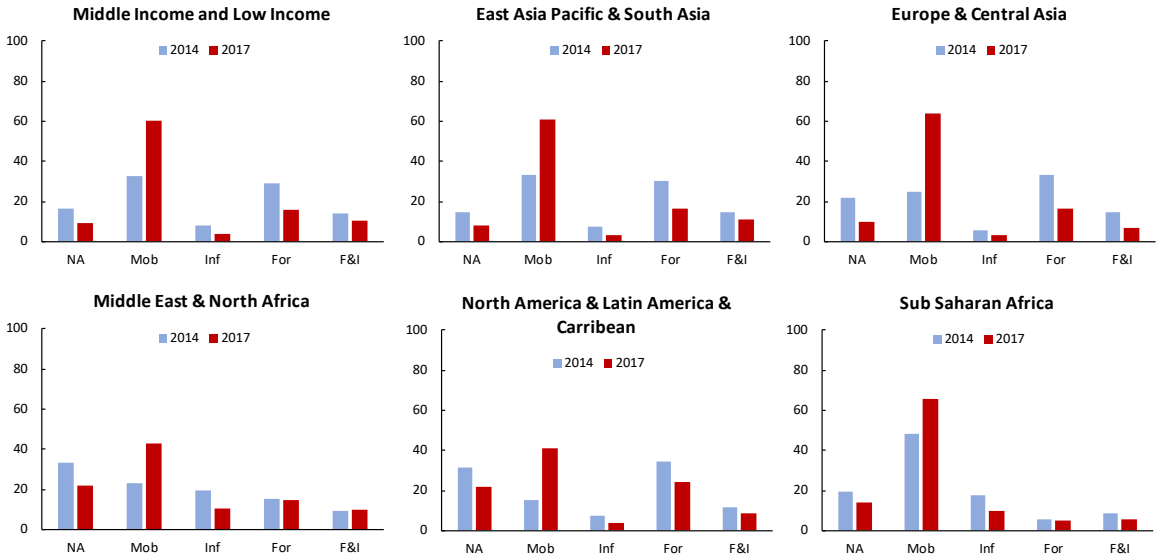
The key implication emerging from these findings is that central bankers and regulators ought to at least consider jointly the interactions between monetary and financial sector policies and financial inclusion. Given possible negative spillover effects from many macroprudential and financial sector policies, their effects on financial inclusion need to be considered *ex ante*. At the same time, policies to support financial inclusion, including by increasing financial and digital literacy and regulatory support to mobile banking should be even more actively pursued.

## Figure 1. Index Categories Used in Econometric Analysis




## Figure 2. Financial Inclusion Around the World

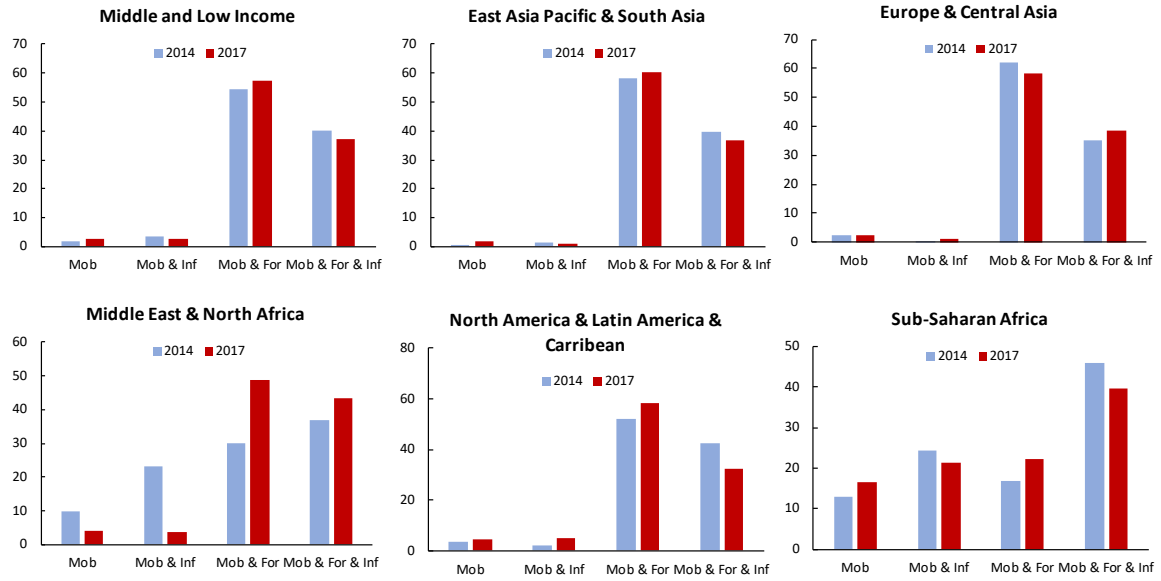
(All respondents, percent of population aged 15 and over)




Note: NA = No Access, Mob = Any Mobile, Inf = Informal Only, For = Formal Only, F&I = Formal & Informal. Data represents only middle and low income countries, and is weighted by individual survey weights and country population.

Source: World Bank Findex 2014 and 2017; World Bank World Development Indicators; IMF World Economic Outlook; author estimates

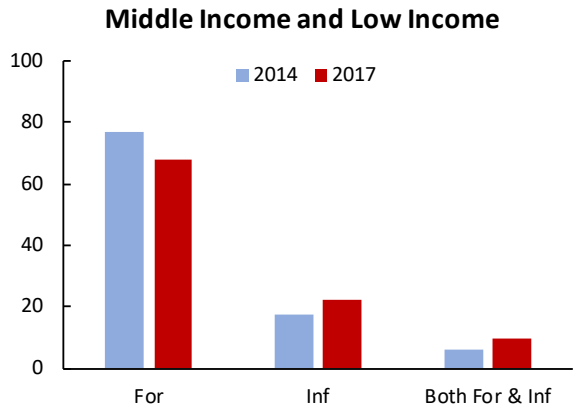
## Figure 3. Decomposing Mobile Financial Access
(All respondents, percent of population aged 15 and over)



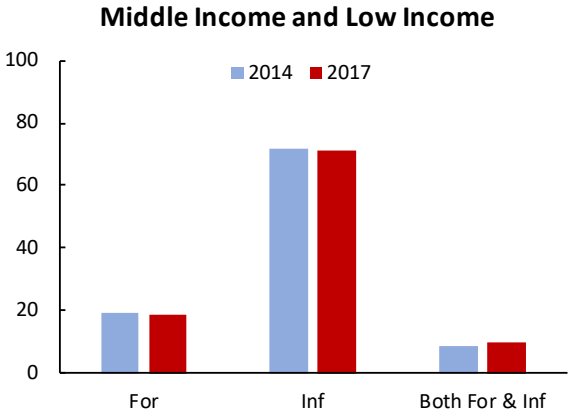

Note: Mob = Mobile only, Mob & Inf = Mobile & Informal, Mob & For = Mobile & Formal, Mob & For & Inf = Mobile & Formal & Informal. Data is weighted by individual weights and country population.
Source: Findex 2014 and 2017, World Bank; World Development Indicators, World Bank;World Economic Outlook, IMF; and IMF Staff

## Figure 4. Savings and Borrowing: 2014 versus 2017, by Region
(All respondents, percent of population aged 15 and over)

***(1) Savings***

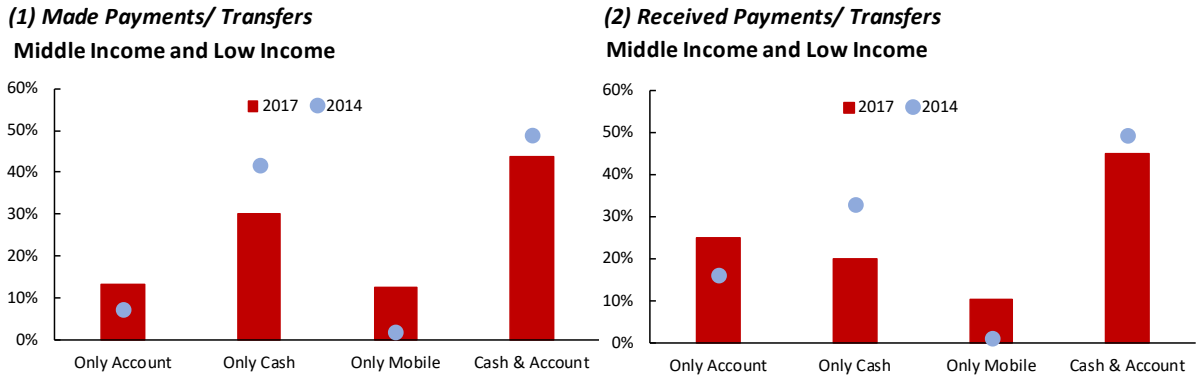



***(2) Borrowings***



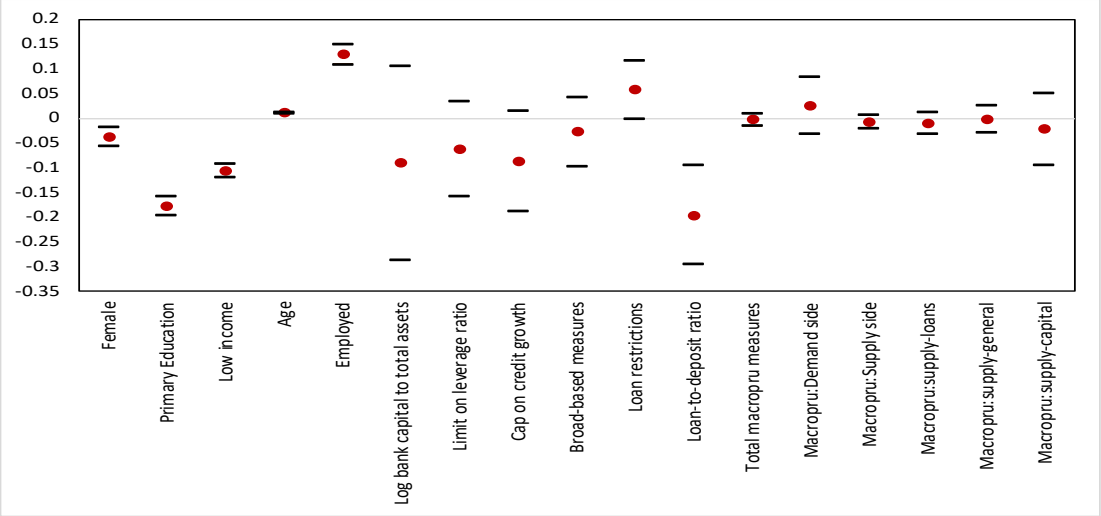

Note: For = Formal, Inf = Informal, Both For & Inf = Formal & Informal. Data represents only middle and low income countries and is weighted by individual survey weights and country population.
Source: Findex 2014 and 2017, World Bank; World Development Indicators, World Bank; World Economic Outlook, IMF; and IMF Staff

## Figure 5. Payments and Transfers: 2014 versus 2017
(All respondents, percent of population aged 15 and over)




Note: Data has been weighted by individual weights and country population
Source: Findex 2014 and 2017, World Bank; World Development Indicators, World Bank;World Economic Outlook, IMF; and IMF Staff

## Figure 6. Margin Plots of Baseline Multinomial Logit Regressions




Note: Margins plots are calculated based on coefficient estimates in Tables 2 and 3.

## Table 1. Multinomial Logit Regressions with Baseline Controls

| | No Access (vs. Informal Access) | Formal (vs. Informal Access) |
|---|---|---|
| Female | -0.085** | -0.236*** |
| | (0.041) | (0.064) |
| Primary education | 0.055 | -0.823*** |
| | (0.051) | (0.060) |
| Low income | 0.101** | -0.441*** |
| | (0.040) | (0.040) |
| Age | -0.023*** | 0.041*** |
| | (0.005) | (0.006) |
| Age^2 | 0.000*** | -0.000*** |
| | (0.000) | (0.000) |
| Receive Wage | -0.486*** | 0.305*** |
| | (0.049) | (0.065) |
| High inflation(12pc) | 0.218 | 0.251 |
| | (0.163) | (0.199) |
| Regulatory quality (estimate) | 0.283 | 0.365 |
| | (0.194) | (0.232) |
| Mobile Money regulatory support | 0.003 | 0.012 |
| | (0.007) | (0.009) |
| Domestic private credit/GDP | -0.001 | 0.007 |
| | (0.003) | (0.006) |
| Inflation Targeter | -0.175 | 0.236 |
| | (0.156) | (0.291) |
| Log GDP per capita | 0.106 | 0.342*** |
| | (0.081) | (0.103) |
| Size of informal sector | -0.001 | -0.009 |
| | (0.007) | (0.011) |
| Credit registry or bureau | -0.206 | -0.075 |
| | (0.158) | (0.239) |
| Constant | 0.688 | -2.163** |
| | (0.884) | (1.091) |
| Regional dummies | Yes | Yes |
| Observations | | 67354 |
| Pseudo R-squared | | 0.102 |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Formal access is defined as any formal access and informal access defined as only informal access. Reference group is informal access. The multinomial logit estimates two models, one logit model for no access relative to informal access and one logit model for formal access relative to informal access.

## Table 2. Multinomial Logit Adding Financial and Monetary Variables

| | No Access (vs. Informal Access) | Formal (vs. Informal Access) |
|---|---|---|
| All control variables | Y | Y |
| Interest rate controls | 0.444* | 0.280 |
| | (0.234) | (0.366) |
| Real interest rate | -0.000 | -0.005 |
| | (0.004) | (0.009) |
| log Bank concentration (%) | -0.047 | -0.430 |
| | (0.258) | (0.434) |
| log Bank capital to total assets (%) | 0.176 | -0.344 |
| | (0.679) | (0.830) |
| *Macroprudential measures* | | |
| Limit on leverage ratio | -0.568*** | -0.681*** |
| | (0.170) | (0.247) |
| Cap on credit growth | -0.274 | -0.602* |
| | (0.196) | (0.329) |
| broad-based measures | -0.362*** | -0.374* |
| | (0.113) | (0.203) |
| Loan restrictions or Borrower eligibility criteria | -0.405*** | 0.016 |
| | (0.119) | (0.164) |
| Loan-to-deposit ratio | -0.426*** | -1.245*** |
| | (0.144) | (0.255) |
| *Macroprudential count by group* | | |
| All macropru measures | -0.081*** | -0.064* |
| | (0.024) | (0.034) |
| Macropru:Demand side | -0.021 | 0.113 |
| | (0.093) | (0.168) |
| Macropru:Supply side | -0.109*** | -0.099*** |
| | (0.024) | (0.034) |
| Macropru:supply-loans | -0.151*** | -0.145** |
| | (0.044) | (0.063) |
| Macropru:supply-general | -0.228*** | -0.162** |
| | (0.076) | (0.081) |
| Macropru:supply-capital | -0.278** | -0.289 |
| | (0.126) | (0.204) |
| Regional dummies | Yes | Yes |
| Observations | | 67354 |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Variables in table are included individually in separate regressions. Regressions includes all control variables from Table 1 and fixed effects for the EMDE sample. Formal access is defined as any formal access and informal access defined as only informal access. Reference group is informal access. The multinomial logit estimates two models, one logit model for no access relative to informal access and one logit model for formal access relative to informal access. Number of observations are identical for each regression. R2 for each regression available upon request

## Table 3. Simple Logit Regression on Mobile Banking Access

| | |
|---|---|
| Female | -0.191*** |
| | (0.040) |
| Primary education | -0.756*** |
| | (0.092) |
| Low income | -0.525*** |
| | (0.039) |
| Age | 0.032*** |
| | (0.006) |
| Age^2 | -0.000*** |
| | (0.000) |
| Receive Wage | 0.552*** |
| | (0.054) |
| High inflation(12pc) | -0.334 |
| | (0.253) |
| Regulatory quality (estimate) | -0.081 |
| | (0.270) |
| Mobile Money regulatory support | 0.026*** |
| | (0.009) |
| Domestic private credit/GDP | -0.004 |
| | (0.003) |
| Inflation Targeter | 0.162 |
| | (0.232) |
| Log GDP per capita | 0.233* |
| | (0.124) |
| Size of informal sector | -0.012 |
| | (0.012) |
| Credit registry or bureau | 0.477 |
| | (0.297) |
| Constant | -4.730*** |
| | (1.344) |
| Regional dummies | Yes |
| Observations | 67354 |
| Pseudo R-squared | 0.162 |

| | |
|---|---|
| All control variables | Y |
| Interest rate controls | 0.032 |
| | (0.419) |
| Real interest rate | -0.013 |
| | (0.009) |
| log Bank concentration (%) | 0.067 |
| | (0.374) |
| log Bank capital to total assets (%) | 0.077 |
| | (0.674) |
| *Macroprudential measures* | |
| Limit on leverage ratio | -0.121 |
| | (0.203) |
| Cap on credit growth | 0.026 |
| | (0.382) |
| broad-based measures | -0.204 |
| | (0.279) |
| Loan restrictions or Borrower eligibility criteria | 0.014 |
| | (0.230) |
| Loan-to-deposit ratio | -0.281 |
| | (0.384) |
| *Macroprudential count by group* | |
| All macropru measures | -0.003 |
| | (0.055) |
| Macropru:Demand side | 0.257 |
| | (0.188) |
| Macropru:Supply side | -0.030 |
| | (0.056) |
| Macropru:supply-loans | 0.017 |
| | (0.105) |
| Macropru:supply-general | -0.162 |
| | (0.124) |
| Macropru:supply-capital | -0.223 |
| | (0.144) |
| Regional dummies | Yes |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Dependent variable is any access to mobile accounts. Financial sector structure, monetary policy and macroprudential variables (i.e. those on the right-hand side table) are added to the full list of control variables one by one. Number of observations match those from the left hand side regression. R2 for individual regressions available upon request.

## Table 4. Multinomial Logit Regressions with Baseline Controls—Borrowing and Saving

| | Borrowing | | Saving | |
|---|---|---|---|---|
| | No Access (vs. Informal Access) | Formal (vs. Informal Access) | No Access (vs. Informal Access) | Formal (vs. Informal Access) |
| Female | 0.034 | -0.008 | -0.369*** | -0.443*** |
| | (0.025) | (0.047) | (0.066) | (0.078) |
| Primary education | 0.083* | -0.313*** | 0.213*** | -0.683*** |
| | (0.046) | (0.092) | (0.064) | (0.085) |
| Low income | 0.020 | -0.246*** | 0.310*** | -0.474*** |
| | (0.038) | (0.059) | (0.039) | (0.057) |
| Age | -0.028*** | 0.090*** | -0.050*** | -0.005 |
| | (0.005) | (0.009) | (0.007) | (0.010) |
| Age^2 | 0.000*** | -0.001*** | 0.001*** | 0.000 |
| | (0.000) | (0.000) | (0.000) | (0.000) |
| Receive Wage | -0.495*** | 0.298*** | -0.600*** | 0.196** |
| | (0.039) | (0.067) | (0.058) | (0.082) |
| High inflation(12pc) | 0.218* | 0.228 | 0.101 | 0.316* |
| | (0.126) | (0.217) | (0.200) | (0.178) |
| Regulatory quality (estimate) | 0.057 | 0.419*** | -0.296 | -0.101 |
| | (0.170) | (0.151) | (0.243) | (0.257) |
| Mobile Money regulatory support | 0.000 | -0.008 | 0.015* | 0.016* |
| | (0.005) | (0.007) | (0.009) | (0.009) |
| domestic private credit/GDP | -0.000 | 0.003 | -0.001 | 0.005 |
| | (0.002) | (0.003) | (0.003) | (0.004) |
| Inflation Targeter | -0.258* | -0.205 | 0.203 | 0.066 |
| | (0.141) | (0.220) | (0.225) | (0.239) |
| Log GDP per capita | 0.136 | -0.175* | 0.235* | 0.416*** |
| | (0.089) | (0.091) | (0.131) | (0.149) |
| Level of informality (Medina and Sc | -0.001 | -0.001 | -0.003 | -0.001 |
| | (0.006) | (0.008) | (0.009) | (0.011) |
| Credit registry or bureau | -0.146 | -0.090 | 0.163 | 0.509** |
| | (0.130) | (0.217) | (0.240) | (0.216) |
| Constant | 0.703 | -0.222 | 1.074 | -3.604 |
| | (0.808) | (0.939) | (1.341) | -1.501 |
| Regional dummies | Yes | Yes | Yes | Yes |
| Observations | | 67354 | | 67345 |
| Pseudo R-squared | | 0.055 | | 0.0992 |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Formal access is defined as any formal access and informal access defined as only informal access. Reference group is informal access. The multinomial logit estimates two models, one logit model for no access relative to informal access and one logit model for formal access relative to informal access.

## Table 5. Adding Financial and Monetary Variables—Borrowing and Saving

| | Borrowing | | Saving | |
|---|---|---|---|---|
| | No Access (vs. Informal Access) | Formal (vs. Informal Access) | No Access (vs. Informal Access) | Formal (vs. Informal Access) |
| All control variables | Y | Y | Y | Y |
| Interest rate controls | 0.177 | -0.191 | 0.703** | 0.740* |
| | (0.222) | (0.230) | (0.331) | (0.421) |
| Real interest rate | 0.003 | 0.007 | 0.022 | 0.020** |
| | (0.004) | (0.008) | (0.015) | (0.009) |
| log Bank concentration (%) | 0.016 | 0.476 | -0.184 | -0.539 |
| | (0.161) | (0.302) | (0.338) | (0.392) |
| log Bank capital to total assets (%) | 0.509* | 0.262 | -1.161 | -1.781 |
| | (0.291) | (0.500) | (1.061) | (1.157) |
| *Macroprudential measures* | | | | |
| Limit on leverage ratio | -0.329** | -0.265 | -0.676*** | -0.688*** |
| | (0.165) | (0.214) | (0.172) | (0.248) |
| Cap on credit growth | -0.095 | -0.139 | 0.018 | -0.256 |
| | (0.162) | (0.280) | (0.281) | (0.330) |
| broad-based measures | -0.299*** | -0.025 | -0.339** | -0.033 |
| | (0.096) | (0.197) | (0.155) | (0.183) |
| Loan restrictions or Borrower | -0.273** | 0.034 | -0.134 | 0.400** |
| | (0.109) | (0.142) | (0.201) | (0.162) |
| Loan-to-deposit ratio | -0.171 | -0.484* | -0.544*** | -0.968*** |
| | (0.131) | (0.248) | (0.185) | (0.319) |
| *Macroprudential count by group* | | | | |
| All macropru measures | -0.057*** | -0.055* | -0.051 | 0.003 |
| | (0.021) | (0.029) | (0.034) | (0.040) |
| Macropru:Demand side | -0.100 | -0.009 | 0.175 | 0.250 |
| | (0.080) | (0.115) | (0.159) | (0.169) |
| Macropru:Supply side | -0.070*** | -0.078** | -0.082** | -0.013 |
| | (0.025) | (0.035) | (0.035) | (0.042) |
| Macropru:supply-loans | -0.077* | -0.103** | -0.107* | -0.063 |
| | (0.041) | (0.052) | (0.055) | (0.063) |
| Macropru:supply-general | -0.161** | -0.111 | -0.161 | 0.052 |
| | (0.063) | (0.085) | (0.098) | (0.093) |
| Macropru:supply-capital | -0.198 | -0.244* | -0.233 | -0.024 |
| | (0.127) | (0.143) | (0.179) | (0.251) |
| Regional dummies | Yes | Yes | Yes | Yes |
| Observations | | 67354 | | 67345 |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Variables in this table are included one by one in separate regressions. Each regression includes all control variables from Table 5 and fixed effect (for EMDE sample only). Formal access is defined as any formal access and informal access defined as only informal access. Reference group is informal access. The multinomial logit estimates two models, one logit model for no access relative to informal access and one logit model for formal access relative to informal access. Number of observations are identical for each regression; R2 for each individual regression available upon request.

## Table 6. Multinomial Logit Regressions—Financial and Monetary Variables—by Level of Financial Development

| | No Access (vs. Informal Access) | Formal (vs. Informal Access) | No Access (vs. Informal Access) | Formal (vs. Informal Access) |
|---|---|---|---|---|
| | High financial development | | Low financial development | |
| All control variables | Y | Y | Y | Y |
| Interest rate controls | -2.220 | -1.056 | 0.523 | 0.222 |
| | (1.561) | (0.757) | (0.368) | (0.558) |
| Real interest rate | -0.002 | 0.028 | 0.006 | -0.011** |
| | (0.011) | (0.020) | (0.004) | (0.005) |
| log Bank concentration (%) | -0.110 | 4.190** | 0.568*** | -0.042 |
| | (1.459) | (1.784) | (0.186) | (0.429) |
| log Bank capital to total assets (%) | 7.086*** | -1.371*** | -1.907*** | 1.131 |
| | (0.204) | (0.519) | (0.538) | (0.908) |
| *Macroprudential measures* | | | | |
| Limit on leverage ratio | -2.183*** | -2.632*** | -0.450** | -0.152 |
| | (0.337) | (0.853) | (0.225) | (0.254) |
| Cap on credit growth | 1.148 | -1.236 | -0.236 | -0.158 |
| | (1.098) | (1.166) | (0.334) | (0.487) |
| broad-based measures | -1.095 | -3.414* | -0.486*** | -0.135 |
| | (1.361) | (1.766) | (0.140) | (0.260) |
| Loan restrictions or Borrower eligibility criteria | -0.721*** | -0.002 | -0.426*** | -0.074 |
| | (0.074) | (0.159) | (0.158) | (0.206) |
| Loan-to-deposit ratio | 2.551 | -4.486* | -0.602*** | -1.056*** |
| | (3.127) | (2.710) | (0.180) | (0.237) |
| *Macroprudential count by group* | | | | |
| All macropru measures | -0.210*** | -0.084 | -0.109*** | -0.056 |
| | (0.035) | (0.053) | (0.029) | (0.049) |
| Macropru:Demand side | -0.544*** | 0.077 | 0.265** | 0.350 |
| | (0.094) | (0.167) | (0.131) | (0.234) |
| Macropru:Supply side | -0.304*** | -0.281** | -0.143*** | -0.084** |
| | (0.061) | (0.132) | (0.026) | (0.042) |
| Macropru:supply-loans | -0.379*** | -0.236* | -0.182*** | -0.093 |
| | (0.077) | (0.126) | (0.050) | (0.081) |
| Macropru:supply-general | -0.913** | -2.171*** | -0.399*** | -0.176* |
| | (0.373) | (0.266) | (0.066) | (0.095) |
| Macropru:supply-capital | -1.481*** | 0.078 | -0.264* | -0.358* |
| | (0.444) | (0.350) | (0.136) | (0.205) |
| Regional dummies | Yes | Yes | Yes | Yes |
| Observations | | 44239 | | 44239 |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Variables in this table are included one by one in separate regressions. Each regression includes all control variables from Table 2 and fixed effect (for EMDE sample only). Formal access is defined as any formal access and informal access defined as only informal access. Reference group is informal access. The multinomial logit estimates two models, one logit model for no access relative to informal access and one logit model for formal access relative to informal access. Number of observations is identical for all regressions; R2 for individual regressions available upon request

## Table 7. Multinomial Logit Regressions—Financial and Monetary Variables—Interaction with Personal Characteristics

| | No Access (vs. Informal Access) | Formal (vs. Informal Access) | No Access (vs. Informal Access) | Formal (vs. Informal Access) |
|---|---|---|---|---|
| | Education | | Female | |
| Limit on leverage*primary educ | -0.051 | 0.040 | 0.049 | -0.078 |
| | (0.111) | (0.153) | (0.091) | (0.172) |
| Cap credit growth*primary educ | -0.243 | 0.132 | -0.133* | 0.042 |
| | (0.168) | (0.173) | (0.068) | (0.162) |
| other broad*primary educ | -0.095 | 0.049 | 0.081 | 0.113 |
| | (0.142) | (0.190) | (0.085) | (0.134) |
| Loan restrictions*primary educ | -0.210* | -0.324** | 0.192*** | 0.130 |
| | (0.117) | (0.143) | (0.068) | (0.127) |
| Loan-to-deposit ratio*primary educ | -0.366*** | -0.299* | -0.001 | -0.287* |
| | (0.130) | (0.158) | (0.091) | (0.159) |
| Macropru measures count* primary educ | -0.050** | -0.040** | 0.326 | 0.131 |
| | (0.020) | (0.020) | (0.220) | (0.394) |
| Macropru:Demand side*primary educ | -0.098 | -0.138 | 0.131** | 0.056 |
| | (0.086) | (0.115) | (0.059) | (0.091) |
| Macropru:Supply side*primary educ | -0.062** | -0.042* | 0.043*** | 0.022 |
| | (0.024) | (0.025) | (0.014) | (0.033) |
| Macropru:supply-loans*primary educ | -0.090*** | -0.074* | 0.058** | 0.029 |
| | (0.034) | (0.040) | (0.023) | (0.049) |
| Macropru:supply-general*primary educ | -0.184*** | -0.106 | 0.101** | 0.057 |
| | (0.069) | (0.089) | (0.042) | (0.072) |
| Macropru:supply-capital*primary educ | -0.114 | -0.028 | 0.131** | 0.066 |
| | (0.088) | (0.119) | (0.061) | (0.118) |
| Regional dummies | Yes | Yes | Yes | Yes |
| Observations | | 70350 | | 70350 |

Note: these interaction dummy variables with financial sector structure, monetary policy and macroprudential variables are added to the full list of control variables one by one, including the finanical/monetary/macropru variable on it's own. These variables are highly correlated and thus should not be included together. Results for the baseline coefficients in these high and low level of informality sample regressions are available upon request. Number of observations is identical across regressions; R2 for each individual regresison available upon request

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## Appendix Table 1. Findex Questionnaire Mapping to Index

| 2017 Question ID | Question Definition | Index Classification | | |
|---|---|---|---|---|
| | | Informal | Mobile | Formal |
| account | Has an account | | yes | yes |
| account_fin | Has an account at a financial institution | | | yes |
| account_mob | Has a mobile money account | | yes | |
| fin2 | Has a debit card | | | yes |
| fin5 | Used mobile phone or internet to access FI account | | yes | |
| fin7 | Has a credit card | | | yes |
| fin17a | Saved in past 12 months: using an account at a financial institution | | | yes |
| fin17b | Saved in past 12 months: using an informal savings club | yes | | |
| fin19 | Has loan from a financial institution for home, apartment, or land | | | yes |
| fin22a | Borrowed in past 12 months: from a financial institution | | | yes |
| fin22b | Borrowed in past 12 months: from family or friends | yes | | |
| fin22c | Borrowed in past 12 months: from an informal savings club | yes | | |
| fin27a | If sent domestic remittances: through a financial institution | | | yes |
| fin27b | If sent domestic remittances: through a mobile phone | | yes | |
| fin29a | If received domestic remittances: through a financial institution | | | yes |
| fin29b | If received domestic remittances: through a mobile phone | | yes | |
| fin31a | If paid utility bills: using an account | | | yes |
| fin31b | If paid utility bills: through a mobile phone | | yes | |
| fin34a | If received wage payments: into an account | | | yes |
| fin34b | If received wage payments: through a mobile phone | | yes | |
| fin39a | If received government transfers: into an account | | | yes |
| fin39b | If received government transfers: through a mobile phone | | yes | |
| fin40 | If received cashless government transfers: first account | | | yes |
| fin41 | If received cashless government transfers: opened to receive payments | | | yes |
| fin43a | If received agricultural payments: into an account | | | yes |
| fin43b | If received agricultural payments: through a mobile phone | | yes | |
| fin27c1 | If sent domestic remittances: in cash | yes | | |
| fin27c2 | If sent domestic remittances: through an MTO | | yes | |
| fin29c1 | If received domestic remittances: in cash | yes | | |
| fin29c2 | If received domestic remittances: through an MTO | | yes | |
| fin34c2 | If received wage payments: to a card | | | yes |
| fin35 | If received cashless wage payments: first account | | | yes |
| fin36 | If received cashless wage payments: opened to receive payments | | | yes |
| fin47a | If received self-employment payments: into an account | | | yes |
| fin47b | If received self-employment payments: through a mobile phone | | yes | |

## Appendix Table 2. Variables' Definition and Data Sources

| Variable Name | Variable Definition | Variable Source |
|---|---|---|
| Female | Dummy variable equal to 1 if respondent is female | Findex 2014 and 2017, World Bank |
| Primary education | Respondent education level is "completed primary or less" | Findex 2014 and 2017, World Bank |
| Low income | Within-economy household income quintile is "poorest 20%" | Findex 2014 and 2017, World Bank |
| Age | Respondent age is between 15-99+ | Findex 2014 and 2017, World Bank |
| Receive Wage | Respondent receives wage payments | Findex 2014 and 2017, World Bank |
| High inflation (>12pc) | Dummy variable equal to 1 inflation in respondent's country is 12 percent or higher | World Development Indicators, World Bank |
| Regulatory quality (estimate) | Aggregate score for getting credit and protecting minority investors as well as the regulatory quality indices from the indicator sets for dealing with construction permits, getting electricity, registering property, enforcing contracts and resolving insolvency | World Bank Doing Business Survey, World Bank |
| Mobile Money regulatory support | Index based on 6 aggegated metrics: authorization, consumer protection, transaction limits, KYC, agent network, investment and infrastructure enironment | Mobile Money Regulatory Index, Groupe Spéciale Mobile Association |
| Domestic private credit/GDP | Domestic credit to private sector (% of GDP) | World Development Indicators, World Bank |
| Inflation Targeter | 0 (no) or 1 (yes) | Annual Report on Exchange Arrangments and Exchange Restrictions, IMF |
| Log GDP per capita | GDP per capita | World Development Indicators, World Bank |
| Size of informal sector | Measured as share of GDP | Medina & Schneider (2018) |
| Credit registry or bureau | Dummy variable equal to 1 if country had a credit registry (public) or bureau (private) | Monetary and Capital Markets, IMF |
| Interest rate controls | 0 (no) or Yes | Annual Report on Exchange Arrangments and Exchange Restrictions, IMF |
| Real interest rate | Value of real interest rate | Annual Report on Exchange Arrangments and Exchange Restrictions, IMF |
| log Bank concentration (%) | Measure of concentration in the banking system (percent) | Global Financial Development Database, World Bank |
| log Bank capital to total assets (%) | Percent of bank capital to total assets | Global Financial Development Database, World Bank |
| Limit on leverage ratio | 0 (no) or 1 (yes) | Macroprudential Policy Survey, IMF |
| Cap on credit growth | 0 (no) or 1 (yes) | Macroprudential Policy Survey, IMF |
| broad-based measures (macroprudential) | 0 (no) or 1 (yes) | Macroprudential Policy Survey, IMF |
| Loan restrictions or Borrower eligibility criteria | 0 (no) or 1 (yes) | Macroprudential Policy Survey, IMF |
| Loan-to-deposit ratio | 0 (no) or 1 (yes) | Macroprudential Policy Survey, IMF |
| All macropru measures | Count of all macroprudential measures (demand side and supply side), by country | Macroprudential Policy Survey, IMF |
| Macropru: Demand side | Count of measures classified as a cap on loan-to-value ratios, cap on loan-to-income ratio, and cap on debt-service-to-income ratios, by country | Macroprudential Policy Survey, IMF |
| Macropru: Supply side | Count of measures classified by supply-loans, supply-general, and supply-capital, by country | Macroprudential Policy Survey, IMF |
| Macropru: supply-loans | Count of measures classifed as forward-looking loan loss provision requirement, cap on credit growth, cap on credit growth to the household sector, loan restrictions or borrower eligibility criteria, restrictions on unsecured loans, loan-to-deposit ratio, and loan-to-deposit ratio differentiated by currency, by country | Macroprudential Policy Survey, IMF |
| Macropru: supply-general | Count of measures classified as limit on amortization periods, other broad-based measures to increase resilience, and other measures, by country | Macroprudential Policy Survey, IMF |
| Macrropru: supply-capital | Count of measures classified as household sector capital requirements and limits on leverage, by country | Macroprudential Policy Survey, IMF |

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## Appendix Table 3. Variables' Mean and Standard Deviation

| Variable Name | Mean | Standard Deviation | # Observations |
|---|---|---|---|
| Female | 1.54 | 0.50 | 150,923 |
| Primary education | 0.35 | 0.48 | 150,938 |
| Low income | 0.35 | 0.48 | 150,938 |
| Age | 41.91 | 17.92 | 150,483 |
| Receive Wage | 3.06 | 1.33 | 150,923 |
| High inflation(>12pc) | 0.13 | 0.33 | 150,938 |
| Regulatory quality (estimate) | 0.05 | 0.97 | 150,923 |
| Mobile Money regulatory support | 75.12 | 10.49 | 74,553 |
| Domestic private credit/GDP | 63.04 | 46.63 | 140,920 |
| Inflation Targeter | 0.27 | 0.44 | 150,923 |
| Log GDP per capita | 8.35 | 1.48 | 150,923 |
| Size of informal sector | 27.75 | 12.00 | 140,926 |
| Credit registry or bureau | 0.82 | 0.39 | 148,878 |
| Interest rate controls | 0.11 | 0.32 | 150,923 |
| Real interest rate | 7.13 | 12.07 | 95,167 |
| log Credit to government and state owned enterprises to GDP (%) | 1.92 | 1.16 | 137,323 |
| log Bank concentration (%) | 4.15 | 0.34 | 120,707 |
| log Bank capital to total assets (%) | 2.15 | 0.37 | 91,618 |
| Limit on leverage ratio | 0.21 | 0.41 | 150,938 |
| Cap on credit growth | 0.10 | 0.30 | 150,938 |
| broad-based measures (macroprudential) | 0.45 | 0.50 | 150,938 |
| Loan restrictions or Borrower eligibility criteria | 0.56 | 0.50 | 150,938 |
| Loan-to-deposit ratio | 0.10 | 0.30 | 150,938 |
| All macropru measures | 2.87 | 2.59 | 150,938 |
| Macropru: Demand side | 0.64 | 0.84 | 150,938 |
| Macropru: Supply side | 2.23 | 2.01 | 150,938 |
| Macropru: supply-loans | 1.14 | 1.20 | 150,938 |
| Macropru: supply-general | 0.62 | 0.78 | 150,938 |
| Macropru: supply-capital | 0.48 | 0.61 | 150,938 |

**Appendix Table 4. Variables' Mean and Standard Deviation**

| | Average number of macropru-demand side measures | Number of countries with all three measures | Number of countries with 2 or more demand-side measures | Number of countries with at least one |
|---|---|---|---|---|
| Demand-side measures | 0.45 | 2 | 16 | 37 |
| Supply-side measures, Loans | 1 | 15 | 37 | 61 |
| Supply-side measures, Capital | 0.36 | 0 | 5 | 39 |
| Supply-side measures, Other | 0.47 | 1 | 14 | 42 |

Source: IMF Macroprudential Policy Survey Database
Note: demand-side measures include cap on loan-to-value ratios, cap on loan-to-income ratio, and cap on debt-service-to-income ratios. Supply-side measures, loans, includes forward-looking loan loss provision requirement, cap on credit growth, cap on credit growth to the household sector, loan restrictions or borrower eligibility criteria, restrictions on unsecured loans, loan-to-deposit ratio, and loan-to-deposit ratio differentiated by currency. Supply-side, capital, includes household sector capital requirements, limits on leverage. Supply-side, general, includes limit on amortization periods, other broad-based measures to increase resilience, and other measures.

## Appendix A: Examining tightening and loosening of macroprudential policies

We dig deeper into the role of macroprudential policies by exploring the impact of the tightness of macroprudential policies. We use the integrated Macroprudential Policy (iMaPP) database constructed by Alam and others (2019), which combines information from five existing databases, including the Annual Macroprudential Policy Survey that was used above. There are two reasons we do not use these data for our baseline regressions. First, the iMaPP database contains information on whether a certain macroprudential measure has been tightened or loosened, but not on its level. The iMaPP variables range between -1 and 1, with -1 indicating a loosening in a given year and 1 a tightening of the macroprudential measure in question. There is one exception to this, which is the loan-to-value ratio variable which the iMaPP defines based on its level. Because our analysis is in the cross-section, we are unable to use the information from the iMaPP variables that are in changes. In order to circumvent this problem and transform the iMaPP variables into a quasi-level value that can be compared across countries, we aggregate the cumulative changes over time for all iMaPP variables

(except the loan-to-value ratio) and create a dummy variable equal to 1 if the measure has been tightned since 2005. This gives us an imperfect, albeit the best possible, measure of tightness of macroprudential policies in the cross section. The second reason this database is less useful for our purposes is that it covers only 34 countries from our EMDE sample and does not include every initial implementation, especially if the instruments were introduced before the sample period.[10]

The strictness of macroprudential measures appears relevant for financial inclusion, as shown in Appendix Table 4 using iMaPP variables. On the demand side, a higher average level of the LTV ratio is associated with greater finanical inclusion. This is consistent with the idea that higher caps on the LTV ratio allow more individuals to access loans. On the supply side, tighter countercyclical capital buffers, tighter limits on credit growth, foreign currency loans, and loan-to-deposit ratios are all associated with lower formal access and higher incidence of no access. More general measures, captured by *other* measures are also associated with a reduction in formal access. This is consistent with our baseline results, where we find most of the impact of macroprudential policies on formal financial access comes from supply-side measures.

[10] The database only includes 2 countries from our SSA sample, so we exclude the separate SSA analysis in this section.

# Appendix Table 4. Multinomial Logit Regressions—Macroprudential Policy Tightening (iMaPP)

| | Emerging Markets and Developing Economies | |
|---|---|---|
| | No Access (vs. Informal Access) | Formal (vs. Informal Access) |
| All control variables | Y | Y |
| **Demand-side measures** | | |
| Average LTV limit (quarter max) | 0.004*** | 0.053*** |
| | (0.001) | (0.001) |
| Limits on the loan-to-value ratio | -0.260 | -0.143 |
| | (0.306) | (0.311) |
| Limits on the debt-service-to-income or loan-to-income ratio | 0.008 | -0.373 |
| | (0.210) | (0.472) |
| **Supply-side measures** | | |
| Countercyclical buffers | -0.935*** | -1.556*** |
| | (0.138) | (0.361) |
| Capital conservation buffers | 0.161 | 0.260 |
| | (0.199) | (0.321) |
| Capital requirements | -0.149 | -0.171 |
| | (0.132) | (0.261) |
| Capital requirements: General | -0.171 | 0.184 |
| | (0.154) | (0.316) |
| Leverage limits | 0.465 | 0.463 |
| | (0.290) | (0.454) |
| Loan loss provisions | -0.162 | 0.812* |
| | (0.259) | (0.437) |
| Limits on credit growth | 0.817*** | 0.535 |
| | (0.234) | (0.580) |
| Limits on credit growth: General | 0.472 | -1.515* |
| | (0.445) | (0.782) |
| Loan restrictions | 0.046 | -0.222 |
| | (0.138) | (0.349) |
| Restrictions on foreign currency loans | -0.492** | -0.767** |
| | (0.223) | (0.358) |
| Liquidity requirements | 0.264 | 0.207 |
| | (0.258) | (0.277) |
| Limits on the loan-to-deposit ratio | -0.477 | -1.510*** |
| | (0.385) | (0.525) |
| Limits on the foreign exchange positions | -0.024 | 0.437 |
| | (0.136) | (0.276) |
| Reserve requirements | 0.093 | 0.320 |
| | (0.214) | (0.258) |
| **Other measures** | | |
| Tax_dummy2 | 0.249 | 0.614*** |
| | (0.170) | (0.234) |
| Other macroprudential measures | -0.461*** | -1.218*** |
| | (0.166) | (0.320) |
| Regional dummies | Yes | Yes |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Variables in this table are included one by one in separate regressions. Each regression includes all control variables from Table 2 and fixed effect (for EMDE sample only). Formal access is defined as any formal access and informal access defined as only informal access. Reference group is informal access. The multinomial logit estimates two models, one logit model for no access relative to informal access and one logit model for formal access relative to informal access.