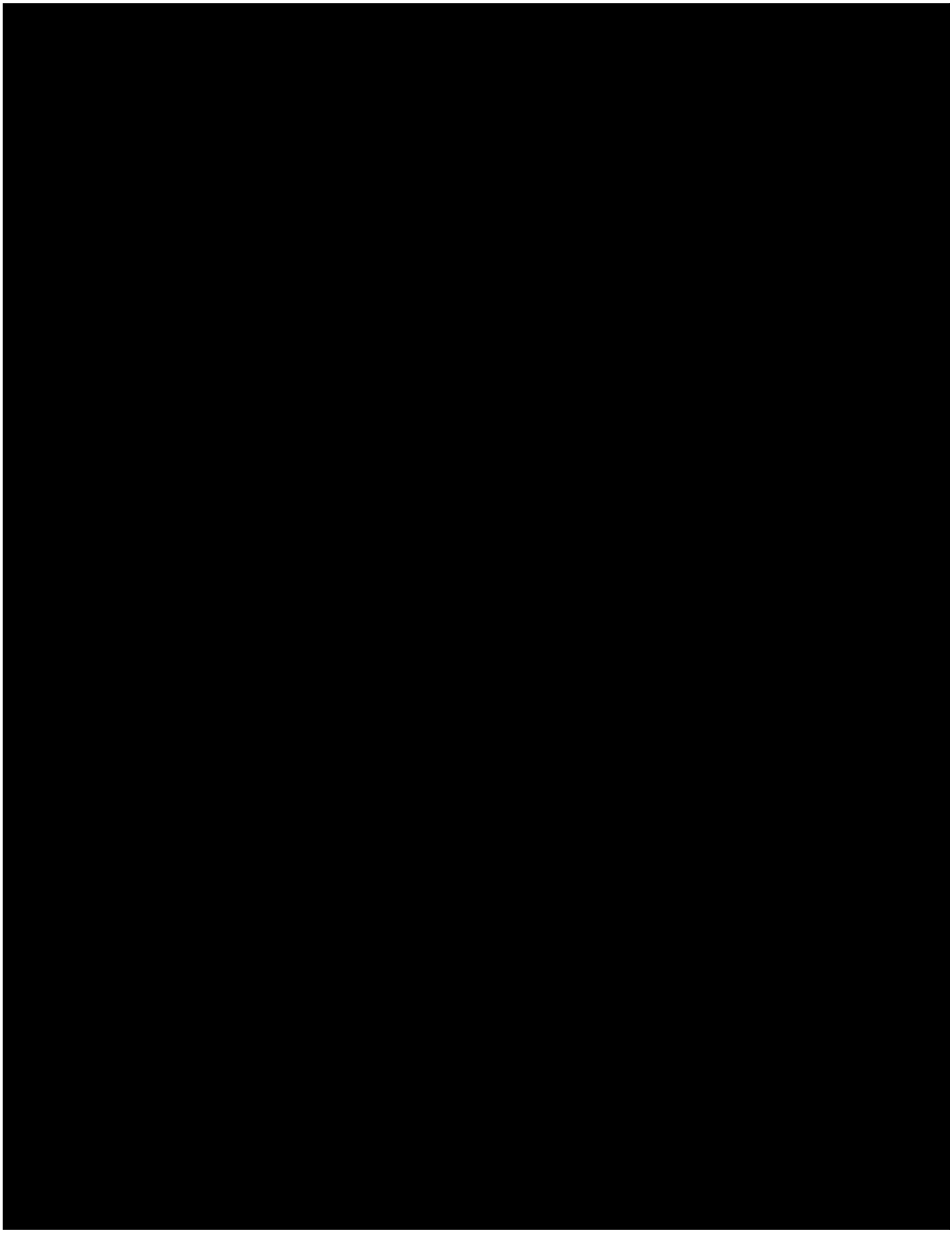

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Financial Inclusion and Bank Competition in Sub-Saharan Africa

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Abstract

In this paper we study how competition and financial soundness affect financial inclusion in Sub-Saharan Africa (SSA). We use detailed individual-level survey data, combined with key country-level indicators of bank competition and financial soundness, to study the effect on the adoption of several financial products (bank accounts, credit and debit cards, and bank loans). We find that more competition tends to increase the probability of access to these financial products. On the contrary, we do not find strong evidence of the effect of bank-balance sheet variables (i.e. capital adequacy or liquidity) on borrowing by individuals. Our results may help policy makers design regulations that could improve financial inclusion, which could potentially impact economic growth and long-term economic development.

JEL Classification Numbers: G21, O16, L10

Keywords: Financial inclusion, competition, financial soundness, accounts, debit cards

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I. INTRODUCTION

Economists have discussed for decades the importance of the financial sector on economic growth and development (Levine, 2005). Well-developed financial systems that provide useful and affordable financial products to individuals are key to channeling funds between savers and investors, facilitating payments and money transactions, and helping to manage risks in the economy. Although there is still much debate on the specific channels that connect the financial system to economic growth, there is broad consensus that countries with a higher level of financial development tend to grow more rapidly. Hence, the issue of financial inclusion in low and middle-income countries has captured the interest of academics and policy makers.

In this paper, we study how competition and financial soundness in the financial industry affect financial inclusion in Sub-Saharan Africa (SSA). We use detailed individual-level survey data, combined with key country-level indicators of bank competition and financial soundness to study the effect of competition and various bank-balance sheet variables on the access to key financial products (bank accounts, credit and debit cards, and bank loans).

In our empirical model, we use Global Findex, a large individual-level database that consistently measures adults' use of financial services across countries and over time. In our empirical model, we include a rich set of individual-level demographic variables, various country-level competition and bank balance-sheet variables, and other country-level variables for SSA countries for years 2011 and 2014. Contrary to other studies that consider financial inclusion at a more aggregate level, the database we use allows us to have a more granular analysis at an individual level, so we can control for individual demographic characteristics and use country and year fixed effects. By focusing only on SSA countries, we use a more homogeneous sample of countries that share many common characteristics.

We first study the effect of competition on financial inclusion. The industrial organization literature, through various game-theoretic models, shows that more concentration typically reduces competition, which increases prices, and reduces output or welfare (Tirole, 1988). In recent decades, bank competition across countries has significantly changed after the gradual process of deregulation (Vives, 2011). More competition increases the supply of financial products, reduces the rates and fees paid, expands the number of financial providers and the network of bank branches, and increases the quality and variety of products offered (Vives, 2016), with a positive effect on financial inclusion. The effect of low bank competition in Africa has frequently been studied by researchers and policy makers (Love & Peria, 2012; Beck & Cull, 2014; Mecagni, Marchettini, & Maino, 2015).

We measure financial inclusion by considering individual-level indicators of adoption of bank accounts, debit cards or credit cards. We use four well-known indicators of competition that have been broadly used in the banking literature, the C5 indicator, the Boone indicator,

the H-statistic and the Lerner index.[1] The use of appropriate variables to measure competition in an industry is a well-known question in the empirical literature. The degree of competition in an industry is related to the "conduct" of the firms in the market but sometimes it is not necessarily related to the degree of concentration in the industry. A market with a single firm could still be "contestable" because the mere presence of potential entrants is enough to reduce the monopoly power of the incumbent (Baumol, Panzar, & Willig, 1988). Also, the existence of high costs in the provison of financial products, as shown in Allen, Demirguc-Kunt, Klapper, & Peria (2016), could simply be due to other factors not directly related to competition (such as higher input costs or lower economies of scale). Therefore, the use of appropriate variables to measure competition is relevant to characterize the conduct of firms.

In our empirical results we generally find that competition has a statistically significant effect on the adoption of accounts, debit cards, and credit cards by individuals in SSA countries. We combine the analysis of the simple C5 indicator with the remainder of the competition indicators that have a more direct behavioral interpretation in terms of competitive behavior and the conduct of firms. Additionally, we find a significant relationship between individuals who do not have a bank account because they think it is expensive, and the degree of competition. This result suggests that the high cost of bank accounts may be due to a lack of competition in the country, instead of other exogenous factors. Our results are generally robust when controlling for a detailed set of individual level variables and using other variables related to financial inclusion, such as GDP or financial depth, as well as country and year fixed effects.

We also study the relationship between key bank balance-sheet variables and borrowing by individuals. Bank balance-sheet weaknesses may affect the ability of banks to supply credit, restricting the borrowing capacity of individuals.[2] One dimension of balance-sheet strength is measured through the level of regulatory capital. In general, there is not a clear consensus about the implications of higher capital ratios on the supply of credit (Admati, DeMarzo, Hellwig, & Pfleiderer, 2011; Hanson, Kashyap, & Stein, 2011). Banks can increase their capital ratios by increasing their levels of regulatory capital (the numerator), which increases their resiliency and their ability to take risks and supply credit. On the other hand, banks may decide to increase their capital ratios by restricting credit (the denominator). Similarly, the effect of liquidity on lending is also debatable. Although banks with more liquid assets are more resilient against shocks, they may hold liquid assets to the detriment of lending less liquid assets (loans) (Cornett, McNutt, Strahan, & Tehranian, 2011).

The effect of changes in bank capital on bank credit supply is a key determinant of the linkage between the financial system and the real activity. Quantifying this relationship has therefore been an important research question (see Berrospide & Edge, 2010; Gambacorta & Marques-Ibanez, 2011; Kapan & Minoiu, 2013; Bridges, et al., 2014; Gropp, Mosk, Ongena,

[1] See Degryse, Morales Acevedo, & Ongena, 2014, for a review of measures of competition used in banking.

[2] This "bank-lending" channel is part of a broader concept termed the credit channel of monetary policy (Bernanke & Gertler, 1987; Bernanke & Blinder, 1988; Bernanke & Gertler, 1995; Kashyap & Stein, 2000; Bernanke, 2007; Jiménez, Ongena, Peydró, & Saurina, 2012; Jiménez, Ongena, Peydro, & Saurina, 2014).

& Wix, 2016; Brun, Fraisse, & Thesmar, 2017, among others). Most of the literature has focused on the effect of bank capital requirements on lending to the corporate sector, and only several studies have considered the case of consumer lending. These studies typically found that higher capital reduces consumer lending less than corporate lending (Bridges, et al., 2014), or even increases the probability of accepting mortage applications (Michelangeli & Sette, 2016). Our paper contributes to understanding the effect of bank balance-sheet variables on the individuals' borrowing, which is a key determinant of financial inclusion in Africa.

In a second set of results, we find a statistically significant relationship between some key bank balance-sheet variables and borrowing by individuals, although the effect is not robust when considering country fixed effects. Without country fixed effects, we find that borrowing by individuals is positively affected in countries with higher Tier 1 capital ratios and more liquid financial systems. We also find that more liquid financial systems are more countercyclical (i.e. more negatively affected by higher GDP growth). Additionally, we find a similar countercyclical effect when considering financial systems with higher Tier 1 capital ratios. In other words, stronger financial systems (in terms of higher capital or liquidity) are more countercyclical (give less credit when GDP growth is higher). However, once we add country fixed effects, some of these effects disappear so we conclude that the effect of these variables on borrowing is not undisputed. Interestingly, Tier 1 capital ratios tend to be higher in SSA compared to other regions, which may be solely a result of financial systems that are highly unstable and therefore buffers are constructed to cover for future loses (Beck, Munzule Maimbo, Faye, & Triki, 2011). In the SSA region, where it is costly for banks to raise capital, capital ratios may be raised by constraining lending (Bernanke & Lown, 1991).

Our paper contributes to the empirical literature that links financial sector development and economic growth (King & Levine, 1993). Financial inclusion can help reduce poverty and inequality by helping people invest, smooth their consumption, and manage financial risks. However, the relationship between financial inclusion and economic growth is not yet well understood, and there is relatively limited research on the topic (Demirguc-Kunt, Klapper, & Singer, 2017). It is important to understand that financial depth and inclusion are two different concepts. In general, financial depth looks at aggregate variables, such as the volume of loans or deposits relative to GDP, while financial inclusion refers to the breadth or outreach of the financial sector to various population segments depending on their income, race, gender, age, etc. For instance, there could be a financial sector that is very developed from the standpoint of the ratio of loans to GDP but ranks negatively in terms of inclusion because few individuals borrow most of these loans.[3] Allen, Demirguc-Kunt, Klapper, & Peria, (2016) is the closest reference to our paper and uses a similar individual-level database from 123 countries for year 2011 to find a significant relationship between political stability, legal rights and other institutional variables on financial inclusion. Also, Delechat, Newiak, Xu, Yang, & Aslan (2018) use a similar database to show the effect of institutional factors on women's financial inclusion.

[3] Some papers that study financial inclusion in SSA are Karlan & Morduch (2009), Allen, et al., (2013), Ahokpossi, et al. (2013), Mlachila & Moheeput, (2014), or Yontcheva & Alter, 2016).

The rest of the paper is organized as follows: We describe the data sources in Section 2. Section 3 studies the relationship between competition and financial inclusion. Section 4 studies the relationship between balance sheet variables and financial inclusion (borrowing). Finally, Section 5 concludes the paper.

II. DATA SOURCES

A. Global Financial Inclusion (Findex) database

We use the World Bank's 2011 and 2014 Global Financial Inclusion (Global Findex) database (Demirguc-Kunt & Klapper, 2013). The Global Findex database was launched by the World Bank in 2011, with an update of the database in 2014. The database covers more than 140 economies, representing more than 97 percent of the world's population. The survey is collected by Gallup, Inc., covering about 150,000 nationally representative and randomly selected adults age 15 and above.[4]

The focus of our project is Sub-Saharan African countries, and we restrict our sample to this region. In total, we have 69,044 observations, 35,000 from the 2011 Findex survey and 34,044 from the 2014 survey. Table 1 below shows summary statistics of the Findex database that suggest a high level of variation across individuals. The age of individuals ranges from 15 to 99 years. The average age is 34.4 years old, and the median is 30 years old. The median person in the sample has completed primary education, and the female to male ratio is 1.5. In terms of income distribution, the poorest 20 percent constitute 15 percent of the sample and the richest 5 percent constitute 28 percent of the sample.

Additionally, thirty-one percent of individuals in our database have a bank account. Those with a debit card are 17 percent of the sample, and 5 percent have a credit card. Among the people who do not have bank account, 22 percent report not having an account because it is too expensive. Also, 7 percent reported having borrowed money from a financial institution in the past year.

Although Global Findex includes variables related to mobile payments and other new financial technologies (i.e. FinTech), we do not consider these services in our study. This is due to several reasons. First, these services are still in development, and mainly used for sending money, and have a limited usage as saving or credit instruments (see Maino, Massara, Perez-Saiz, Sharma, & Sy, forthcoming). Second, measuring competition in the FinTech industry is very difficult, and there is limited data available. Finally, with the exception of several countries in East and South Africa, most of these new services are still

[4] Demirguc-Kunt, Asli, Leora Klapper, Dorothe Singer, and Peter Van Oudheusden. 2015. "The Global Findex Database 2014: Measuring Financial Inclusion around the World." Policy Research Working Paper 7255, World Bank, Washington, DC.

not very successful in the continent. Therefore, we limit our study to more traditional banking products, like bank accounts, cards and loans.

B. Financial Soundness Indicators (FSI) database

We use IMF's FSI (Financial Soundness Indicators) database at country level to combine it with the Findex database, so we can obtain insight on the financial soundness of banking institutions in SSA. FSIs are indicators compiled to monitor the health and soundness of financial institutions and markets, and of their corporate and household counterparts. However, the FSI database suffers from missing data, as it only contains 24 countries from SSA. The main variables available in the FSI are asset quality, non-performing loans to total gross loans, earnings and profitability of the banking sector, return on assets and equity, capital adequacy and liquidity ratios. Table 2 shows the complete list of variables.

Table 1: Summary statistics

Variable	Mean	Min	P1	P25	P50	P75	P99	Max
Demographic variables:								
Age	34.4	15.0	15.0	23.0	30.0	43.0	78.0	99.0
Education	1.5	1.0	1.0	1.0	1.0	2.0	3.0	5.0
Female	1.5	1.0	1.0	1.0	1.0	2.0	2.0	2.0
Income quantile	3.3	1.0	1.0	2.0	3.0	5.0	5.0	5.0
Financial inclusion variables:								
Has bank account	0.3	0.0	0.0	0.0	0.0	1.0	1.0	1.0
Has debit card	0.2	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Has credit card	0.1	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Don't have account because expensive	0.2	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Borrowed last year	0.1	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Competition indicators:								
C5	82.3	54.4	54.4	72.5	82.1	95.3	100.0	100.0
Boone	-0.1	-0.3	-0.3	-0.1	-0.1	0.0	0.2	0.2
H statistic	0.5	0.1	0.1	0.4	0.6	0.6	0.8	0.8
Lerner	0.3	0.1	0.1	0.2	0.3	0.3	0.5	0.5
Bank indicators and growth:								
LAR	29.3	10.7	10.7	21.5	29.1	37.1	51.5	51.5
Tier1 ratio	15.7	2.2	2.2	13.2	15.8	19.1	24.4	24.4
GDP growth	5.6	2.8	2.8	4.4	5.5	7.4	8.6	8.6

Sources: Global Findex, IFS, and Global Financial Development databases.

Table 2: Financial Soundness Indicators

Variable	Type	Format	Description
Deposit Takers	Percent	numeric	Deposit taker institutions
Asset Quality	Percent	numeric	Asset quality
Non-Performing Loans to Total Gross Loans	Percent	numeric	Calculated by using the value of NPLs as the numerator and the total value of the loan portfolio (including NPLs, and before the deduction of specific loan loss provisions) as the denominator.
Earnings and Profitability	Percent	numeric	Earnings and profitability
Return to Assets	Percent	numeric	Calculated by dividing net income before extraordinary items and taxes by the average value of total assets over the same period
Return to Equity	Percent	numeric	Calculated by dividing net income before extraordinary items and taxes by the average value of capital over the same period
Capital Adequacy	Percent	numeric	Capital adequacy
Capital to Risk-Weghted Assets	Percent	numeric	Calculated using total regulatory capital as the numerator and risk-weighted assets as the denominator.

Sources: IMF, FSI database.

C. Global Financial Development (GFD) database

The Global Financial Development Database is provided by the World Bank. The dataset provides extensive data on financial system characteristics for 206 economies.[5] The table below shows some of the variables included in the GFD database. The main explanatory variables we are interested in are the ones that measure bank competition. We use C5 (higher C5, less competition), H-statistic (higher H, more competition), Lerner index (higher, less competition), and Boone indicator (higher, more competition).

This database also contains variables that measure access to banking, such as bank accounts per 1,000 adults, and ATMs per 100,000 adults. The indicators that measure the depth of the banking sector include: private credit to deposit money banks, deposit money banks' assets to GDP, and central bank assets to GDP. The resilience and stability of banks are present in variables related to non-performing loans to gross loans, bank capital to total assets, and credit to bank deposits. Macroeconomic variables, including GDP or GDP per capita are the other variables we control for, and are included in the GFD database.

Below, we describe in detail the four indices that measure the level of bank competition, which are our main explanatory variables related to competition. Degryse, Morales Acevedo, & Ongena (2014) provide more detailed information about the use of various competition variables in the financial industry.

[5] Martin Čihák, Aslı Demirgüç-Kunt, Erik Feyen, and Ross Levine, 2012. "Benchmarking Financial Systems Around the World." World Bank Policy Research Working Paper 6175, World Bank, Washington, D.C.

C5 indicator

The C5 indicator is equal to the combined market share of the five largest financial institutions in the country. It is the simplest indicator of competition. The industrial organization literature shows, through game-theoretic models of collusion, that more concentration tends to increase prices, and reduces output or welfare. However, concentration is an imperfect measure of competitive behavior. For instance, the Bertrand model without differentiated goods or the contestable market theory (Baumol, Panzar, & Willig, 1988) shows that it is possible to have a perfectly competitive market where price is equal to marginal cost, even with a monopolistic or a duopolistic market structure. Therefore, other measures of competition that are more related to the conduct of firms are necessary to complement the C5 indicator.

Panzar-Rosse H-statistic (H-Statistic)

The H-statistic captures the elasticity of bank interest revenues to input prices, where input prices include the price of deposits, personnel, and equipment, and fixed capital.[6] The H-statistic is defined such that the higher its value, the more competitive are banking systems . It was proposed originally by Panzar & Rosse (1987). A monopoly situation yields an H-statistic that can be negative or zero, whereas monopolistic competition yields values between 0 and 1, and perfect competition greater than 1 (see Bikker & Haaf, 2002; and Claessens & Laeven, 2004).

Lerner Index

The Lerner Index is defined as the difference between output prices and marginal costs (relative to prices) and is equal to the inverse of the elasticity of demand for the case of a perfect monopoly and equal to zero for a perfect competitive market. Therefore, higher values of the Lerner Index indicate less bank competition. For industry structures between competition and monopoly, the value of the Lerner index depends on the reaction of a bank to the strategic choices of other competitors. The stronger this reaction, the lower the degree of competition, and the higher the Lerner index (Shaffer, 1993).

Boone Indicator

The Boone Indicator (Boone, 2008) reflects the effect of efficiency on profits, calculated as the elasticity of profits to marginal costs. The indicator mainly measures that more-efficient banks achieve higher profits. Therefore, the more negative the Boone indicator, the higher the level of competition in the market. The Boone indicator ranges from -0.3 to 0.24, and the average value for our sample countries is close to zero at -0.05.

[6] See also http://www.worldbank.org/en/publication/gfdr/background/banking-competition for more information

By looking at the statistics in our sample, we note that the H-statistic and Lerner indices show average statistics indicating low bank competition levels among the SSA countries represented in our database.

When compared to other simpler measures (such as C5), the H-statistic, Lerner and Boone indicators provide a step forward in measuring competition. However, it should be noted that these three competition indicators have relatively high requirements in terms of data needs as they use input prices or costs of production at bank level, which may not be available for researchers in non-advanced economies, especially in the SSA region.

Financial access and competition: Comparing SSA with the rest of the world

Table 4 below shows summary statistics of variables measuring financial access for different world regions. Not surprisingly, the rate of financial account ownership in SSA is significantly lower compared to more advanced economies. In SSA, 25.6 percent of the population have a financial account, compared to about 94 percent in advanced economies and 40 percent in non-advanced economies. Other measures of financial access such as ownership of credit or debit cards are also significantly lower in SSA.

The table shows that the SSA region does relatively well in mobile money account ownership. Eleven percent of adults have a mobile bank account, whereas only 6 percent of adults in advanced economies, and 6.5 percent in non-advanced economies have mobile accounts. Mobile phone ownership is also relatively high in SSA at 81 percent of adults own mobile phones. Internet access, however, is still very low in SSA, where only 14 percent of adults access internet from home, whereas 81 percent in advanced economies and 34 percent in non-advanced economies have internet access at home.

Table 3: Global Financial Development Database

Variable	Type	Format	Description
Bank accounts per 1,000 adults	continuous	numeric	Number of depositors with commercial banks per 1,000 adults.
Bank branches per 100,000 adults	continuous	numeric	Number of commercial bank branches per 100,000 adults.
Loans requiring collateral	continuous	numeric	Percentage of loans where a formal financial institution requires collateral in order to provide the financing.
Value of collateral needed for a loan (% of the loan amount)	continuous	numeric	Value of collateral needed by a formal financial institution for a loan or line of credit as a percentage of the loan value or the value of the line of credit.
Private credit by deposit money banks to GDP (%)	continuous	numeric	The financial resources provided to the private sector by domestic money banks as a share of GDP.
Deposit money banks' assets to GDP (%)	continuous	numeric	Total assets held by deposit money banks as a share of GDP
Central bank assets to GDP (%)	continuous	numeric	Total assets held by deposit money banks as a share of GDP
Bank net interest margin (%)	continuous	numeric	Accounting value of bank's net interest revenue as a share of its average interest-bearing (total earning) assets.
Bank lending-deposit spread	continuous	numeric	Difference between lending rate and deposit rate. Lending rate is the rate charged by banks on loans to the private sector and deposit interest rate is the rate offered by commercial banks on three-month deposits.
Bank concentration (%)	continuous	numeric	Assets of three largest commercial banks as a share of total commercial banking assets.
Bank deposits to GDP (%)	continuous	numeric	The total value of demand, time and saving deposits at domestic deposit money banks as a share of GDP.
H-statistic	continuous	numeric	A measure of the degree of competition in the banking market. Higher H-statistic, more competition.
Lerner index	continuous	numeric	A measure of market power in the banking market. Higher Lerner, less competition.
Boone indicator	continuous	numeric	in the banking market. Higher value (less negative), less competition.
Bank Z-score	continuous	numeric	It captures the probability of default of a country's commercial banking system.
Bank nonperforming loans to gross loans (%)	continuous	numeric	Ratio of defaulting loans (payments of interest and principal past due by 90 days or more) to total gross loans (total value of loan portfolio).
Bank capital to total assets (%)	continuous	numeric	Ratio of bank capital and reserves to total assets.
Bank credit to bank deposits (%)	continuous	numeric	The financial resources provided to the private sector by domestic money banks as a share of total deposits.
Bank regulatory capital to risk-weighted assets (%)	continuous	numeric	The capital adequacy of deposit takers. It is a ratio of total regulatory capital to its assets held, weighted according to risk of those assets.
Liquid assets to deposits and short term fu	continuous	numeric	The ratio of the value of liquid assets (easily converted to cash) to short-term funding plus total deposits.
Provisions to nonperforming loans (%)	continuous	numeric	Provisions to nonperforming loans.
Stock price volatility	continuous	numeric	Stock price volatility is the average of the 360-day volatility of the national stock market index.
GDP (Current USD)	continuous	numeric	GDP (Current USD)
GDP per capita (Constant 2005 USD)	continuous	numeric	GDP per Capita (Constant 2000 USD)
GNP (Current USD)	continuous	numeric	GNP (Current USD)
Population (Total)	continuous	numeric	Population, Total

Sources: World Bank Global Financial Development (GFD) database.

Table 4: Selected Summary Indicators (percent population with)

	SSA	Africa	Advanced economies	Non-advanced economies	Descriptor
Bank accounts	25.6	25.1	93.72	40.28	
CreditCard	3.04	3.1	44.83	9.05	
DebitCard	14.89	14.3	80.28	26.29	
Mobile bank account	11.07	11.1	6.15	6.48	
Bank branches	5.66	6.35	29.74	16.33	
Internet access from home	14.06	16.1	81.37	34.25	
mobile	81.22	82.41	124.56	103.33	
ATMs	14.69	13.63	89.66	37.36	
Boone indicator	-0.102	-0.091	-0.092	-0.072	Boone indicator: Higher value (less negative), less competition
H statistic	0.49	0.51	0.64	0.55	H-statistic: Higher H, more competition
Lerner index	0.42	0.38	0.3	0.33	Lerner index: Higher Lerner, less competition

Sources: Global Findex, IFS, and Global Financial Development databases.

III. COMPETITION AND FINANCIAL INCLUSION

A. Empirical model

The objective of our empirical model is to use this detailed panel of individuals provided by Findex to focus on two separate research issues. First, we want to understand how various competition indicators at country level affect having an account, a credit card, or a debit card. Second, we want to understand how several measures of financial soundness at country level affect borrowing by individuals.

To estimate the effect of competition, we consider a simple probit model where $y_{i,c,t} = 1$ is an indicator for an individual i in country c and year t having adopted a certain financial product and we assume that $Pr(y_{i,c,t} = 1) = Pr(y^*_{i,c,t} > 0)$ where

$$y^*_{i,c,t} = \alpha_1 compet_{c,t-1} + \alpha_2 X_{i,c,t} + \alpha_3 Z_{c,t} + \alpha_t + \alpha_c + \varepsilon_{i,c,t} \qquad (1)$$

where the term $compet_{c,t-1}$ is a lagged variable of competition constructed using the C5, Boone, H-statistic or the Lerner index, $X_{i,c,t}$ is a vector of individual-level variables, $Z_{c,t}$ is a

vector of country-level variables, α_t are year fixed effects and α_c are country fixed-effects. We also use model (1) to determine how competition affects not getting a bank account because it is too expensive, which is one of the questions that is asked in the Findex survey.

From this model, we can test the validity of the *market power hypothesis* by considering the sign of parameter α_1 in model (1):

Hypothesis 1:

$\alpha_1 > 0$ (Greater competition increases the probability of having a financial product)

Country and year fixed effects play a relevant role in identifying the parameters of interest in model (1). Country fixed effects allow control of time invariant, country-level variables that may influence the decision of having a financial product. We estimate a short panel (two years) with about 1,000 individuals per country-year. The individual-level data that we use includes a rich set of individual-level demographic variables that may affect the decision to buy a financial product or obtain access to credit.

B. Results

We present the results related to the estimation of model (1) that show the effect of competition variables on the adoption of bank accounts, debit cards and credit cards by individuals in SSA countries. Table 5 shows the effect of competition variables on the adoption of bank accounts by individuals. Given the definition of every competition indicator, a positive effect of competition on the adoption of bank accounts (i.e., if competition in the market increases, adoption increases) would imply that the estimated parameter is negative for the C5 indicator, negative for the case of the Boone indicator, positive for the H-statistic, and negative for the Lerner index.

In all regressions we use three country level indicators, the ratio of private credit to GDP, the GDP level in US dollars, and GDP per capita. The three indicators should be positively related to the level of financial depth, which could be related to financial inclusion (however this is not always the case, see Karlan & Morduch 2009) because financial inclusion tends to be higher in more advanced economies with more developed financial systems. These variables also help control for other factors, such as the degree of informality in the financial market. Countries in Sub-Saharan Africa tend to have large informal credit markets which might affect the results.

We start our econometric analysis with the simplest competition indicator, the C5 indicator of concentration, and we find an intuitive negative coefficient for C5 in column (1). In column (2) we find that the effect of the C5 indicator in countries with a more developed financial system (measured as the ratio of credit to GDP) is negative. This is an interesting

result, as it shows the importance of competition indicators for financial inclusion in countries with higher levels of financial depth.

In columns (3) to (5) we add additional competition variables that provide a step forward in measuring competition (Boone, H-statistics and Lerner), and we interact them with the simple C5 indicator. This is motivated by the fact that concentration may not be a strong indicator of competitive behavior.[7] The Boone, H-statistic and Lerner index have a stronger behavioral interpretation that is related to the competitive behavior of the industry. In column (3) we find that adoption of accounts increases in markets that are more competitive (more negative Boone indicator) for a given level of concentration C5. In addition, the interaction of the two indicators has a positive effect on adoption.

In the following columns we consider the H-statistic and Lerner indicators. In all cases, the effect of the C5 indicator is negative, and the effect of the Lerner indicator in column (5) is consistent with Hypothesis 1. We do not find an intuitive effect of the H statistic indicator that is consistent with our hypothesis.

Interestingly, the effect of credit/GDP (financial depth) and other levels of economic development (GDP) variables on financial inclusion are positive and statistically significant in all specifications. This suggests a link between financial inclusion and financial depth.

In columns (6)-(10) we repeat the analysis and include country fixed effects. Some of the results change considerably. For instance, the effect of credit/GDP on adoption becomes negative in most cases, and the effect of concentration has an opposite sign when we do not consider other competition indicators. When including the effect of the Boone and Lerner indicators, we find intuitive effects that are consistent with the case of no fixed effects and Hypothesis 1. Also, it is interesting that when country fixed effects are added, the effect of credit/GDP (financial depth) is not always positive and it becomes negative in some specifications; this indicates that the link between financial inclusion and financial depth may not be clear.

Several intuitive results are discovered regarding the effect of individual level variables (education, gender, age, etc.) on the probability of having a bank account. In all specifications, older individuals, female individuals, and well-educated individuals (tertiary education or more), are more likely to have a bank account. Also, poor individuals (poorest 20%) are less likely to have a bank account. The results are also robust for other products (debit and credit cards) that will be presented in the following tables.

[7] For instance, a simple duopoly market can be very competitive if the two firms compete in prices (Bertrand competition). Also, a monopoly can set a perfectly competitive price if the market is “contestable” (see Baumol, Panzar, & Willig, 1988).

Table 5: Have a bank account and bank competition (country and year fixed effects)

	No Country Fixed Effects					*Including Country Fixed Effects*				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
C5	-1.119***	-0.780***	-0.484***	-1.701***	-1.632***	0.691***	1.400***	0.0129	-1.254*	-3.863***
	(0.0447)	(0.0910)	(0.0725)	(0.149)	(0.237)	(0.133)	(0.256)	(0.217)	(0.710)	(0.753)
C5 x Credit/GDP		-0.0113***					-0.0488***			
		(0.00266)					(0.0151)			
Boone indicator			-27.34***					-38.82***		
			(2.911)					(9.720)		
C5 x Boone			6.012***					9.364***		
			(0.661)					(2.205)		
H statistic				-8.054***					-16.50***	
				(1.910)					(6.155)	
C5 x H stat				1.607***					4.469***	
				(0.430)					(1.419)	
Lerner index					-8.773**					-34.79***
					(3.611)					(8.901)
C5 x Lerner					2.454***					8.550***
					(0.828)					(2.073)
Credit/GDP	0.0134***	0.0625***	0.0147***	0.0111***	0.0112***	-0.0478***	0.166**	-0.0301***	-0.0775***	-0.0281***
	(0.000508)	(0.0116)	(0.000509)	(0.000597)	(0.000658)	(0.00408)	(0.0661)	(0.00452)	(0.00756)	(0.00746)
GDP per capita	0.176***	0.175***	0.154***	0.256***	0.194***	2.306***	2.085***	1.050*	1.831***	0.147
	(0.0104)	(0.0104)	(0.0108)	(0.0158)	(0.0160)	(0.503)	(0.507)	(0.549)	(0.679)	(0.885)
GDP	0.0265***	0.0473***	0.0146**	0.0699***	0.0747***	1.353***	1.415***	1.383***	1.068***	1.305***
	(0.00710)	(0.00844)	(0.00720)	(0.00867)	(0.00840)	(0.102)	(0.104)	(0.107)	(0.130)	(0.153)
Respondent age		0.0115***	0.0119***	0.0117***	0.0117***	0.0127***	0.0127***	0.0127***	0.0125***	0.0128***
		(0.000546)	(0.000547)	(0.000602)	(0.000600)	(0.000568)	(0.000568)	(0.000568)	(0.000626)	(0.000625)
Female		0.0831***	0.0844***	0.0986***	0.0895***	0.0977***	0.0975***	0.0987***	0.102***	0.0970***
		(0.0155)	(0.0156)	(0.0169)	(0.0170)	(0.0160)	(0.0160)	(0.0160)	(0.0175)	(0.0175)
Primary education or less		-0.280*	-0.311*	-0.340*	-0.272	-0.367**	-0.375**	-0.371**	-0.436**	-0.331
		(0.165)	(0.165)	(0.184)	(0.187)	(0.182)	(0.181)	(0.182)	(0.197)	(0.201)
Secondary education		0.401**	0.389**	0.344*	0.392**	0.369**	0.364**	0.364**	0.293	0.397**
		(0.164)	(0.165)	(0.184)	(0.187)	(0.182)	(0.181)	(0.182)	(0.197)	(0.201)
Tertiary education or more		1.115***	1.146***	1.112***	1.115***	1.244***	1.239***	1.254***	1.185***	1.270***
		(0.168)	(0.169)	(0.187)	(0.190)	(0.185)	(0.184)	(0.186)	(0.200)	(0.205)
Education: missing		-0.125	-0.253	-0.495	-0.437	-0.495*	-0.506*	-0.505*	-0.664	-0.567
		(0.256)	(0.260)	(0.502)	(0.488)	(0.282)	(0.281)	(0.282)	(0.551)	(0.540)
Poorest 20%		-0.825***	-0.820***	-0.823***	-0.833***	-0.864***	-0.862***	-0.863***	-0.869***	-0.875***
		(0.0261)	(0.0261)	(0.0284)	(0.0287)	(0.0270)	(0.0270)	(0.0270)	(0.0294)	(0.0297)
Second 20%		-0.698***	-0.694***	-0.710***	-0.716***	-0.727***	-0.726***	-0.728***	-0.746***	-0.747***
		(0.0248)	(0.0249)	(0.0271)	(0.0273)	(0.0256)	(0.0256)	(0.0257)	(0.0281)	(0.0282)
Middle 20%		-0.512***	-0.508***	-0.502***	-0.519***	-0.541***	-0.540***	-0.541***	-0.542***	-0.547***
		(0.0231)	(0.0232)	(0.0253)	(0.0252)	(0.0239)	(0.0238)	(0.0239)	(0.0261)	(0.0261)
Fourth 20%		-0.318***	-0.316***	-0.315***	-0.327***	-0.331***	-0.330***	-0.331***	-0.337***	-0.342***
		(0.0214)	(0.0215)	(0.0235)	(0.0233)	(0.0220)	(0.0220)	(0.0220)	(0.0240)	(0.0239)
Observations	33,991	33,991	33,991	28,985	28,989	33,991	33,991	33,991	28,985	28,989
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Expected sign C5	-	-	-	-	-	-	-	-	-	-
Expected sign Boone			-					-		
Expected sign H stat				+					+	
Expected sign Lerner					-					-

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

Notes: Probit regressions bank competition.

Table 6 shows the estimated parameters for a probit regression where the endogenous variable is an indicator equal to 1 if the individual that does not have an account responds in the survey that he or she does not have it because accounts are too expensive. We use this

probit model to understand if there is a statistical relationship between the fact that accounts are expensive, and the level of competition of the banking industry in the country. This relationship is not a priori obvious. Industries that are more competitive do not necessarily have lower prices for the products offered because there could be other exogenous factors, such as changes in the costs of inputs, that could affect prices without affecting the level of competition in the industry.[8]

Estimated parameters in Table 6 show that individuals are generally less likely to report that they do not have an account because it is expensive in countries where the banking industry is more competitive. For the case of country fixed effects, we find intuitive signs of the competition coefficients for the C5, Boone and Lerner indicators (but not for the H statistic). Therefore, overall, we find there is a direct relationship between prices and competition which is consistent with Hypothesis 1.

Table 7 presents similar estimates to Table 5, but for the case of debit cards. The sign of the probit estimates for the competition indicators are consistent with Hypothesis 1, and are in general more robust than the case of bank accounts. Also, the interaction term for credit over GDP is positive and significant (for the case of country fixed effects). It is interesting to note that the effect of competition on financial inclusion (using access to debit cards) in countries with higher levels of financial depth is opposite to the case of accounts.

In Table 7, the separate effects of the C5, H statistic, and Lerner indicators are consistent with Hypothesis 1. The estimates for the interaction terms show that when concentration levels increase, lower levels of competition (using the Boone and the H statistic) reduce the adoption of debit cards. The interaction term between C5 and the Lerner index has an opposite effect to the Hypothesis 1.

[8] For instance, in an extreme case the equilibrium price of a perfectly competitive industry with perfectly elastic supply function only depends on the marginal cost of production, that may depend on purely exogenous factors such as exchange rates, costs of materials and labor.

Table 6: Does not have account because it is expensive

	No Country Fixed Effects					*Including Country Fixed Effects*				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
C5	0.226***	-0.311***	-0.465***	-0.474***	-1.567***	1.719***	1.236***	1.461***	2.913***	5.285***
	(0.0450)	(0.0886)	(0.0745)	(0.142)	(0.231)	(0.170)	(0.338)	(0.224)	(0.717)	(0.809)
C5 x Credit/GDP		0.0200***					0.0333*			
		(0.00276)					(0.0202)			
Boone indicator			40.45***					57.06***		
			(3.081)					(9.629)		
C5 x Boone			-9.267***					-13.16***		
			(0.703)					(2.205)		
H statistic				-10.19***					10.53*	
				(1.831)					(6.260)	
C5 x H stat				2.535***					-2.709*	
				(0.411)					(1.438)	
Lerner index					-27.07***					21.16**
					(3.607)					(9.212)
C5 x Lerner					5.926***					-5.150**
					(0.827)					(2.129)
Credit/GDP	-0.0114***	-0.0991***	-0.0118***	-0.00711***	-0.00958***	-0.00145	-0.152*	-0.0151***	0.0120	-0.0191**
	(0.000539)	(0.0120)	(0.000533)	(0.000648)	(0.000677)	(0.00506)	(0.0911)	(0.00577)	(0.00832)	(0.00886)
GDP per capita	-0.0160	-0.0147	-0.0277**	-0.159***	-0.0220	1.030**	1.260**	1.377**	1.373**	3.213***
	(0.0110)	(0.0110)	(0.0114)	(0.0167)	(0.0165)	(0.505)	(0.522)	(0.594)	(0.630)	(0.839)
GDP	0.0100	-0.0180**	0.0451***	-0.0393***	0.0274***	0.258**	0.206*	0.154	0.600***	0.574***
	(0.00738)	(0.00851)	(0.00776)	(0.00804)	(0.00884)	(0.104)	(0.108)	(0.109)	(0.138)	(0.158)
Respondent age	-0.00294***	-0.00287***	-0.00309***	-0.00287***	-0.00265***	-0.00259***	-0.00261***	-0.00264***	-0.00211***	-0.00234***
	(0.000558)	(0.000558)	(0.000560)	(0.000611)	(0.000608)	(0.000572)	(0.000572)	(0.000572)	(0.000624)	(0.000620)
Female	0.0118	0.0129	0.0132	0.00404	0.00828	0.00179	0.00179	0.00120	-0.00621	0.00242
	(0.0159)	(0.0159)	(0.0159)	(0.0173)	(0.0171)	(0.0162)	(0.0162)	(0.0162)	(0.0176)	(0.0174)
Primary education or less	0.442**	0.452**	0.477**	0.698***	0.623***	0.459**	0.460**	0.452**	0.628***	0.554**
	(0.201)	(0.202)	(0.203)	(0.233)	(0.223)	(0.206)	(0.205)	(0.205)	(0.234)	(0.224)
Secondary education	0.127	0.138	0.147	0.349	0.337	0.136	0.136	0.129	0.320	0.251
	(0.201)	(0.202)	(0.202)	(0.233)	(0.223)	(0.206)	(0.205)	(0.205)	(0.234)	(0.224)
Tertiary education or more	-0.416**	-0.411**	-0.435**	-0.283	-0.311	-0.417**	-0.416**	-0.424**	-0.298	-0.361
	(0.206)	(0.207)	(0.208)	(0.238)	(0.229)	(0.211)	(0.210)	(0.211)	(0.239)	(0.230)
Education: missing	0.452	0.408	0.604**	0.621*	0.508	0.587**	0.591**	0.594**	0.669*	0.523
	(0.276)	(0.276)	(0.282)	(0.358)	(0.350)	(0.286)	(0.286)	(0.286)	(0.364)	(0.356)
Poorest 20%	0.342***	0.343***	0.335***	0.305***	0.330***	0.356***	0.355***	0.355***	0.330***	0.336***
	(0.0257)	(0.0257)	(0.0258)	(0.0280)	(0.0277)	(0.0262)	(0.0262)	(0.0262)	(0.0285)	(0.0281)
Second 20%	0.276***	0.276***	0.271***	0.228***	0.284***	0.285***	0.285***	0.285***	0.251***	0.288***
	(0.0254)	(0.0254)	(0.0254)	(0.0277)	(0.0272)	(0.0259)	(0.0259)	(0.0259)	(0.0281)	(0.0277)
Middle 20%	0.265***	0.266***	0.263***	0.226***	0.272***	0.277***	0.277***	0.277***	0.249***	0.280***
	(0.0246)	(0.0246)	(0.0247)	(0.0268)	(0.0264)	(0.0252)	(0.0251)	(0.0252)	(0.0273)	(0.0268)
Fourth 20%	0.185***	0.186***	0.181***	0.157***	0.187***	0.188***	0.188***	0.188***	0.172***	0.186***
	(0.0236)	(0.0236)	(0.0236)	(0.0257)	(0.0252)	(0.0241)	(0.0241)	(0.0241)	(0.0261)	(0.0257)
Observations	33,991	33,991	33,991	28,985	28,989	33,991	33,991	33,991	28,985	28,989
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Expected sign C5	+	+	+	+	+	+	+	+	+	+
Expected sign Boone			+					+		
Expected sign H stat				-					-	
Expected sign Lerner					+					+

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

Notes: Probit regressions bank competition.

Table 7: Have a debit card and bank competition

	No Country Fixed Effects					*Including Country Fixed Effects*				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
C5	-0.546***	-0.580***	0.209**	0.808***	-2.153***	-0.737***	-1.736***	-1.472***	4.327***	-2.375***
	(0.0503)	(0.0997)	(0.0837)	(0.162)	(0.285)	(0.144)	(0.275)	(0.259)	(0.873)	(0.906)
C5 x Credit/GDP		0.00105					0.0733***			
		(0.00267)					(0.0173)			
Boone indicator			-30.74***					20.19*		
			(3.326)					(11.08)		
C5 x Boone			6.677***					-4.312*		
			(0.754)					(2.499)		
H statistic				18.14***					43.47***	
				(1.973)					(7.396)	
C5 x H stat				-4.336***					-10.12***	
				(0.448)					(1.713)	
Lerner index					-23.98***					-44.65***
					(4.237)					(11.00)
C5 x Lerner					5.926***					10.45***
					(0.973)					(2.578)
Credit/GDP	0.0114***	0.00680	0.0136***	0.00859***	0.0123***	0.0111***	-0.305***	0.0149***	-0.0110	0.00279
	(0.000493)	(0.0116)	(0.000517)	(0.000610)	(0.000721)	(0.00412)	(0.0747)	(0.00446)	(0.00854)	(0.00812)
GDP per capita	0.221***	0.221***	0.190***	0.370***	0.193***	-1.565***	-1.710***	-2.185***	0.593	-1.028
	(0.0118)	(0.0118)	(0.0124)	(0.0180)	(0.0198)	(0.593)	(0.601)	(0.622)	(0.794)	(1.028)
GDP	0.101***	0.0983***	0.0808***	0.185***	0.164***	0.163	0.151	0.0960	0.346**	0.496***
	(0.00727)	(0.00907)	(0.00751)	(0.00943)	(0.00922)	(0.113)	(0.113)	(0.116)	(0.150)	(0.176)
Respondent age	0.00742***	0.00743***	0.00785***	0.00669***	0.00725***	0.00826***	0.00823***	0.00825***	0.00707***	0.00828***
	(0.000621)	(0.000621)	(0.000622)	(0.000698)	(0.000705)	(0.000651)	(0.000652)	(0.000652)	(0.000722)	(0.000736)
Female	0.0543***	0.0544***	0.0566***	0.0722***	0.0545***	0.0940***	0.0937***	0.0940***	0.0986***	0.0854***
	(0.0175)	(0.0175)	(0.0176)	(0.0193)	(0.0198)	(0.0183)	(0.0183)	(0.0183)	(0.0199)	(0.0204)
Primary education or less	-0.00133	-0.00115	-0.0401	-0.105	-0.0313	-0.0651	-0.0506	-0.0658	-0.131	-0.0594
	(0.225)	(0.225)	(0.223)	(0.253)	(0.283)	(0.242)	(0.244)	(0.243)	(0.265)	(0.283)
Secondary education	0.821***	0.822***	0.798***	0.736***	0.806***	0.770***	0.782***	0.768***	0.688***	0.772***
	(0.225)	(0.225)	(0.223)	(0.253)	(0.283)	(0.242)	(0.244)	(0.243)	(0.265)	(0.283)
Tertiary education or more	1.466***	1.466***	1.484***	1.464***	1.480***	1.558***	1.569***	1.558***	1.493***	1.545***
	(0.227)	(0.226)	(0.225)	(0.255)	(0.285)	(0.244)	(0.246)	(0.245)	(0.268)	(0.286)
Education: missing	0.387	0.383	0.285	-0.122	-0.0550	-0.191	-0.174	-0.191	-0.253	-0.230
	(0.306)	(0.306)	(0.307)	(0.605)	(0.615)	(0.329)	(0.330)	(0.329)	(0.622)	(0.627)
Poorest 20%	-0.861***	-0.861***	-0.860***	-0.880***	-0.898***	-0.924***	-0.926***	-0.924***	-0.934***	-0.948***
	(0.0309)	(0.0309)	(0.0310)	(0.0340)	(0.0353)	(0.0323)	(0.0323)	(0.0323)	(0.0350)	(0.0368)
Second 20%	-0.722***	-0.722***	-0.721***	-0.762***	-0.762***	-0.776***	-0.778***	-0.776***	-0.818***	-0.811***
	(0.0288)	(0.0288)	(0.0289)	(0.0319)	(0.0327)	(0.0299)	(0.0299)	(0.0299)	(0.0328)	(0.0339)
Middle 20%	-0.564***	-0.564***	-0.561***	-0.571***	-0.603***	-0.614***	-0.615***	-0.614***	-0.628***	-0.644***
	(0.0259)	(0.0259)	(0.0260)	(0.0285)	(0.0293)	(0.0272)	(0.0272)	(0.0272)	(0.0296)	(0.0306)
Fourth 20%	-0.349***	-0.349***	-0.348***	-0.352***	-0.367***	-0.381***	-0.383***	-0.381***	-0.393***	-0.398***
	(0.0231)	(0.0231)	(0.0231)	(0.0255)	(0.0259)	(0.0241)	(0.0241)	(0.0241)	(0.0263)	(0.0268)
Observations	33,991	33,991	33,991	28,985	28,989	33,991	33,991	33,991	28,985	28,989
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Expected sign C5	-	-	-	-	-	-	-	-	-	-
Expected sign Boone			-					-		
Expected sign H stat				+					+	
Expected sign Lerner					-					-

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

Notes: Probit regressions bank competition.

We also find that the effect of financial depth (measured with the ratio credit/GDP) and financial inclusion (considering debit cards) is not always positive and becomes negative in some cases. A similar result is obtained for the case of credit cards.

Table 8 presents similar estimates to Table 5 for the case of the adoption of credit cards. The sign of the probit estimates for the competition indicators are in general similar to previous tables when considering fixed effects. The effect of GDP per capita is also negative, which is unintuitive. We also do not see a significant effect in the interaction between financial depth and concentration.

In summary, the empirical results generally show an economically and statistically significant effect of competition on the adoption of bank accounts, debit cards and credit cards. We combine the use of concentration indicators (C5) with other variables that have an easier behavioral interpretation (Boone, H statistic and Lerner). In general, we find that concentration matters in explaining financial inclusion, but concentration indicators need to be complemented with other indicators of competition that have a clearer behavioral interpretation in terms of competition. These results are in general robust after controlling for individual variables (e.g. age, income or education), other country-level variables (GDP and financial depth) and country and year fixed effects.

We also find a statistically and economically significant relationship between less competition and individuals not opening bank accounts because it is expensive. This may be because more competition translates directly to lower prices offered for bank accounts. These results contribute to a better understanding of the importance of bank competition and industry deregulation to increase financial inclusion in the SSA region.

Table 8: Have a credit card, and bank competition

	No Country Fixed Effects					*Including Country Fixed Effects*				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
C5	-0.0699	-0.394***	-0.155	0.719**	-0.267	-1.062***	-1.553***	-2.533***	1.578	-3.592**
	(0.0785)	(0.143)	(0.137)	(0.290)	(0.408)	(0.287)	(0.474)	(0.418)	(1.317)	(1.522)
C5 x Credit/GDP		0.00914***					0.0309			
		(0.00351)					(0.0236)			
Boone indicator			6.874					58.04***		
			(5.520)					(16.62)		
C5 x Boone			-1.703					-12.81***		
			(1.235)					(3.776)		
H statistic				8.808***					23.33**	
				(3.401)					(11.51)	
C5 x H stat				-2.012***					-5.486**	
				(0.769)					(2.628)	
Lerner index					-3.103					-42.22**
					(6.367)					(18.34)
C5 x Lerner					0.746					10.79**
					(1.454)					(4.234)
Credit/GDP	0.00434***	-0.0352**	0.00467***	0.00369***	0.00327***	0.0216***	-0.110	0.0281***	0.0155	0.0438***
	(0.000648)	(0.0152)	(0.000734)	(0.000808)	(0.000890)	(0.00551)	(0.101)	(0.00620)	(0.0136)	(0.0132)
GDP per capita	0.260***	0.262***	0.246***	0.291***	0.298***	-5.048***	-5.249***	-7.084***	-4.294***	-5.940***
	(0.0169)	(0.0170)	(0.0174)	(0.0246)	(0.0251)	(0.861)	(0.879)	(0.951)	(1.096)	(1.796)
GDP	-0.0443***	-0.0690***	-0.0461***	-0.0391***	-0.0481***	-0.178	-0.183	-0.452**	0.0734	0.558**
	(0.00988)	(0.0131)	(0.0106)	(0.0126)	(0.0118)	(0.179)	(0.179)	(0.202)	(0.221)	(0.262)
Respondent age	0.00755***	0.00761***	0.00758***	0.00619***	0.00637***	0.00804***	0.00803***	0.00803***	0.00658***	0.00686**
	(0.000893)	(0.000892)	(0.000894)	(0.000979)	(0.000990)	(0.000908)	(0.000908)	(0.000910)	(0.000992)	(0.00101)
Female	0.104***	0.105***	0.104***	0.111***	0.0933***	0.112***	0.111***	0.112***	0.119***	0.0995***
	(0.0263)	(0.0263)	(0.0263)	(0.0284)	(0.0292)	(0.0267)	(0.0267)	(0.0267)	(0.0288)	(0.0298)
Primary education or less	0.00952	0.0111	-0.00334	-0.108	-0.112	0.00596	0.0125	-0.000815	-0.0920	-0.113
	(0.327)	(0.326)	(0.326)	(0.336)	(0.339)	(0.324)	(0.325)	(0.326)	(0.335)	(0.341)
Secondary education	0.644**	0.647**	0.632*	0.539	0.521	0.633*	0.638**	0.625*	0.539	0.508
	(0.326)	(0.326)	(0.325)	(0.335)	(0.339)	(0.323)	(0.324)	(0.325)	(0.334)	(0.340)
Tertiary education or more	1.238***	1.239***	1.221***	1.163***	1.143***	1.214***	1.219***	1.212***	1.150***	1.117***
	(0.328)	(0.327)	(0.326)	(0.337)	(0.340)	(0.324)	(0.325)	(0.326)	(0.336)	(0.342)
Education: missing	-0.127	-0.168	-0.0737			-0.169	-0.161	-0.169		
	(0.540)	(0.541)	(0.539)			(0.539)	(0.539)	(0.542)		
Poorest 20%	-0.615***	-0.616***	-0.617***	-0.564***	-0.597***	-0.639***	-0.641***	-0.640***	-0.592***	-0.630***
	(0.0508)	(0.0507)	(0.0507)	(0.0533)	(0.0563)	(0.0510)	(0.0509)	(0.0511)	(0.0534)	(0.0566)
Second 20%	-0.460***	-0.460***	-0.460***	-0.438***	-0.448***	-0.478***	-0.479***	-0.478***	-0.460***	-0.471***
	(0.0436)	(0.0436)	(0.0437)	(0.0466)	(0.0487)	(0.0441)	(0.0441)	(0.0441)	(0.0470)	(0.0495)
Middle 20%	-0.492***	-0.492***	-0.492***	-0.482***	-0.454***	-0.507***	-0.508***	-0.509***	-0.502***	-0.476***
	(0.0410)	(0.0411)	(0.0411)	(0.0444)	(0.0454)	(0.0416)	(0.0416)	(0.0417)	(0.0449)	(0.0462)
Fourth 20%	-0.294***	-0.294***	-0.294***	-0.295***	-0.278***	-0.300***	-0.300***	-0.300***	-0.306***	-0.289***
	(0.0333)	(0.0333)	(0.0333)	(0.0362)	(0.0372)	(0.0338)	(0.0338)	(0.0339)	(0.0368)	(0.0380)
Observations	33,991	33,991	33,991	28,965	28,968	33,991	33,991	33,991	28,965	28,968
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES
Expected sign C5	-	-	-	-	-	-	-	-	-	-
Expected sign Boone			-					-		
Expected sign H stat				+					+	
Expected sign Lerner					-					-

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

Notes: Probit regressions bank competition.

IV. FINANCIAL INCLUSION AND BANK-BALANCE SHEET VARIABLES

A. Empirical model

We now study how relevant bank-balance sheet variables affect financial inclusion, more precisely, the borrowing capacity of individuals. By estimating the importance of this "bank-lending channel," we estimate how key balance sheet variables (such as Tier 1 capital ratios, or liquidity ratios) affect the probability of borrowing by individuals, and how these variables interact with the economic cycle. We consider a simple probit model where borrowing depends on the following latent variable:

$$\begin{aligned} Borrow^{*}_{i,c,t} = {} & \beta_1 GDPgrow_{c,t-1} + \beta_2 Tier1_{c,t-1} + \beta_3 LAR_{c,t-1} \\ & + \beta_4 Tier1_{c,t-1} \times GDPgrow_{c,t-1} \\ & + \beta_5 LAR_{c,t-1} \times GDPgrow_{c,t-1} + \beta_6 X_{i,c,t} + \beta_t + \beta_c + \varepsilon_{i,c,t} \end{aligned} \quad (2)$$

where $GDPgrow_{c,t-1}$ is the lagged value of GDP growth for country *c* in period *t-1*, $Tier1_{c,t-1}$ is the lagged average Tier 1 ratio for the country, and $LAR_{c,t-1}$ is the average liquid asset ratio (liquid assets to total assets). The dependent variable in the probit model is an indicator variable equal to 1 if the individual has borrowed in the last 12 months from a financial institution, which allows us to estimate the relationship between new loans obtained by individuals, and lagged bank balance sheet variables. The parameters of interest in this regression are the terms $\beta_1 - \beta_5$ that represent the effect of lagged balance sheet variables, economic growth and their interactions, on the probability that an individual borrows from a bank. As in the previous model (1), in model (2) we also use a vector of individual level variables, other country-level variables, and fixed effects.

As previously discussed in the introduction, the existing literature has not found undisputed results regarding the relationship between borrowing and the balance sheet strength of the financial systems. In our model, the case $\beta_2, \beta_3 > 0$ would be consistent with the view that borrowing increases in countries with stronger financial systems (i.e. more liquid or more capitalized). Also, the case of $\beta_4, \beta_5 < 0$ would imply a certain degree of countercyclicality in the credit, i.e. stronger financial systems (in terms of higher capital or liquidity) provide less credit when GDP growth is high so stronger banks are more countercyclical.

A limitation of our empirical strategy is the fact that we are not able to separately identify supply from demand-side determinants of adoption of financial products or borrowing. In order to separately identifying these effects, we would need to have access to accepted and rejected credit/product bank applications as in Jiménez, Ongena, Peydró, & Saurina, 2012 or Jiménez, Ongena, Peydro, & Saurina, 2014. Alternatively, the use of instrumental variables estimation methods could be useful to separately identify supply from demand-side effects, but valid instruments are usually difficult to find given the existing data constrains in SSA.

B. Empirical results

In the second set of results, we want to understand how relevant bank balance-sheet variables affect financial inclusion, more precisely, the borrowing capacity of individuals. By estimating the importance of this "bank-lending channel," we can determine how key balance sheet variables (such as Tier 1 capital ratios, or liquidity ratios) affect the probability of borrowing by individuals.

As we mentioned before, the literature does not provide conclusive results on the effect of bank capital on lending. In addition, we are not able to disentangle demand-side from supply-side effects, given the limitations of our data. Also, we would expect a certain degree of cyclicality, i.e. that borrowing is affected in a certain way in countries with lower GDP growth and with less capitalized or less liquid financial systems.

Table 9 presents the results of the probit model. Contrary to the probit estimates on competition, the use of country fixed effects significantly changes some of the results. When considering no country fixed effects, column (1) shows that countries that have financial systems with higher capital ratios generate a positive effect on borrowing. Also, a higher liquid asset ratio (LAR) has a positive effect on borrowing in the next period. When we include Tier 1 capital ratios (column 3), we still obtain a positive (and larger) effect of the Tier 1 ratio, but the effect of LAR ratio is inexistent.[9]

Second, we consider interaction effects between GDP growth, Tier 1 and LAR ratios in specifications (4) -(7). In general, we still find a positive and significant effect of Tier 1 and LAR ratios. Also, the effect of GDP growth is positive and significant. This is an intuitive procyclical effect of economic growth on borrowing.

When considering the interaction terms, and consistent with the recent literature that studies cyclicality, we find that higher GDP growth reduces credit more in financial systems with higher liquidity ratios, i.e. more liquid banks are more countercyclical (they lend less). We also find a similar effect of Tier 1 capital, i.e. borrowing decreases in countries with high GDP growth and higher capital ratios so more capitalized banks are more countercyclical. When combining the two interactions for liquidity and capital, only the Tier 1 interaction with GDP is statistically significant. The individual effect of capital is also significant in all cases. The individual effect of the LAR ratio becomes also insignificant in column (7).

In columns (8)-(14), we repeat the same regressions, but included country fixed effects. Some of the results previously found are not present anymore. The effect of capital is less clear and becomes even negative (see column 14), although the positive effect of the liquidity ratio is positive as in the no fixed-effects case. Interaction terms with GDP have insignificant

[9] Higher Tier 1 capital ratios could also have an opposite effect. Tier 1 capital ratios tend to be higher in SSA compared to other regions. Higher capital may reflect a financial system that is highly unstable and therefore buffers are constructed to cover for future loses (Beck, Munzule Maimbo, Faye, & Triki, 2011). In the SSA region, where it is costly for banks to raise capital, high capital ratios could constrain lending like in a "credit crunch" (Bernanke & Lown, 1991).

or opposite effects to the non-fixed effect case. We conclude from these results that the effect of bank balance sheet variables on borrowing by individuals is not undisputed.

Finally, as in the case of accounts, debit and credit cards, we find similar intuitive results regarding the effect of demographic variables on borrowing. In all specifications, older individuals, female individuals, and well-educated individuals (tertiary education or more), are more likely to borrow. Also, poor individuals (poorest 20%) are less likely to borrow.

V. CONCLUSION

In this paper, we study how competition and financial soundness in the financial sector affect financial inclusion in Sub-Saharan Africa. We use detailed individual-level survey data, combined with key country-level indicators of bank competition and financial soundness to study the effect of competition and the strength of several bank balance sheet variables on the adoption of key financial products.

Our results show in general a positive and significant effect of competition on the adoption of various financial products. We do not find clear results when considering the effect of balance sheet variables on borrowing by households. These results may help policy makers in Africa and other regions to be aware of the importance of the several key features of the banking sector that are necessary to promote financial inclusion. This could help design regulations that may have very positive effects on economic growth and long-term economic development.

There are two remarkable forces of change that could potentially increase competition in the sector, with positive effects on financial inclusion. First, new and efficient technologies are being developed to transform the financial sector with new products, processes and providers (i.e. FinTech)[10]. Second, financial markets are increasingly interconnected across the world, and Sub-Saharan Africa is not an exception. Both forces are instrumental in bringing a relatively optimistic outlook regarding future improvements on financial inclusion.

Although mobile payments are very successful in several countries in eastern Africa, we expect that FinTech will progressively cover other financial services like loans and saving accounts, and more granular data is necessary to understand how these services are transforming the industry. Policy makers can take advantage of FinTech and other developments to foster greater competition and increase the rate of financial inclusion. Given the economic, social and political advances that Sub-Saharan Africa has achieved in recent decades, we believe that the financial sector offers large opportunities for growth in the future. The potential to improve financial inclusion is high.

[10] For instance, distributed ledger technologies, mobile payments, virtual currencies, crowdfunding, robo-advice, etc. See Maino, Massara, Perez-Saiz, Sharma, & Sy (forthcoming).

Table 9: Borrowed in the last year and bank-balance sheet variables

	No Country Fixed Effects							*Including Country Fixed Effects*						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
GDP growth	-0.0414***	-0.0764***	-0.0624***	-0.0191	0.232***	-0.0191	0.231***	-0.00397	-0.00774	-0.0599***	-0.0980*	1.445***	-0.0980*	-2.667***
	(0.0136)	(0.0139)	(0.0147)	(0.0271)	(0.0465)	(0.0271)	(0.0478)	(0.0167)	(0.0166)	(0.0169)	(0.0572)	(0.289)	(0.0572)	(0.398)
Tier 1	0.0462***		0.0393***		0.172***		0.190***	0.0135		0.00344		0.771***		-2.321***
	(0.00449)		(0.00508)		(0.0226)		(0.0413)	(0.0103)		(0.0132)		(0.146)		(0.360)
LAR		0.0153***	0.00356	0.0309***		0.0309***	-0.00571		0.00963	0.00394	0.0251*		0.0251*	0.666***
		(0.00198)	(0.00247)	(0.00762)		(0.00762)	(0.0161)		(0.0218)	(0.0137)	(0.0131)		(0.0131)	(0.104)
LAR x GDP growth				-0.00278**		-0.00278**	0.00237				0.00268		0.00268	-0.106***
				(0.00129)		(0.00129)	(0.00333)				(0.00257)		(0.00257)	(0.0165)
Tier 1 x GDP growth					-0.0193***		-0.0246***					-0.0963***		0.331***
					(0.00329)		(0.00738)					(0.0181)		(0.0511)
Respondent age	0.00616***	0.00684***	0.00695***	0.00679***	0.00605***	0.00679***	0.00688***	0.00643***	0.00692***	0.00620***	0.00665***	0.00660***	0.00665***	0.00699***
	(0.000946)	(0.000989)	(0.000993)	(0.000990)	(0.000951)	(0.000990)	(0.001000)	(0.000982)	(0.00102)	(0.00100)	(0.00102)	(0.000978)	(0.00102)	(0.00101)
Female	0.165***	0.158***	0.159***	0.156***	0.161***	0.156***	0.155***	0.161***	0.159***	0.153***	0.156***	0.157***	0.156***	0.158***
	(0.0304)	(0.0310)	(0.0311)	(0.0310)	(0.0305)	(0.0310)	(0.0313)	(0.0310)	(0.0317)	(0.0310)	(0.0318)	(0.0309)	(0.0318)	(0.0316)
Primary education or less	-0.0775	-0.0434	-0.0331	-0.0490	-0.126	-0.0490	-0.0921	-0.259	-0.258	-0.361	-0.352	-0.141	-0.352	-0.125
	(0.358)	(0.358)	(0.359)	(0.358)	(0.358)	(0.358)	(0.359)	(0.318)	(0.315)	(0.284)	(0.289)	(0.362)	(0.289)	(0.362)
Secondary education	0.342	0.379	0.384	0.373	0.292	0.373	0.322	0.153	0.148	0.0385	0.0420	0.280	0.0420	0.288
	(0.358)	(0.359)	(0.359)	(0.359)	(0.359)	(0.359)	(0.359)	(0.319)	(0.315)	(0.285)	(0.290)	(0.362)	(0.290)	(0.362)
Tertiary education or more	0.805**	0.862**	0.844**	0.863**	0.759**	0.863**	0.785**	0.652**	0.638**	0.541*	0.531*	0.781**	0.531*	0.779**
	(0.361)	(0.361)	(0.362)	(0.361)	(0.361)	(0.361)	(0.362)	(0.322)	(0.318)	(0.288)	(0.293)	(0.364)	(0.293)	(0.365)
Poorest 20%	-0.551***	-0.538***	-0.545***	-0.539***	-0.560***	-0.539***	-0.554***	-0.564***	-0.562***	-0.566***	-0.564***	-0.562***	-0.564***	-0.558***
	(0.0559)	(0.0567)	(0.0569)	(0.0567)	(0.0559)	(0.0567)	(0.0570)	(0.0570)	(0.0580)	(0.0565)	(0.0582)	(0.0567)	(0.0582)	(0.0577)
Second 20%	-0.336***	-0.328***	-0.338***	-0.330***	-0.345***	-0.330***	-0.347***	-0.356***	-0.365***	-0.368***	-0.365***	-0.354***	-0.365***	-0.360***
	(0.0483)	(0.0493)	(0.0494)	(0.0493)	(0.0483)	(0.0493)	(0.0494)	(0.0490)	(0.0500)	(0.0488)	(0.0500)	(0.0488)	(0.0500)	(0.0497)
Middle 20%	-0.242***	-0.233***	-0.240***	-0.235***	-0.252***	-0.235***	-0.252***	-0.249***	-0.252***	-0.254***	-0.251***	-0.248***	-0.251***	-0.247***
	(0.0443)	(0.0452)	(0.0454)	(0.0451)	(0.0443)	(0.0451)	(0.0454)	(0.0451)	(0.0461)	(0.0451)	(0.0462)	(0.0449)	(0.0462)	(0.0459)
Fourth 20%	-0.231***	-0.226***	-0.232***	-0.227***	-0.236***	-0.227***	-0.236***	-0.234***	-0.239***	-0.240***	-0.240***	-0.233***	-0.240***	-0.235***
	(0.0409)	(0.0417)	(0.0419)	(0.0417)	(0.0410)	(0.0417)	(0.0420)	(0.0416)	(0.0426)	(0.0417)	(0.0427)	(0.0415)	(0.0427)	(0.0424)
Observations	14,962	13,964	13,964	13,964	14,962	13,964	13,964	14,962	13,964	13,964	13,964	14,962	13,964	13,964
Other country variables	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Country FE	NO	NO	NO	NO	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES

Robust standard errors in parentheses (*** p<0.01, ** p<0.05, * p<0.1)

Notes: Probit regressions bank balance sheet.

VI. REFERENCES

Admati, A. R., DeMarzo, P. M., Hellwig, M. F., & Pfleiderer, P. C. (2011). Fallacies, Irrelevant Facts, and Myths in the Discussion of Capital Regulation: Why Bank Equity is not Socially Expensive. *Stanford GSB Research Paper No. 2063*.

Ahokpossi, C., Ismail, K., Karmakar, S., & Koulet-Vickot, M. (2013). Financial Depth in the WAEMU: Benchmarking Against Frontier SSA Countries. *IMF Working Paper*.

Allen, F., Carletti, E., Cull, R., Qian, J., Senbet, L. W., & Valenzuela, P. (2013). Resolving the African Financial Development Gap: Cross-Country Comparisons and a Within-Country Study of Kenya. *NBER Working Paper No 18013.*

Allen, F., Demirguc-Kunt, A., Klapper, L. F., & Peria, M. S. (2016). The Foundations of Financial Inclusion: Understanding Ownership and Use of Formal Accounts. *Journal of Financial Intermediation, 27*(27), 1-30.

Baumol, W. J., Panzar, J. C., & Willig, R. D. (1988). *Contestable Markets and the Theory of Industry Structure.* New York: Harcourt Brace Jovanovich.

Beck, T., & Cull, R. (2014). Banking in Africa. In *The Oxford Handbook of Banking, Second Edition.*

Beck, T., Munzule Maimbo, S., Faye, I., & Triki, T. (2011). *Financing Africa: Through the crisis and beyond.* World Bank.

Bernanke, B. S. (2007). The Financial Accelerator and the Credit Channel. *Presented at the Atlanta Federal Reserve Bank conference on the The Credit Channel of Monetary Policy in the 21st Century, Atlanta, GA.*

Bernanke, B. S., & Blinder, A. S. (1988). Credit, Money, and Aggregate Demand. *American Economic Review, 78*(2), 435-39.

Bernanke, B. S., & Gertler, M. (1987). Banking and Macroeconomic Equilibrium. In W. A. Barnett, & K. J. Singleton, *New Approaches to Monetary Economics: Proceedings of the Second International Symposium in Economic Theory and Econometrics* (pp. 89-111).

Bernanke, B. S., & Gertler, M. (1995). Inside the Black Box: The Credit Channel of Monetary Policy Transmission. *Journal of Economic Perspectives*, 27-48.

Bernanke, B. S., & Lown, C. S. (1991). *The Credit Crunch.* Brookings Papers on Economic Activity.

Berrospide, J. M., & Edge, R. M. (2010). The Effects of Bank Capital on Lending: What Do We Know, and What Does It Mean? *International Journal of Central Banking*.

Bikker, J. A., & Haaf, K. (2002). Competition, Concentration and Their Relationship. *Journal of Banking and Finance, 26*, 2191-2214.

Boone, J. (2008). A New Way to Measure Competition. *The Economic Journal, 118*(531), 1245-1261.

Bridges, J., Gregory, D., Nielsen, M., Pezzini, S., Radia, A., & Spaltro, M. (2014). The Impact of Capital Requirements on Bank Lending. *Bank of England Working paper No. 486*.

Brun, M., Fraisse, H., & Thesmar, D. (2017). The Real Effects of Bank Capital Requirements. *ESRB Working Paper*.

Claessens, S., & Laeven, L. (2004). What Drives Bank Competition? Some International Evidence. *Journal of Money, Credit, and Banking, 36*, 563-583.

Cornett, M. M., McNutt, J. J., Strahan, P. E., & Tehranian, H. (2011). Liquidity Risk Management and Credit Supply in the Financial Crisis. *Journal of Financial Economics*, 297-312.

Degryse, H., Morales Acevedo, A., & Ongena, S. (2014). Competition in Banking. In A. N. Berger, P. Molyneux, & J. O. Wilson, *The Oxford Handbook of Banking, Second Edition.*

Delechat, C., Newiak, M., Xu, R., Yang, F., & Aslan, G. (2018). What is driving women's financial inclusion across countries? *IMF Working Paper 18/38*.

Demirguc-Kunt, A., & Klapper, L. F. (2013). Measuring Financial Inclusion: Explaining Variation in Use of Financial Services across and within Countries. *Brookings Papers on Economic Activity*.

Demirguc-Kunt, A., Klapper, L., & Singer, D. (2017). Financial Inclusion and Inclusive Growth: A Review of Recent Empirical Evidence. *World Bank Policy Researcvh Working Paper*.

Gambacorta, L., & Marques-Ibanez, D. (2011, Economic Policy 2011). The Bank Lending Channel: Lessons from the Crisis. *Economic Policy, 26*(66), 135-182.

Gropp, R., Mosk, T., Ongena, S., & Wix, C. (2016). Banks Response to Higher Capital Requirements: Evidence from a Quasi-Natural Experiment. *The Review of Financial Studies*.

Hanson, S. G., Kashyap, A. K., & Stein, J. C. (2011). A Macroprudential Approach to Financial Regulation. *Journal of economic Perspectives 25, no. 1*, 3-28.

Jiménez, G., Ongena, S., Peydró, J. L., & Saurina, J. (2012). Credit Supply and Monetary Policy : Identifying the Bank Balance-Sheet Channel with Loan Applications. *The American Economic Review, 102*(5), 2301-2326.

Jimenez, G., Ongena, S., Peydro, J., & Saurina, J. (2014). Hazardous Times for Monetary Policy: What Do Twenty-Three Million Bank Loans Say About the Effects of Monetary Policy on Credit Risk-Taking? *Econometrica, 82*(2), 463-505.

Kapan, T., & Minoiu, C. (2013). Balance Sheet Strength and Bank Lending during the Global Financial Crisis. *IMF Working Paper 13-102*.

Karlan, D. S., & Morduch, J. (2009). Access to Finance. *Handbook of Development Economics, 5*, 4703-4784.

Kashyap, A. K., & Stein, J. C. (2000). What Do a Million Observations on Banks Say about the Transmission of Monetary Policy. *The American Economic Review, 90*(3), 407-428.

Khwaja, A., & Mian, A. (2008). Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market. *American Economic Review*, 1413-42.

King, R. G., & Levine, R. (1993). Finance and Growth: Schumpeter Might Be Right. *Quarterly Journal of Economics, 108*(3), 717-737.

Levine, R. (2005). Finance and Growth: Theory and Evidence. In *Handbook of Economic Growth* (Chapter 12).

Love, I., & Peria, M. S. (2012). How Bank Competition Affects Firms' Access to Finance. *World Bank Economic Review, 29*(3), 413-448.

Maino, R., Massara, A., Perez-Saiz, H., Sharma, P., & Sy, A. (forthcoming). FinTech in Sub-Saharan African Countries: A Game Changer. *IMF Working Paper*.

Mecagni, M., Marchettini, D., & Maino, R. (2015). Evolving Banking Trends in Sub-Saharan Africa. *African Department Working Paper, International Monetary Fund*.

Michelangeli, V., & Sette, E. (2016). "How Does Bank Capital Affect the Supply of Mortgages? Evidence from a randomized experiment. *BIS Working Papers No 557*.

Mlachila, D., & Moheeput, A. (2014). Does Openness Matter for Financial Development in Africa? *IMF WP 14/94*.

Panzar, J. C., & Rosse, J. N. (1987). Testing for Monopoly Equilibrium. *Journal of Industrial Economics, 35*(4), 443-456.

Shaffer, S. (1993). A Test of Competition in Canadian Banking. *Journal of Money, Credit and Banking, 25*(1), 49-61.

Tirole, J. (1988). *The Theory of Industrial Organization.* MIT Press.

Vives, X. (2011). Competition policy in banking. *Oxford Review of Economic Policy, 27*(3), 479-497.

Vives, X. (2016). *Competition and Stability in Banking.* Princeton University Press.

Yontcheva, B., & Alter, A. (2016). Financial Inclusion and Development in the CEMAC. *IMF Working Paper 15/235*.