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Drivers of Financial Access: The Role of Macroprudential Policies

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

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Abstract

This study analyzes the drivers of the use of formal vs. informal financial services in emerging and developing countries using the 2017 Global FINDEX data. In particular, we investigate whether individuals' choice of financial services correlates with macro-financial and macro-structural policies and conditions, in addition to individual and country characteristics. We start our analysis on middle and low-income countries, and then zoom in on sub-Saharan Africa, currently the region that most relies on informal financial services, and which has the largest uptake of mobile banking. We find robust evidence of an association between macroprudential policies and individuals' choice of financial access after controlling for personal and country-level characteristics. In particular, macroprudential policies aimed at controlling credit supply seem to be associated with greater resort to informal financial services compared with formal, bank-based access. This highlights the importance for central bankers and financial sector regulators to consider the potential spillovers of monetary policy and financial stability measures on financial inclusion.

JEL Classification Numbers: D14, E26, E44, E52, G21

Keywords: Financial inclusion, formal financial services, informal financial services, mobile banking, sub-Saharan Africa

Author's E-Mail Address: cdelechat@imf.org, lkiyasseh@imf.org, mmacdonald@imf.org, rxu@imf.org

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 and usage of formal financial services by all members of the economy (Camara and Tuesta, 2014, Sarma, 2008). A rapidly-growing literature discusses the micro and macroeconomic benefits of greater financial inclusion, in terms of consumption smoothing, efficient allocation of productive resources, female empowerment, human development, poverty and inequality reduction, and faster economic growth (see for example Aslan et al., 2017, Allen et al., 2016, Beck et al., 2007, Dabla-Norris et al., 2015, Mookerjee and Kalipioni, 2010, Sahay et al., 2015, Sarma and Pais, 2011, Sethi and Acharya, 2018, World Bank, 2013).

Financial inclusion has thus become a goal of public policy, often formulated in comprehensive national financial inclusion strategies. Typically prepared by central banks (e.g. Ghana, Uganda, Zambia), these strategies explicitly aim at reducing financial exclusion and resort to informal financial services such as moneylenders, the latter seen as providing only limited amounts of financing at high costs (Sarma, 2011). 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 greater formal financial inclusion as a way to enhance transparency and traceability of transactions by reducing use of cash or informal financial services (FATF, 2010).

Higher degrees of formal financial inclusion (i.e. lower financial exclusion) may however not necessarily mean lower use of informal financial services. By formal financial services we mean in this paper any financial institution or mobile-based form of financial access, including micro-finance institutions, post offices, credit unions and cooperatives. Informal financial services include resort to family and friends or any type of informal credit or savings club (Global FINDEX, 2017). A large number of studies document that formal and informal services tend to coexist as complements, rather than substitutes, even though, over time, the gradual increase in formal financial inclusion tends to lower both exclusion and access to informal financial services (Aryeetey, 1994, 2008, De Koker and Jentzsch, 2013, Global FINDEX, 2017, Pradhan, 2013, Soyibo, 1996)**.** Theoretical and empirical studies explain the persistent use of informal financial services by information asymetries, including inadequate contract enforcement or social capital (Gine, 2011, Madestam, 2014, Mookherjee and Motta, 2016).

The persistence of informal financial services is particularly striking in sub-Saharan Africa (SSA). SSA stands out as the region with 81 percent of adults using some form of informal financial services, but with only 5 percent of adults having an account in a commercial bank or micro-finance institution. It is also the region where mobile banking is the most prevalent, with more than 10 percent of adults having a mobile money account (Global FINDEX, 2017, Klapper and Singer, 2015). In fact, most of the gains in formal financial inclusion in SSA since 2014 come from the expansion of mobile banking, unlike the rest of the world where the increase is driven by greater resort to accounts in financial institutions (Global FINDEX, 2017).

In this paper, we investigate jointly 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 financial services. The contributions of this study to the existing literature are twofold:

- We construct a new, granular categorization of the various ways individuals combine access to formal and informal financial services using the 2017 Global FINDEX micro-data world-wide sample. We find that individuals tend to use a menu of different types of financial services as complements. Mobile banking in particular combines with both formal and informal financial services, highlighting its role as a leapfrogging technology allowing to bridge the gap between informal and formal finance. To our knowledge, ours is one of the first studies to analyze jointly the determinants of different types of financial access in a large cross-section of countries, looking separately at mobile banking access.
- We study the relation between monetary and financial sector policies, including macroprudential measures using the IMF's 2016-17 macroprudential policies survey, and the use of formal and informal financial services. Although there are intuitive reasons why monetary policy or measures aimed at increasing financial stability would influence financial inclusion (and vice-versa), this topic remains little explored in the literature. In particular we are interested in the potential relation between macroprudential policies (which affect formal financial services and their users) and the persistence of resort to informal financial services. This would be consistent with empirical findings that macroprudential policies "leak", by creating incentives for individuals or firms to move from formal towards informal or unregulated financial services (Aiyar et al., 2014, Alam et al., 2019, Ayyagari et al. 2018).

Our findings suggest that central banks and bank regulators ought to pay greater attention to the interactions between monetary and financial sector policies and financial inclusion. More precisely, we find that macroprudential policies 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. In SSA, which is the region has the highest prevalence of informality and the lowest level of financial development, we find that macroprudential policies have a particularly strong relationship with the no financial access. Across all EMDEs, however, potential leakage of macro-prudential policies is particularly noteworthy in countries with more developed financial systems.

The rest of the paper is structured as follows. Section II briefly reviews the related literature. Section III presents our definitions of formal and informal financial access and key stylized facts. Section IV presents the empirical approach, choice of variables and empirical results, while Section V concludes.

II. RELATED LITERATURE

A. Formal vs Informal Financial Inclusion, Mobile Banking

Our research links to the literature on formal and informal financial inclusion and

their determinants. Theoretical and empirical studies (mostly focusing on a single country) highlight the importance of social capital (Guiso et al, 2004), contract enforcement (Gine, 2011, Karaivanov and Kessler, 2018), and information asymmetries (Armendariz and Morduch, 2005, Dabla-Norris and Koeda, 2008, Jain, 1999, Madestam, 2014, Mookherjee and Motta, 2016), in explaining simultaneous resort to formal and informal financial services. The fixed cost of providing credit is larger for formal financial institutions, which can provide larger loans more suited to starting/developing businesses, hence the importance of collateral and the ability to recover it and/or credit information. Informal lenders operate within close social circles and are able to observe loan uses and enforce repayment, are easy to access, disburse rapidly and are flexible in collateral requirements, but the amounts of credit they can provide remain too small to have an impact on the development of new businesses (Aryeetey, 2008).

Empirical studies of the drivers of financial inclusion find that resort to informal financial services is highly persistent, with limited success of policy interventions aimed at increasing formal financial inclusion.[1] In particular, the persistence of the use of informal finance in SSA, as well as the key role of mobile banking in driving financial inclusion in the region are increasingly well-documented (Allen et al., 2014, 2016, De Koker and Jentsch, 2013, Demirguc-Kunt and Klapper, 2012, Klapper and Singer, 2015, Zins and Weill, 2016). In particular, Zins and Weill (2016) find that the individual-level determinants of mobile banking are the same as for formal banking, but that they are different from informal finance. As indicated by Johnson et al. (2010) in the case of Kenya, the reasons people resort to informal finance (accessing emergency funds and developing social networks) would make it difficult to develop linkages with the more formal financial sector. It is therefore not surprising that government interventions aimed at increasing access to cheaper credit have not resulted in lower use of informal finance (Gine, 2011). Nonetheless, Agarwal et al. (2018) document how government-sponsored credit cooperatives in Tanzania, together with a functioning credit bureau, helped increase formal credit, though they also find that more formal financial institutions tend to cream-skim borrowers.

Mobile-based financial services could help bridge the gap between formal and informal finance. The fact that mobile banking shares characteristics of informal finance, in terms of accessibility, convenience, affordability and safety, may help explain the significant role it plays in driving financial inclusion in SSA. De Koker and Jentsch (2013) present evidence on 8 SSA countries that formal and informal financial services use are positively associated, and that mobile money is often used to expand access to formal financial services. Ouma et al (2017), using data on Kenya, Uganda, Malawi and Zambia, find that mobile

[1] On the supply of financial services, the International Monetary Fund'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, 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.

financial services users are indeed more likely to save, and in larger amounts, than non-users.

B. Monetary and Financial Sector Policies and Financial Inclusion

The literature on monetary policy and financial inclusion is fairly sparse, although there are intuitive reasons for why the degree of financial inclusion would affect monetary policy. Yetman (2017) summarizes the literature on this issue into three main points. First, monetary policy 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 regarding 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 vs. output stabilisation. Qin et al. (2014) find that informal credit lending rates are highly receptive to monetary policies and that informal lending is substitutive to bank savings in the short run but complementary to bank lending in the long run in China, suggesting that the bank lending channel also operates through the informal financial sector.

Another important issue for central bankers and financial market supervisors is the relation between financial stability and financial inclusion. Sahay et al. (2015) find that financial stability risks increase when access to credit is expanded without supervision, but that increasing other types of access to financial services do not adversely impact financial stability (e.g. access to ATMs, bank branches, transaction accounts). Han and Melecky (2013) similarly find that financial inclusion, measured by broader access to deposits, can improve banks' deposit bases in times of financial shocks. Hannig and Jansen (2010) find that financial inclusion can enhance financial stability through a deeper and more diversified financial system.

The structure and health of the financial sector might also be associated with financial inclusion. Owen and Pereira (2018), using FAS data on supply-based financial inclusion on a large cross-country figure, 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. Countries in which regulations allow banks to engage in a broader scope of activities are also characterized by greater financial inclusion. Mengistu and Perez-Saiz (2018) find that, for SSA, lower bank concentration is associated with a higher probability of access to formal financial products. Sarma and Pais (2011) find that high non-performing loans, high capital/asset ratios are associated with lower formal financial inclusion.

Macroprudential policies are an important tool to address systemic risk and maintain financial stability, but could also interact with financial access.[2] In particular, by acting on formal financial intermediaries and households relying on formal credit, macroprudential policies could unintentionally "push" credit activity towards the informal sector. Ayyagari et

[2] 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).

al. (2018) show that borrower-targeted macroprudential policies are robustly and negatively associated with growth in long-term firm financing, while policies targeted at financial institutions do not appear to be significantly correlated with firm financing growth. This is consistent with the argument that avoidance or leakage is easier when policies target institutions rather than borrowers. Aiyar et al. (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 et al. (2019) find that larger LTV tightenings have a smaller per-unit effect on household credit, possibly because a strong tightening could incentivize credit from abroad or from nonbank lenders. Cizel et al. (2016) find that the effect of macroprudential measures on bank credit is always substantially higher than the effect on total credit to the private sector, owing to an increase in non-bank credit, with the effect being stronger in advanced economies compared with emerging ones and for measures affecting the quantity of credit rather than its price. Ben Hassine and Rebei (2019) show that informality weakens the impact of macro-prudential policies in emerging markets, as positive shocks would have a larger impact on the informal sector (which has lower hiring costs) and a smaller impact on the more capital-intensive formal sector.

Overall, there are three main take-aways from this brief literature survey. First, financial access takes multiple forms for the same individuals. The choice of type of financial access is influenced by personal characteristics, but also by country-level factors, including measures of institutional quality**.** Second, it 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 relatively scarce literature, looking into how monetary and financial sector policies, including macro-prudential policy tools, are related to formal financial inclusion in countries with large informal sectors (EMDEs in general but more particularly SSA) would help inform central banks' policies, given their joint objectives of ensuring macroeconomic and financial stability as well as financial inclusion.

III. KEY STYLIZED FACTS OF FORMAL VS. 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 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 obtainint 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 only 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 response 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 also 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 order to present stylized facts on the evolution of financial inclusion, we match our results to the 2014 Findex by classifying the respondents answers according to the same criteria as described above. While the questions in the 2014 Findex differ somewhat from those in the 2017 survey (in particular, there are less questions regarding mobile access and no questions regarding the use of the internet to send or receive payments), there is sufficient

overlap in the questions to make a reasonable comparison. For our econometric analysis, however, we focus only on the cross section of the 2017 survey which allows us to exploit the individual level data.[3]

In the econometric analysis we also collapse the index into three categories: access to formal or mobile banking, access to informal financial services only, and complete exclusion**.** 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

The various facets of financial access

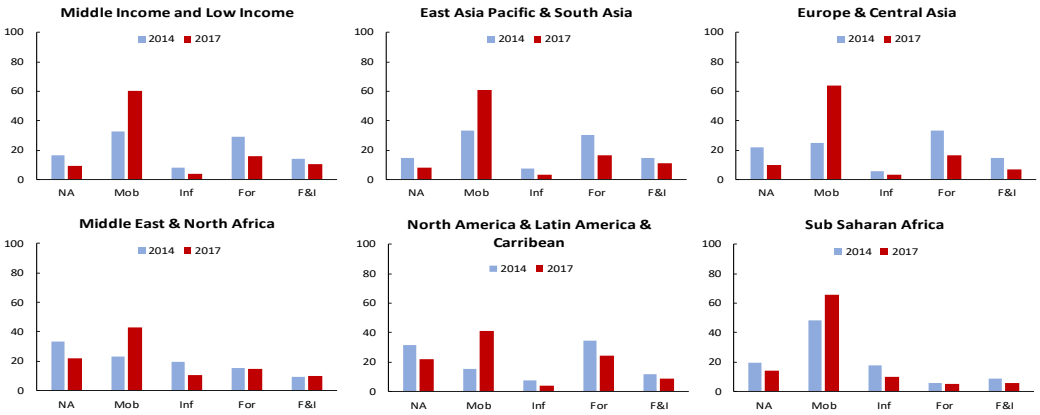
Globally, financial access has improved between 2014 and 2017. The number of indvidiuals completely excluded or with only access to informal services has fallen worldwide, and practically disappeared in advanced economies. While the number of individuals with only access to traditional banking (i.e. formal or formal and informal) has also fallen, this has been more than made up for by those with any access to mobile technology. The simultaneous resort to formal and informal financial services by individuals is striking and suggests a complementarity relationship.

The adoption of mobile financial services as a means to access formal financial services is particularly pronounced in SSA. Access to informal financial services fell in SSA, by more than 25% in absolute terms from its level in 2014, while the shift towards mobile (with or without other types of services) compensated for this; accounting for 65% of total respondents in 2017 (Figure 1). A detailed look at six countries in SSA shows wide cross-country variation (Figure 2). A further breakdown of the use of mobile accounts together with other services illustrates the complementarity relationship between them (Figure 3).

Looking more specifically at uses of financial services show little recent progress in savings and borrowing through formal means worldwide. SSA has the most people both saving and borrowing informally rather than formally (Figure 4).In SSA, since 2014, the use of only cash for both making and receiving payments has fallen, and users have moved more towards accounts and mobile access indicating an increase in financial access—in fact this is also true globally (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 This also suggests that formal financial institutions may not adequately serve the needs of large parts of the SSA population.

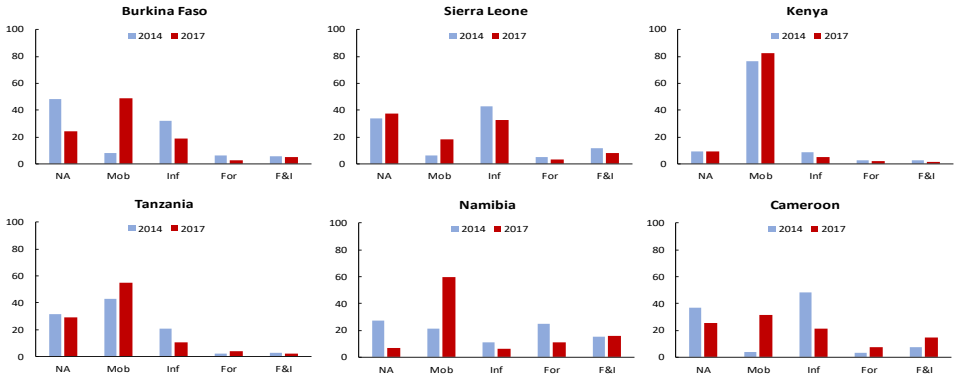
[3] The different waves of the FINDEX survey's do not follow the same individuals and so cannot be combined at the individual level. See section IV for a more detailed discussion.

Figure 1. Financial Inclusion Around the World
(All respondents, percent of population aged 15 and over)



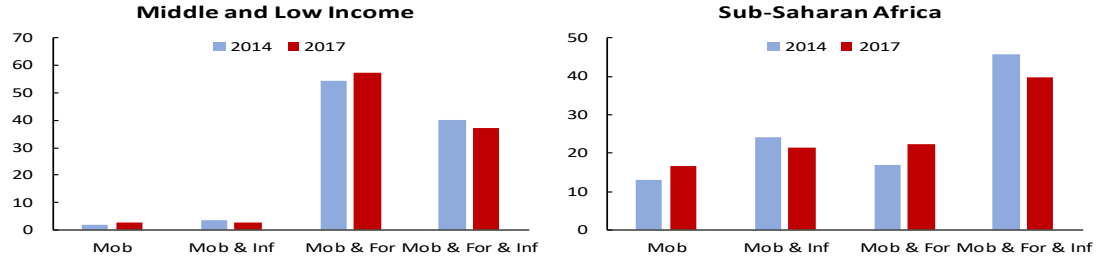
Note: NA = No Access, Mob = Any Mobile, Inf = Informal Only, For = Formal Only, F&I = Formal & Informal. Data represents only middle and low income countries, and is weighted by individual survey weights and country population.
Source: Findex 2014 and 2017, World Bank; World Development Indicators, World Bank; World Economic Outlook, IMF; and IMF Staff

Figure 2. Financial Inclusion in Sub-Saharan Africa
(All respondents, percent of population aged 15 and over)



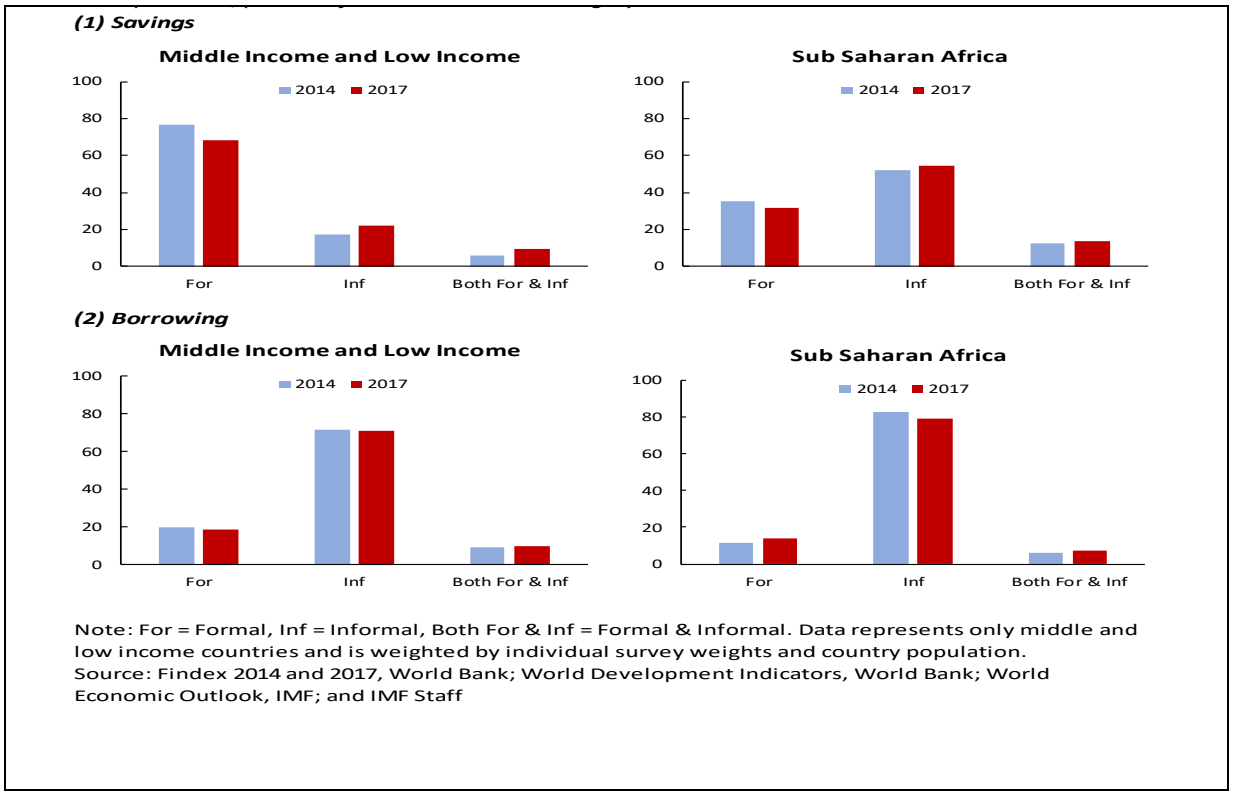
Note: NA = No Access, Mob = Any Mobile, Inf = Informal Only, For = Formal Only, F&I = Formal & Informal. Data is weighted by individual weights
Source: Findex 2014 and 2017, World Bank; World Development Indicators, World Bank; World Economic Outlook, IMF; and IMF Staff

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

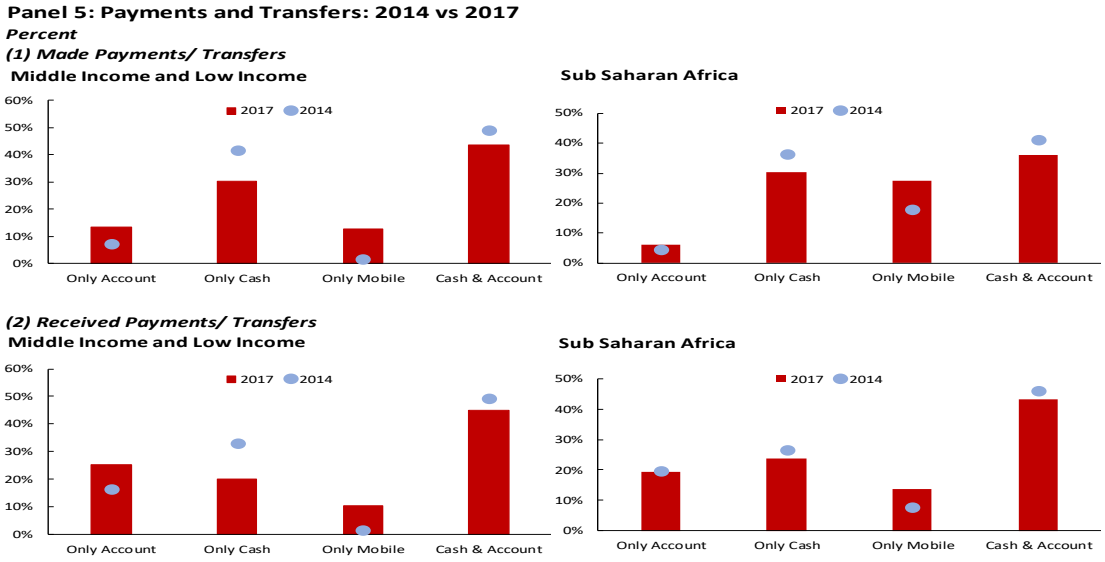
Figure 4. Savings and Borrowing: 2014 vs 2017, by Region
(All respondents, percent of population aged 15 and over)



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 vs 2017

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

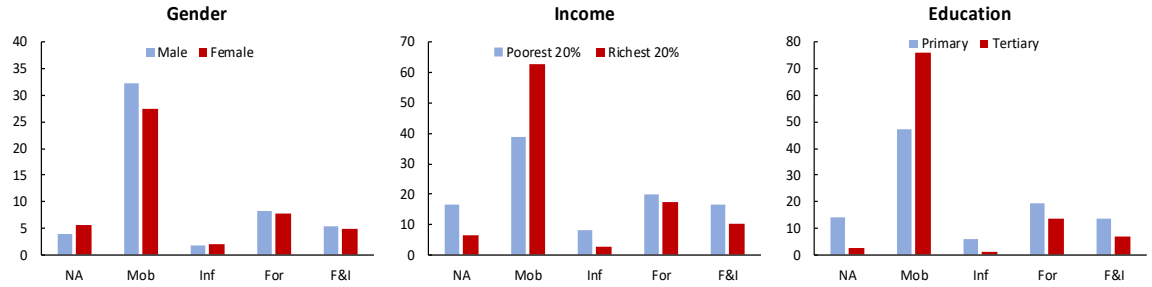


Note: Data has been weighted by individual weights and country population
Source: Findex 2014 and 2017, World Bank; World Development Indicators, World Bank;World Economic Outlook, IMF; and IMF Staff

Demographic Characteristics

Women are more likely to be financially excluded, while men save more formally than women, and women save more informally than men. Further, men borrow more than women, both formally and informally (Global FINDEX, 2017). The poorest 20% have approximately two thirds of access to mobile services as the richest 20% do, and those with tertiary education have almost twice as much access to mobile accounts than those with primary education (Figure 6).

Figure 6. Financial Inclusion by Individual Characteristics: 2017
(All respondents, percent of population aged 15 and over)

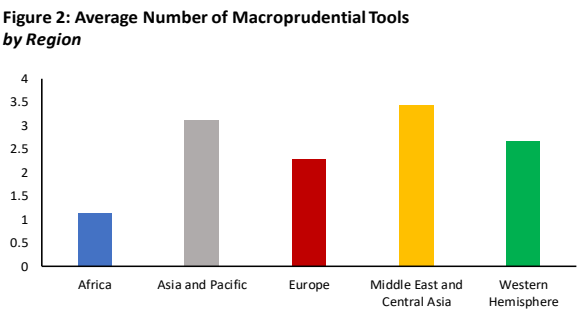


Note: NA = No Access, Mob = Any Mobile, Inf = Informal Only, For = Formal Only, F&I = Formal & Informal. Data is weighted by individual weights and country population.
Findex 2014 and 2017, World Bank; World Development Indicators, World Bank;World Economic Outlook, IMF; and IMF Staff

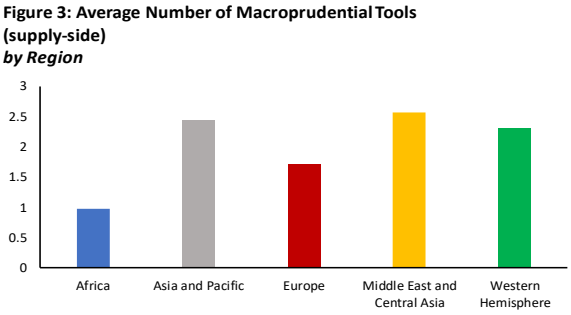
Macroprudential policies are related to financial access

More recently, many countries have been using macroprudential policies to support financial stability. By end-2016, 90 EMDEs used macro-prudential policy tools. Of these, the highest average number of macroprudential tools were used by countries in the Middle East and Central Asia, followed by Asia & Pacific, with Africa having the lowest rate of use. Additionally, the largest average number of supply-side macroprudential tools were in the Middle East and Central Asia, followed by Asia & Pacific, as well (Figure 7). These include loan restrictions or borrow eligibility criteria, limits on leverage ratios, caps on credit growth, loan to deposit ratios, and other broad-based measures.

Figure 7. Average Number of Macroprudential Tools



Note: Sample excludes Advanced Economies
Source: Macroprudential Survey, IMF



Note: Sample excludes Advanced Economies
Source: Macroprudential Survey, IMF

Text Table 1 shows the relationship between the two forms of financial access (informal and formal) and broad indicators of macroprudential policy. The pairwise correlations are between the share of individuals who have informal or formal access in a country with the total amount of macroprudential measures in place in a country. These indicate that macroprudential policies are positively associated with greater formal financial access and lower use of informal financial services, on average. These simple correlations do not imply causality and could simply be driven by the fact that macroprudential policies are more prevalent in more financially-developed economies. Indeed one of our research question will be to investigate whether this relationship still holds after introducing controls for other drivers of formal vs. informal financial access in a regression setting.

Text Table 1. Correlations Between Macroprudential Variables and Forms of Access

Macroprudential Variables	Informal Access	Formal Access
All macropru measures	0.01	0.39*
Macropru: Demand side	-0.10*	0.40*
Macropru: Supply side	0.04*	0.34*
Macropru: supply-loans	0.10*	0.25*
Macropru: supply-general	0.01	0.29*
Macropru: supply-capital	-0.09*	0.27*

Note: Asterisk represents pairwise correlation significance at the 5% level

Source: Macroprudential Survey, IMF; and IMF staff

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 referent group and estimate a model for no access relative to informal access and a model for formal access relative to informal access. The multinomial logit essentially runs two logit models: one on formal access vs. informal access and the other on no access vs. 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 in the model 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/macro-prudential 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 (see appendix for questions that fall into these categories). 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 macro-prudential 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, sources and summary statistics can be found in Appendix Tables 2 and 3, respectively.

- *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).[4] 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,[5] 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 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 overall, 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),

[4] 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.

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

a number of countries in the world still have interest controls in place (Alper et al. 2019, 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).

- *Macro-prudential policies.* We use data based on a world-wide survey of macro-prudential policies in 2016-17 developed at the International Monetary Fund. The data set catalogues the use of macro-prudential 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). For SSA, about 11 out of 44 countries resort to macro-prudential policy instruments, for an average of 6 measures per country (IMF, 2018).[6] 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 et al, (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 (vs informal) financial inclusion.

- *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).

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[6] The survey information is available at https://www.elibrary-areaer.imf.org/Macroprudential/Pages/Home.asp

[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.

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 left part shows the EMDE sample and the right part presents the results among SSA. 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. Among SSA countries, regulatory support for mobile money also has strong positive association with formal financial access.

- **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] In sub-Saharan Africa countries with tighter monetary policy, measured by the real interest rate, are associated with less formal financial access.

[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.

Table 1. Multinomial Logit Regressions with Baseline Controls

	Emerging Markets and Developing Economies		Sub-Saharan Africa	
	No Access (vs. Informal Access)	Formal (vs. Informal Access)	No Access (vs. Informal Access)	Formal (vs. Informal Access)
Female	-0.085**	-0.236***	-0.121**	-0.283***
	(0.041)	(0.064)	(0.053)	(0.055)
Primary education	0.055	-0.823***	0.110**	-0.977***
	(0.051)	(0.060)	(0.056)	(0.068)
Low income	0.101**	-0.441***	0.195***	-0.445***
	(0.040)	(0.040)	(0.044)	(0.043)
Age	-0.023***	0.041***	-0.020***	0.025***
	(0.005)	(0.006)	(0.005)	(0.007)
Age^2	0.000***	-0.000***	0.000***	-0.000***
	(0.000)	(0.000)	(0.000)	(0.000)
Receive Wage	-0.486***	0.305***	-0.574***	0.278***
	(0.049)	(0.065)	(0.073)	(0.087)
High inflation(12pc)	0.218	0.251	0.132	0.226
	(0.163)	(0.199)	(0.184)	(0.234)
Regulatory quality (estimate)	0.283	0.365	-0.005	0.445
	(0.194)	(0.232)	(0.290)	(0.406)
Mobile Money regulatory support	0.003	0.012	-0.008	0.028*
	(0.007)	(0.009)	(0.011)	(0.015)
Domestic private credit/GDP	-0.001	0.007	-0.003	0.004
	(0.003)	(0.006)	(0.004)	(0.006)
Inflation Targeter	-0.175	0.236	-0.157	0.231
	(0.156)	(0.291)	(0.252)	(0.306)
Log GDP per capita	0.106	0.342***	0.056	0.340**
	(0.081)	(0.103)	(0.103)	(0.139)
Size of informal sector	-0.001	-0.009	-0.006	-0.008
	(0.007)	(0.011)	(0.013)	(0.020)
Credit registry or bureau	-0.206	-0.075	-0.050	-0.018
	(0.158)	(0.239)	(0.194)	(0.309)
Constant	0.688	-2.163**	1.767	-2.408
	(0.884)	(1.091)	(1.169)	(1.822)
Regional dummies	Yes	Yes	No	No
Observations		67354		27829
Pseudo R-squared		0.102		0.094

Notes: *** p<0.01, ** p<0.05, * p<0.1. *Formal access* is defined as <u>any</u> formal access (and thus includes access to informal and formal, mobile and formal, and informal and formal and mobile) and *informal access* defined as <u>only</u> informal access. The 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.

Adding monetary and financial variables

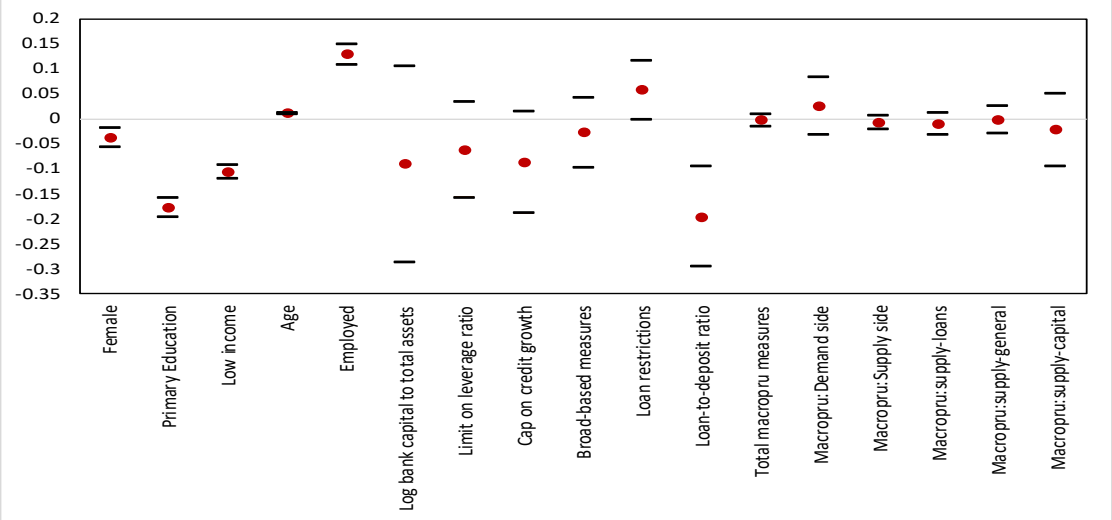
After establishing the baseline control variables, we explore the relationship between monetary policy and financial market structure on financial inclusion. We add these monetary and financial variables one by one to the baseline specification considering the high correlation between them. The results, 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. In particular, more concentration in the banking sector is associated with more individuals having no access to financial services in SSA. 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. For SSA, Mengistu and Perez-Saiz (2018) find that more competition is related to greater formal financial access.

- **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 8, 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.

Figure 8. Margin Plots of Baseline Multinomial Logit Regressions



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

Table 2. Multinomial Logit Adding Financial and Monetary Variables

	Emerging Markets and Developing Economies		Sub-Saharan Africa	
	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	0.444*	0.280		
	(0.234)	(0.366)		
Real interest rate	-0.000	-0.005	0.003	-0.021***
	(0.004)	(0.009)	(0.004)	(0.005)
log Bank concentration (%)	-0.047	-0.430	0.461***	-0.172
	(0.258)	(0.434)	(0.175)	(0.393)
log Bank capital to total assets (%)	0.176	-0.344	-0.566	-0.160
	(0.679)	(0.830)	(0.824)	(0.812)
Macroprudential measures				
Limit on leverage ratio	-0.568***	-0.681***	-0.895***	-0.544**
	(0.170)	(0.247)	(0.129)	(0.222)
Cap on credit growth	-0.274	-0.602*	-1.352***	-1.049***
	(0.196)	(0.329)	(0.322)	(0.317)
broad-based measures	-0.362***	-0.374*	-0.668***	-0.295
	(0.113)	(0.203)	(0.112)	(0.266)
Loan restrictions or Borrower	-0.405***	0.016	-0.377**	-0.213
	(0.119)	(0.164)	(0.165)	(0.215)
Loan-to-deposit ratio	-0.426***	-1.245***	-0.690***	-0.789***
	(0.144)	(0.255)	(0.221)	(0.163)
Macroprudential count by group				
All macropru measures	-0.081***	-0.064*	-0.118***	-0.064
	(0.024)	(0.034)	(0.026)	(0.044)
Macropru:Demand side	-0.021	0.113	0.260**	0.453
	(0.093)	(0.168)	(0.127)	(0.298)
Macropru:Supply side	-0.109***	-0.099***	-0.145***	-0.097***
	(0.024)	(0.034)	(0.025)	(0.033)
Macropru:supply-loans	-0.151***	-0.145**	-0.190***	-0.118
	(0.044)	(0.063)	(0.048)	(0.080)
Macropru:supply-general	-0.228***	-0.162**	-0.394***	-0.260***
	(0.076)	(0.081)	(0.065)	(0.100)
Macropru:supply-capital	-0.278**	-0.289	-0.506***	-0.438**
	(0.126)	(0.204)	(0.170)	(0.220)

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 thus includes access to informal and formal, mobile and formal, and informal and formal and mobile) and *informal access* defined as only informal access. The 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.

Mobile banking, identified as the main driver of improved financial access from 2014 to 2017 in SSA, 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 3. 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 both samples. Results in Table 3 show that certain supply-side macroprudential measures have a strong and negative association with mobile banking in SSA (caps on credit growth, loan-to-deposit ratios). This may be due to the fact that mobile banking is complementary to formal banking (in many SSA countries mobile financial services have to be backed by a formal bank account).

Table 3. Simple Logit Regression on Mobile Banking Access

	Emerging Markets and Developing Economies	Sub-Saharan Africa
Female	-0.191***	-0.151***
	(0.040)	(0.043)
Primary education	-0.756***	-0.952***
	(0.092)	(0.082)
Low income	-0.525***	-0.540***
	(0.039)	(0.058)
Age	0.032***	0.033***
	(0.006)	(0.007)
Age^2	-0.000***	-0.000***
	(0.000)	(0.000)
Receive Wage	0.552***	0.586***
	(0.054)	(0.082)
High inflation(12pc)	-0.334	-0.350
	(0.253)	(0.328)
Regulatory quality (estimate)	-0.081	0.562
	(0.270)	(0.446)
Mobile Money regulatory support	0.026***	0.044**
	(0.009)	(0.020)
Domestic private credit/GDP	-0.004	-0.005
	(0.003)	(0.005)
Inflation Targeter	0.162	0.565
	(0.232)	(0.360)
Log GDP per capita	0.233*	0.198
	(0.124)	(0.185)
Size of informal sector	-0.012	0.001
	(0.012)	(0.023)
Credit registry or bureau	0.477	0.164
	(0.297)	(0.338)
Constant	-4.730***	-4.850*
	(1.344)	(2.569)
Regional dummies	Yes	No
Observations	67354	27829
Pseudo R-squared	0.162	0.112

	Emerging Markets and Developing Economies	Sub-Saharan Africa
All control variables	Y	Y
Interest rate controls	0.032	
	(0.419)	
Real interest rate	-0.013	-0.024***
	(0.009)	(0.006)
log Bank concentration (%)	0.067	-0.426
	(0.374)	(0.637)
log Bank capital to total assets (%)	0.077	0.758
	(0.674)	(1.131)
Macroprudential measures		
Limit on leverage ratio	-0.121	-0.537
	(0.203)	(0.338)
Cap on credit growth	0.026	-1.506***
	(0.382)	(0.440)
broad-based measures	-0.204	-0.075
	(0.279)	(0.409)
Loan restrictions or Borrower eligibility criteria	0.014	-0.128
	(0.230)	(0.305)
Loan-to-deposit ratio	-0.281	-1.006***
	(0.384)	(0.322)
Macroprudential count by group		
All macropru measures	-0.003	-0.046
	(0.055)	(0.064)
Macropru:Demand side	0.257	0.433
	(0.188)	(0.301)
Macropru:Supply side	-0.030	-0.090*
	(0.056)	(0.050)
Macropru:supply-loans	0.017	-0.089
	(0.105)	(0.117)
Macropru:supply-general	-0.162	-0.210
	(0.124)	(0.163)
Macropru:supply-capital	-0.223	-0.543*
	(0.144)	(0.304)
Regional dummies	Yes	No

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.

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 to 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).

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 et al, (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.[9]

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	No
Observations		67354		67,354
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 thus includes access to informal and formal, mobile and formal, and informal and formal and mobile) and *informal access* defined as only informal access. The 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.

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

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	No	No

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 4 and fixed effect (for EMDE sample only). *Formal access* is defined as any formal access (and thus includes access to informal and formal, mobile and formal, and informal and formal and mobile) and *informal access* defined as only informal access. The 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.

The strictness of macroprudential measures appears relevant for financial inclusion, as shown in Table 6 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.

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 macro-prudential 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 7 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.[10] 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 generally associated with greater odds of informal access relative to no access, while showing little-to-no leakages from formal to informal.

[10] 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.

Table 6. 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 1 and fixed effect (for EMDE sample only). *Formal access* is defined as any formal access (and thus includes access to informal and formal, mobile and formal, and informal and formal and mobile) and *informal access* defined as only informal access. The 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 7. Multinomial Logit Regressions—Financial and Monetary Variables—by Level of Financial Development

	Emerging Markets and Developing Economies			
	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

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 1 and fixed effect (for EMDE sample only). *Formal access* is defined as any formal access (and thus includes access to informal and formal, mobile and formal, and informal and formal and mobile) and *informal access* defined as only informal access. The 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.

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 of individuals. 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 individuals have and gender. Results, reported in Table 8, show that the leakage of macroprudential policies—in the sense of our baseline result of an association between supply-side macro-prudential policies and informal finance—is even more pronounced on individuals with only primary education, and true both in the full sample and the SSA sample. This is consistent with macroprudential policies being associated with increased used of informal finance, particularly for less sophisticated borrowers, and thus highlighting the important role of financial literacy. When interacting macro-prudential 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 AND POLICY IMPLICATIONS

Financial inclusion continues to be an important goal of public policy in low income countries. The micro and macroeconomic 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, domestic policy in many countries and international organizations, like the FATF, have rightly set greater financial inclusion as an important objective.

Across EMDEs, financial inclusion has been improving thanks in large part to the adoption of mobile financial services in recent years. For instance, although SSA continues to have the highest rates of informal finance, since 2014 its share of total access to financial services has declined by 7.8 percent. In its place mobile money and mobile banking have mostly taken over. 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.

Financial inclusion, including through access to mobile financial services, still has far to go. While access greatly increased between 2014 and 2017, a large share of individuals in SSA are still excluded from the formal financial sector. The rates are lower, albeit still elevated for financial exlcusion in other EMDE regions globally. And even though access to bank accounts has increased world-wide, much less progress has been made in using 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 of formal financial services that full-fledged mobile banking would. To further increase the resort to formal savings and borrowing instruments – which has not much progressed in recent years – 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.

Macro-prudential policies, and the health of the financial sector seem to play a role in financial inclusion. Our results are some of the first to show a robust association between financial inclusion and monetary, macro-prudential and financial sector policies and conditions. In particular, supply-side (institution-based) macroprudential policies seem to be associated with greater use of informal finance and with lower 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. While not establishing causality, these results suggest a significant relationship between certain policies and individual-level use of certain types of financial services. While the precise channel for these leakages 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 macro-prudential policies on firms (Ayyagari et al., 2018), we also find evidence that women and less-educated individuals are more affected by these leakages.

The key policy message emerging from these initial findings is that central bankers and bank 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, policy makers may need to consider *ex ante* the potential effects of these policies on financial inclusion. 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.

Table 8. Multinomial Logit Regressions—Financial and Monetary Variables—Interaction with Personal Characteristics

	Emerging Markets and Developing Economies				Sub-Saharan Africa			
	No Access (vs. Informal Access)	Formal (vs. Informal Access)	No Access (vs. Informal Access)	Formal (vs. Informal Access)	No Access (vs. Informal Access)	Formal (vs. Informal Access)	No Access (vs. Informal Access)	Formal (vs. Informal Access)
Personal characteristic	Education		Female		Education		Female	
Limit on leverage*personal characteristic	-0.051	0.040	0.049	-0.078	0.095	0.246	0.130	0.047
	(0.111)	(0.153)	(0.091)	(0.172)	(0.188)	(0.223)	(0.104)	(0.138)
Cap credit growth*personal characteristic	-0.243	0.132	-0.133*	0.042	-0.111*	-0.612***	-0.020	-0.468***
	(0.168)	(0.173)	(0.068)	(0.162)	(0.061)	(0.074)	(0.054)	(0.051)
other broad*personal characteristic	-0.095	0.049	0.081	0.113	0.112	-0.467***	0.136	-0.033
	(0.142)	(0.190)	(0.085)	(0.134)	(0.125)	(0.180)	(0.087)	(0.137)
Loan restrictions*personal characteristic	-0.210*	-0.324**	0.192***	0.130	-0.001	-0.409***	0.217**	0.132
	(0.117)	(0.143)	(0.068)	(0.127)	(0.161)	(0.141)	(0.096)	(0.112)
Loan-to-deposit ratio*personal characteristic	-0.366***	-0.299*	-0.001	-0.287*	0.153	-0.480***	0.165	-0.146
	(0.130)	(0.158)	(0.091)	(0.159)	(0.104)	(0.136)	(0.119)	(0.234)
Macropru measures count* personal characteri	-0.050**	-0.040**	0.326	0.131	0.010	-0.065*	0.058**	0.017
	(0.020)	(0.020)	(0.220)	(0.394)	(0.024)	(0.034)	(0.026)	(0.034)
Macropru:Demand side*personal characteristi	-0.098	-0.138	0.131**	0.056	0.092	-0.314	0.333***	0.278***
	(0.086)	(0.115)	(0.059)	(0.091)	(0.084)	(0.219)	(0.096)	(0.068)
Macropru:Supply side*personal characteristic	-0.062**	-0.042*	0.043***	0.022	-0.003	-0.073**	0.051**	0.004
	(0.024)	(0.025)	(0.014)	(0.033)	(0.024)	(0.032)	(0.026)	(0.036)
Macropru:supply-loans*personal characteristic	-0.090***	-0.074*	0.058**	0.029	0.016	-0.101	0.085*	0.006
	(0.034)	(0.040)	(0.023)	(0.049)	(0.043)	(0.062)	(0.048)	(0.062)
Macropru:supply-general*personal characteris	-0.184***	-0.106	0.101**	0.057	0.052	-0.262***	0.058	-0.023
	(0.069)	(0.089)	(0.042)	(0.072)	(0.063)	(0.094)	(0.056)	(0.083)
Macropru:supply-capital*personal characterist	-0.114	-0.028	0.131**	0.066	-0.165*	0.104	0.210**	0.128
	(0.088)	(0.119)	(0.061)	(0.118)	(0.100)	(0.173)	(0.085)	(0.107)
Regional dummies	Yes	Yes	No	No	No	No	No	No

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 1 and fixed effect (for EMDE sample only). *Formal access* is defined as any formal access (and thus includes access to informal and formal, mobile and formal, and informal and formal and mobile) and *informal access* defined as only informal access. The 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.

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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 if respondent 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 As
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 Restr
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 Restr
Real interest rate	Value of real interest rate	Annual Report on Exchange Arrangments and Exchange Restr
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 macroprudential measures by country	Macroprudential Policy Survey, IMF
Macropru: Demand side	Count of macroprudential measures by country	Macroprudential Policy Survey, IMF
Macropru: Supply side	Count of macroprudential measures by country	Macroprudential Policy Survey, IMF
Macropru: supply-loans	Count of macroprudential measures by country	Macroprudential Policy Survey, IMF
Macropru: supply-general	Count of macroprudential measures by country	Macroprudential Policy Survey, IMF
Macrropru: supply-capital	Count of macroprudential measures by country	Macroprudential Policy Survey, IMF

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. List of Countries in the Database

List of Countries in Sample (MPS)		List of Countries in Sample (iMaPP)	
SSA sample (19)	**EM sample (49)**	**SSA sample (14)**	**EM sample (40)**
Benin	Argentina	Benin	Argentina
Botswana	Armenia	Botswana	Armenia
Burkina Faso	Bangladesh	Burkina Faso	Bangladesh
Central African Republic	Benin	Cote d'Ivoire	Benin
Chad	Bolivia	Ghana	Botswana
Cote d'Ivoire	Botswana	Kenya	Brazil
Ghana	Brazil	Mali	Burkina Faso
Kenya	Burkina Faso	Mozambique	Cambodia
Madagascar	Cambodia	Niger	Colombia
Mali	Central African Republic	Nigeria	Cote d'Ivoire
Mozambique	Chad	Senegal	Dominican Republic
Namibia	Colombia	South Africa	El Salvador
Niger	Cote d'Ivoire	Uganda	Georgia
Nigeria	Dominican Republic	Zambia	Ghana
Rwanda	El Salvador		Haiti
Senegal	Georgia		Honduras
South Africa	Ghana		India
Uganda	Guatemala		Jordan
Zambia	Haiti		Kenya
	Honduras		Kyrgyz Republic
	India		Malaysia
	Jordan		Mali
	Kenya		Mongolia
	Kyrgyz Republic		Morocco
	Madagascar		Mozambique
	Malaysia		Nepal
	Mali		Niger
	Mongolia		Nigeria
	Morocco		Pakistan
	Mozambique		Paraguay
	Myanmar		Philippines
	Namibia		Romania
	Nepal		Russian Federation
	Nicaragua		Senegal
	Niger		South Africa
	Nigeria		Thailand
	Pakistan		Tunisia
	Paraguay		Uganda
	Philippines		Vietnam
	Romania		Zambia
	Russian Federation		
	Rwanda		
	Senegal		
	South Africa		
	Thailand		
	Tunisia		
	Uganda		
	Vietnam		
	Zambia		

Note: iMaPP = integrated Macroprudential Policy database, IMF; MPS = Macroprudential Policy Survey, IMF