Credit risk and bank competition in Sub-Saharan Africa

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Abstract

This paper investigates the impact of bank competition in Sub-Saharan Africa on bank non-performing loans, a measure of credit risk. Using bank-level data for a sample of 221 banks from 33 countries over the period 2000-2015, we find a non-linear or U-shaped relationship between bank competition (measured by the Lerner Index) and credit risk. In other words, increased bank competition has the potential to lower credit risk via efficiency gains (lower credit cost, operational gains, etc.). However, the positive effects may be outweighed by adverse effects of excessive competition. We also find that credit risk in Sub-Saharan Africa is not only related to macroeconomic determinants, such as growth, public debt, financial deepening and economic structure, but also to the regulatory environment. These results may provide useful insights on how to design and adapt prudential and regulatory frameworks to the specific needs in developing countries.

Keywords: Bank competition, Credit risk, Bank stability, Lerner index, Africa

JEL classification: G21, G28, D4, O55

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Introduction

Banking sectors in Sub Saharan Africa have been growing rapidly in the last two decades in the wake of the super-cycle of commodity prices and high growth on the continent. Regional or pan African bank conglomerates have emerged, translating into higher, albeit still limited, financial integration .The importance of financial stability issues have grown accordingly, notably during the Nigerian banking sector crisis of 2009-2010. Whereas attention to this issue has increased tremendously in developed countries affected by the 2008 financial crisis, few empirical studies have focused on Sub Saharan Africa (SSA) so far. With credit risk rising since 2014 as a result of the fall of commodity prices and the ensuing sub African economic slowdown, analyzing the determinants of credit risk seems both relevant and timely.

A growing strand of theoretical and empirical research highlights the importance of financial deepening and inclusion to spur economic growth in Sub-Saharan African countries (Chauvet and Jacolin, 2017; Leon, 2015a; Ncube, 2007). In such countries characterized by high levels of economic growth, at least since the super-cycle of commodity prices, the reliance on banking sectors to ensure adequate financing for growth is essential, but at the same time there exist high risks of macroeconomic instability spurred by external exogenous shocks. In this context, the linkages between growing competition in SSA banking sectors and credit risk have become salient: even if they have remained in SSA countries with weak and isolated financial systems (Marchettini and Maino, 2015), banking crises arising from credit booms may become an increasing source of concern for regulatory and supervisory authorities, to the extent that the interactions between credit and economic cycles become stronger, similar to the trends observed in the advanced economies.

However, the relationship between bank competition and credit risk is less than straightforward. Bank competition may spur efficiency gains (lower credit costs, improved operational and risk management practices, better allocation of capital, economies of scale), and thus contribute to higher potential growth and translate into healthier bank credit portfolios, i.e. lower ratios of non-performing loans. However, it may also encourage additional risk taking by financial intermediaries, making banks more fragile or instable in the face of economic fluctuations, notably through a deterioration of the quality of their credit books.[2] To shed light to the bank competition/credit risk nexus, a large body of theoretical and empirical literature produced mixed conclusions (Keeley, 1990; Boyd and De Nicolo, 2005; Martinez-Mierra and Repullo, 2010; Salas and Saurina, 2003; Fungacova and Weil, 2013; Beck et al., 2006; Jimenez et al., 2013).

In addition to its focus on Sub Saharan Africa, the main contribution of our research is to provide new empirical insight on how bank competition affects credit risk in SSA countries,

[2] As Brock and Rojaz Suarez (2000) argue in the case of the Latin American experience, regulators overly permissive attitude towards the entry of new banks can pose a threat to financial system stability, especially, when many or large entrants compete aggressively with the existing banks for costumers by lowering loan rates and increasing deposit rates to levels that are unsustainable.

controlling for macroeconomic determinants, bank-specific (structural and operational) indicators, and regulatoryenvironments. Our study also seeks to contribute to the ongoing discussion about whether and to what extent regulatory and policy design should be adapted to developing countries-specific determinants of credit risk.

Using data on the financial statements of 221 commercial banks (of which 140 are foreign-owned) from 33 countries in SSA over the high economic growth period of 2000–2015, we find that the relationship between non-performing loans and bank competition, as measured by market power, is non-linear and U-shaped, suggesting that beyond a certain threshold the efficiency gains of more bank competition may be outweighed by financial instability effects. Our study also highlights the expected positive effect on credit risk of macroeconomic variables, such as growth, financial deepening and economic structure, as well as bank portfolio choices or regulatory environment. Finally, we show that public indebtedness may have an impact on bank credit risk in these countries, where public authorities make up a significant portion of the formal economy.

The remainder of the paper proceeds as follows. Section 2 provides a brief review of the related literature. Section 3 discusses and reports summary statistics for the sample data. Section 4 describes the empirical model for credit risk. The section also discusses the definitions and the measurements of the variables selected in parameterizing the empirical model. The empirical results are reported in Section 5, and Section 6 discusses the robustness checks of the results. The final section concludes.

Literature review on bank competition and stability

The existing literature on the relationship between bank competition and bank stability is based on two opposite views: (i) the competition-fragility (or franchise value) paradigm and (ii) the competition-stability paradigm. The first paradigm stresses the view that a higher degree of competition increases the incentives of banks to take on risks. The argument behind this is that higher competition tends to be associated with lower expected bank returns and thus lower franchise values. Other things being equal, this encourages banks to engage in activities with higher expected returns, which typically involve higher risks (Marcus, 1984; Keeley, 1990). Franchise values are affected because more competition reduces oligopoly rents in the form of interest margins, which may also serve as cushions against unexpected shocks (Boyd et al., 2004; Allen et al., 2004) and make banks more resilient to external macroeconomic and liquidity shocks. The concentration of banking systems may also mitigate problems associated with information asymmetries through repeated interaction and the centralization of information, thus reducing the risk of loan defaults (Hauswald and Marquez, 2006). Opposed to the competition-fragility view, Boyd and De Nicolo (2005) argue that more competitive banking markets are associated with lower risks. The argument is based on the view that loan rates are lower in more competitive markets, which increases the net present value of investment projects and decreases the default probability of borrowers.

Martinez-Miera and Repullo (2010) combine both views and develop a theoretical model that predicts a non-linear relationship between bank competition (measured by the number of banks) and stability. On the one hand, their model implies that more competition leads to lower loan rates, lower borrower default probabilities, and thus to sounder loan books (risk-shifting effect). On the other hand, however, lower interest payments from performing loans reduce their ability to act as buffers to cover loan losses (margin effect) with adverse effects on bank stability. The model predicts a U-shaped relationship between competition and bank risk depending on which the two forces dominates. In very concentrated markets, the risk-shifting effect dominates and more competition reduces the risk of bank failure. As competition grows, the margin effect dominates, and the erosion of banks' franchise values translates into lower bank stability.

The empirical literature on the relationship between competition and credit risk (defined as the rate of non-performing loans) has produced mixed conclusions. Keeley (1990) shows that the relaxation of state branching restrictions in the 1980s increased competition, and induced large bank holding companies in the United States to increase their risk taking.[3] Using a sample of Spanish banks, Salas and Saurina (2003) provide evidence for a risk-reducing effect of bank competition. Agoraki et al. (2011) finds that banks with higher market power take on lower risks and have lower default probabilities. Fungacova and Weil (2013) use a sample of Russian banks and find evidence supporting that tighter bank competition enhances the occurrence of bank failures. Jayaratne and Strahan (1998) highlight that the increase in competition due to deregulation policies has been associated with lower loan losses. Schaeck and Cihak (2014) provide evidence that competition has increased bank efficiency and contributed to bank soundness in the American and European banking sectors. Using data from the Central and Eastern European banking systems, Craig and Dinger (2013) find that competition in the deposit markets leads to more conservative risk strategies by banks. Kasman and Kasman (2015) focus on the Turkish banking market and find that higher competition has been associated with less the non-performing loans.

Studies focusing on the competition and credit risk relationship for developing countries are scarce with some notable exceptions. For instance, Beck et al. (2006) find that financial crises are less likely in economies with more concentrated banking sectors for a sample of 69 developed and developing countries. Turk Ariss (2010) investigates how different degrees of market power affect bank efficiency and stability and finds that increased competition may undermine bank stability. Beck et al. (2013a) focus on the cross-country variation in the relationship between bank competition and stability and provide evidence that these variations depend on bank market characteristics, as well as regulatory and institutional framework.[4] Their results suggest that an increase in competition has a larger impact on banks' risk taking incentives in countries with stricter activity restrictions, more homogenous market structures, more generous deposit insurance and more effective systems of credit information sharing.

[3] Also see Edwards and Mishkin, 1995; Galloway et al., 1997, etc.

[4] Also see Yeyati and Micco (2007), Fu et al. (2014), Clerides et al. (2015), Tabak (2012), etc.

Other empirical studies have tested for the presence of a nonlinear relationship between competition and credit risks. First, Berger et al. (2009) support the view of a nonlinear relationship using bank-level data of 23 developed countries. Their results suggest that banks with a higher degree of market power also have less overall risk exposure, while at the same time as market power increases loan portfolio risks increase. Using data from the Spanish banking system, Jimenez et al. (2013) find a nonlinear relationship between market power and bank risk-taking after controlling for macroeconomic conditions and bank characteristics.

Other determinants of credit risk

Many studies focus on the impact of macroeconomic environment and bank characteristics on credit risk (or non-performing loans). The theoretical literature highlights the business cycle itself as a systematic factor influencing bank loss rates (Carey, 1998; Ruckes, 2004). A strand of empirical studies[5] have established a negative relationship between non-performing loans and economic growth in advanced economies, along with unemployment (Nkusu, 2011, Castro, 2013) or the level of interest rates (Jakubik, 2007).

Other research has emphasized the role of bank-specific balance sheet and profitability characteristics to explain non-performing loans. For instance, Salas and Saurina (2002) find that credit risk in Spain is explained not only by GDP growth rate but also by bank size, inefficiency, net interest margin and other bank specific variables (like Quagliarielli, 2007 in the Italian case). Louzis et al. (2012) conclude that Greek bank's risk portfolio can be explained by macroeconomic fundamentals (GDP, unemployment, interest rates and public debt) and management quality. Using data from 16 Central, Eastern and South-Eastern Europe (CESEE) countries over the period 1998-2011, Klein (2013) find that both bank-specific as well as macroeconomic (GDP, inflation) factors influence credit risk. In addition to macroeconomic factors (inflation, public debt), Ghosh (2015) use data from 50 American commercial and savings banks, and documents that bank-level variables (capitalization, cost efficiency, size, etc.) influence non-performing loans significantly.

In addition, studies focusing on developing countries have also highlighted their vulnerability to external macroeconomic factors. Using data from 16 Sub-Saharan African countries, Fofack (2005) finds evidence that non-performing loans are largely driven by macroeconomic volatility, reflecting the driving influence of external shocks and the impact of insufficient economic diversification. In this study, he highlights that the real interest rate, real exchange rate, economic growth, net interest margin and interbank loans are significant determinants of non-performing loans. Love and Turk Ariss (2014) use a panel of Egyptian banks over 1993-2010, and argue that positive shock to capital inflows and GDP growth improve bank's loan quality. For four African countries (Kenya, Uganda, Zambia and Nigeria) over the period 1985-1994, Brownbridge (1998) finds that a major determinant is insider

[5] See review in Beck et al. (2015) and also see Skarica (2014), Zhang et al. (2016).

lending which itself depends on the concentration of ownership, political pressure and the degree of capitalization. For a sample of 46 banks from 12 countries in the Middle East and North Africa (MENA) region, over the period 2002-2006, Boudriga et al. (2009) finds that foreign participation, coming especially from developed countries, credit growth, loan loss provisions and the institutional environment have a significant impact on the level of non-performing loans. For sample of 35 banks from the 6 countries of the Central African Economic and Monetary Community over the period 2001-2010., Fouopi Djiogap and Ngomsi (2012) finds a significant negative relationship between the capital adequacy ratio and non-performing loans.

Other research also addressed the relationship between regulatory framework and credit risk (Barth et al., 2004; Fernandez and Gonzalez, 2005; Chen et al., 2017; Triki et al., 2017). For instance, Barth et al. (2004) show that private monitoring reduces the level of non-performing loans and cost of intermediation. More recently, Agénor (2016) highlights theoretically that macroprudential indicators (such as reserve requirement) may reduce the supply of loanable funds of banks, hence private investment and economic growth.

Studies focusing on non-performing loans, bank competition and determinants of credit risk in developing countries have remained scarce. In countries with lower levels of financial deepening and inclusion, such studies are difficult to conduct due to market deficiencies, data limitations, most notably to calculate usual indicators of instability (such as the Z-score). At the same time, in the context of high African growth since the super-cycle of commodity prices, competition has increased and one has witnessed gradual financial deepening of African bank markets, along with regional financial integration. Our study seeks to add to the current string of research by using non-performing loans as an indicator of bank portfolio quality hence stability, and by shedding light on determinants of non-performing loans in the case of sub Saharan African countries.

Data description

We obtain bank-level data on financial statements from Fitch Connect over the period 2000-2015. Our initial sample covers 526 financial institutions located in 37 Sub-Saharan Africa countries. Where possible, we gather consolidated financial statements of banks making the assumptions that banks manage the entire set of assets on a consolidated basis. If no consolidated statement exists, we use the unconsolidated financial statements. Our study focuses on the credit risk of deposit-taking institutions and as consequence, we exclude non-deposit-taking institutions (consumer and micro finance companies, multilateral and development banks, general insurance, investment banks, real estate and trust companies) from the sample[6]. Further, we eliminate banks and countries from the study for which we

[6] We cross-referenced the list of financial institutions obtained from Fitch Connect with the registry of licensed banking entities reported on the websites of the various central banks in the region in order to distinguish between deposit-taking entities from the other types of financial firms.

were unable to obtain relevant information to compute non-performing loans[7] or the macroeconomic and the regulatory variables to parameterise the empirical model. After applying our filters, our final sample covers 221 deposits-taking institutions entities from 33[8] Sub-Saharan African countries. Of the 221 banks, 81 are domestically owned (17 are public banks) and 140 are subsidiaries of foreign banks (86 are banks from African countries, 48 from advanced economies and 6 from emerging countries)

Table 1 reports the list and the summary information for the countries in our sample. As can be seen, total assets for our sample of banks amounted to 310 billion USD at the end of 2015, corresponding to an average of 21.5 percent of GDP. The lowest asset-to-GDP ratio are observed in Gabon, Equatorial Guinea, Chad and Democratic Republic of the Congo (below 5%), whereas bank Cape Verde and Kenya amounted to more than 65% of GDP. At the end of 2015, total assets of the 221 banks represented, on average, 72% of total assets to the entire Sub-Saharan African banking system[9]. Therefore, our sample is a good representation of the Sub-Saharan African banking sector.

A much larger fraction of loans in the SSA countries has become non-performing than compared to the advanced economies (see Figure 1). More specifically, the median of banks' non-performing loan ratio declined from 10 to 5% of loans during 2000-2008, picking slight upwards thereafter. The peak observed in 2010 is to some extent explained by the Nigerian oil crisis of 2009. Indeed, it subsequently turned into banking crisis due to the high concentration banks' portfolio on this sector.

Econometric framework

Our econometric model takes the form of a dynamic panel regression. The baseline model is specified as follows:

$$NPL_{ijt} = \alpha_0 + \alpha_i + \alpha_1 NPL_{ijt-1} + \varphi_1 Lerner_{ijt} + \beta X_{ijt} + \gamma M_{jt} + \delta O_{jt} + \varepsilon_{ijt} \quad (1)$$

where NPL_{ijt} denotes the non-performing loans of bank i located in country j in year t, $Lerner_{ijt}$ represents the bank competition indicator, X_{ijt} is a vector of bank-specific characteristics, M_{jt} and O_{jt} denote the vectors of macroeconomic and other (structural and institutional) control variables. We also include bank fixed-effects α_i to account for time-invariant and unobserved differences in the loan quality across banks. The model is estimated in dynamic form by including a lagged value of non-performing loans to capture the persistence of credit risk over time.

[7] We eliminated all banks with less than 5 observations over the period, which is mainly the case for small banking institutions.

[8] Republic of Congo, Guinea-Bissau, The Gambia and Seychelles were excluded from the sample due to the poor data quality. In addition, in order to focus on developing countries, we do not include South Africa in our sample.

[9] At the end of 2015, the total assets of the entire banking sector amounted to 429 billion USD (Banque de France).

The non-performing loan ratio is measured by impaired loans as a proportion of total loans. The vector X_{ijt} includes a set of bank-specific indicators of non-performing loans that highlighted in the empirical literature as important drivers of credit risk, notably the net interest margins (net interest income divided by total assets), the loan-to-assets ratio, income diversification (non-interest income divided by total assets), operating cost (non-interest expenses divided by total assets), and bank size (logarithm of total assets). We instrument the bank-specific characteristics by their lagged values in order to mitigate any possible endogeneity problem, we may have in our model specification.

To capture a possible non-linear relationship between bank competition and loan quality, we augment our baseline model with a quadratic term for the competition measure. The augmented model is thus specified as follows:

$$NPL_{ijt} = \alpha_0 + \alpha_i + \alpha_1 NPL_{ijt-1} + \varphi_1 Lerner_{ijt} + \varphi_2 Lerner_{ijt}^2 + \beta X_{ijt} + \gamma M_{jt} + \delta O_{jt} + \varepsilon_{ijt} \quad (2)$$

The relationship between credit risk and bank competition can be hereby summarized as follows:

$$\frac{\partial NPL_{ijt}}{\partial Lerner_{ijt}} = \varphi_1 + 2\varphi_2 \cdot Lerner_{ijt} \quad (3)$$

For example, if we find that $\varphi_1 < 0$ and $\varphi_2 > 0$, there would be evidence of a U-shaped relationship between credit risk and bank competition. In such a case, at lower levels, increased competition would be associated with lower credit risks. However, once a certain threshold of competition is reached, heightened competition would lead to higher credit risks.

Bank competition indicator

We decided to measure bank competition by the Lerner index which is an indicator of market power[10]. It is based on the idea that banks in less competitive markets are able to extract higher monopoly rents compared to banks that operate in more competitive banking environments. Formally, the Lerner index measures the mark-up of price over a bank's marginal cost:

$$Lerner_{it} = \frac{P_{it} - MC_{it}}{P_{it}}, \quad (4)$$

where P_{it} is the price of the banking output of bank i at time t, and MC_{it} the marginal cost of bank i at time t. The price of banking output is measured by the ratio of total bank-revenues (gross dividend and interest income plus total non-interest operating income) to total assets.

[10] For a review of different competition measures, see Leon (2015b). Among the 31 studies reported by Zigraiova and Havranek (2016) on the competition-stability nexus, 36% have used the Lerner index as an indicator for bank competition.

Koetter et al. (2012) argue that the conventional approach of computing the Lerner index implicitly fails to consider the possibility that banks may choose not to exploit pricing opportunities resulting from market power. It also assumes both profit and cost efficiencies. Consequently, if banks do not set their prices optimally and do not make optimal choices regarding their inputs, the conventional Lerner index does not measure correctly the true market power. In order to capture such effects, the authors suggest an adjustment in form of the efficiency-adjusted Lerner index[11]:

$$Adjusted\ Lerner_{it} = \frac{\pi_{it} + TC_{it} - MC_{it} * Q_{it}}{\pi_{it} + TC_{it}}, \quad (5)$$

where π_{it} is the pre-tax profit of bank i at time t, TC_{it} is the total cost, and Q_{it} is the total output. Similar to the conventional Lerner index, the adjusted Lerner index ranges from zero (perfect competition) to one (monopoly).

Marginal costs are calculated via the estimation of the following trans-log cost function:

$$\ln(TC_{it}) = \alpha_0 + \alpha_1 \ln(Q_{it}) + \frac{1}{2}\alpha_2 \ln(Q_{it})^2 + \sum_{n=1}^{3} \beta_n \ln(w_{int}) + \sum_{m=1}^{3}\sum_{n=1}^{3} \beta_{mn} \ln(w_{imt} w_{int}) + \sum_{n=1}^{3} \gamma_n \ln(Q_{int}) \ln(w_{int}) + \delta_1 T + \frac{\delta_2}{2} T^2 + \delta_3 T ln(Q_{it}) + \sum_{k=1}^{3} \varphi_k T ln(w_{ikt}) + \varepsilon_{it}, \quad (6)$$

Total costs TC_{it} are measured by the sum of personnel expenses, other non-interest and interest expenses, output Q_{it} by total assets, and w_{int} are three input prices (i.e., for labor, capital and funding). The price of labor is hereby measured by the ratio of personnel expenses to total assets, the price of physical capital by the ratio of other non-interest expenses to fixed assets, and the price for borrowed funds is measured by the ratio of interest expenses to total deposits and money market funding. We also include a quadratic time trend (T) to control for unobserved determinants of total costs that are common to all banks over the time (such as technical progress).

We further apply the following restrictions of standard symmetry and homogeneity in the first degree of:

$$\sum_{n=1}^{3} \beta_n = 1, \sum_{n=1}^{3} \gamma_n = 0 \ and \ \forall\, m, n \in \{1,3\}: \sum_{m=1}^{3}\sum_{n=1}^{3} \beta_{mn} = 0. \quad (7)$$

Under these conditions, the estimated coefficients of the total cost function are applied to compute marginal cost:

$$MC_{it} = \frac{TC_{it}}{Q_{it}} (\alpha_1 + \alpha_2 \ln(Q_{it}) + \sum_{n=1}^{3} \gamma_n \ln(w_{int}) + \delta_3 T). \quad (8)$$

We measure the net interest margin (NIM) as the ratio of gross interest and dividend income minus total interest expenses to total assets. We expect the bank interest margins be positively related with non-performing loans, because a high level of NIM may point to the fact that a bank charges high interest rates due to a risky credit portfolio and/or it anticipates significant losses (Angbazo, 1997; Maudos and Fernandez De Guevara, 2004; Carbo and Rodriguez, 2007).

[11] This Lerner index specification is also used by Clerides et al. (2015), Kasman and Kasman (2015) and Lapteacru (2017).

Loans growth is considered one of the most important determinants of loan losses (Podpiera and Weil, 2008, Jimenez and Saurina, 2006). Rapid credit growth is not problematic in itself, especially in African countries where financial development is low and economic development may go hand in hand with dynamic bank credit, along with high financing. But such expansion is usually associated with a reduction of credit screening and monitoring quality, that subsequently increases the probability of loan defaults. We expect credit growth to positively affect credit risk. We measure this by the loans-to-assets ratio, similar to Ghosh (2015) and Klein (2013).

Income diversification is measured by non-interest income as a proportion of total assets. The sign of the relationship between non-performing loans and bank diversification is not clear. Whereas Ghosh (2015) and Louzis et al. (2012) document that more diversification reduces risk and improves loan quality. Lepetit et al. (2008) point out that banks may also neglect screening and monitoring of borrowers when focusing on non-banking activities[12].

Capitalization is measured by total equity as a proportion of total assets, much like Louizis et al. (2012), Klein (2013), and Zhang et al. (2016). We expect a negative relationship between bank capitalization and credit risk because higher level of equity ratio reflect that the bank is relatively safer and will have lower non-performing loans.

Bank size, measured in our study by the natural logarithm of total assets is considered as an important determinant of non-performing. Salas and Saurina (2002) show that larger banks with more credit diversification opportunities can decrease the level of bad loans. Hu et al. (2004) argue that larger banks are in a better position to assess loan quality better due to superior access to resources and economies of scale in information processing. The "too big to fail" hypothesis, on the other hand, highlights that larger banks may take more risks due to their implicit bail-out guarantee (Louzis et al., 2012), and they hence may operate with higher non-performing loan ratios. However, the relationship between bank size and loan quality can be positive or negative.

In addition to the bank-specific variables, macroeconomic factors are likely influence non-performing loans. Following the current literature, we include real GDP growth to capture business cycle conditions and expect a negative relationship between economic activity and non-performing loans (Castro, 2013; Louzis et al., 2012, Salas and Saurina, 2002). The impact of inflation is ambiguous (Klein, 2013), as higher inflation reduces the real value of loans and can make debt servicing easier but also reduces the real income of borrowers, hence their ability to service debt. We also include public debt as a share of GDP (Louzis et al., 2012). Public debt may positively affect non-performing loans both through expenditure (wage bill, investment) or revenue effects to soften fiscal deficits. (Perotti, 1996). In Sub-Saharan African economies where a high share of public receipts may depend on commodity prices fluctuations, and we expect a feedback loop between public revenue, spending and public

[12] Also see Wagner (2010)

debt on the one hand and defaults of both households and firms (through the accumulation or arrears for instance) on the other. We also include domestic credit to private sector (% of GDP) as a measure of financial development. As suggested Honohan and Beck (2007) small financial systems are usually associated with inefficiencies in financial intermediation (poor regulatory quality and rule of law, higher fixed costs, etc.). Therefore, we expect a negative relationship between financial development and credit risk.

We control for both economic structure and institutional environment. Following Fofack (2005), we include a measure of economic concentration[13] to capture macroeconomic volatility and external shocks to which weakly diversified economies are subjected. We expect a positive link between economic concentration and credit risk. Finally, following the literature on "law and finance" (La Porta et al., 1998), we include in our model the quality of institutions by using an indicator on regulatory quality, which captures the ability of government to promote private sector development (Kaufmann et al., 2011).

Results

We estimate four separate models for non-performing loans. The first includes the simple term of the adjusted Lerner index, the second its square to capture a possible non-linear relationship between bank competition and credit risk, and the third one includes on top macroeconomic variables. Our final fourth one incorporates all four sets of determinants: bank competition, bank-specific variables, macroeconomic /institutional indicators. The summary statistics for the regression variables are shown in Table 3, and the regression results are reported in Table 4.

In all of our models, the lagged dependent variable is significant (1 % level), confirming the persistence of credit risk over time and our dynamic specification. This is not surprising to the extent that non-performing loans remain on the balance sheet for a certain time before they are written off. The Hansen test also validates the instrument used in all model specifications since we cannot reject the null hypothesis that the instruments can be considered exogenous.

In the linear specification I (Table 4), higher bank competition (i.e. lower Lerner index) is associated with better loan quality, giving support to the competition-stability view. In specifications II, III and IV, the coefficient of bank competition indicator is negative for the linear term but positive for the quadratic term and both coefficients are statistically significant (1 % level). This implies a significant non-linear relationship between credit risk and bank competition in Sub-Saharan Africa. As in Martinez-Miera and Repullo (2010), the results suggest that the reduction in the cost of credit brought about by more competition reduces borrowing costs and hence the share of non-performing loans. However, as

[13] Economic concentration index is a measure of the degree of product concentration provided by UNCTAD. An index value closer to 1 indicates a country's exports or imports are highly concentrated on a few products. On the contrary, values closer to 0 reflect exports or imports are more homogeneously distributed among a series of products.

competition further increases, the loss of revenue stemming from price competition across banks affects their ability to establish sufficient buffers to cover loan losses and thus decreases bank stability (Liu et al., 2013). In specification IV, the inflection point is 0.28(compared to an average of 0.23, see Table 3), suggesting that bank competition is desirable to reap the benefits from efficiency gains only up to a certain point. However, beyond that point more competition results in an increase of credit risks (Figure 3).

All our bank-specific control variables are not significant, except the loans-to-assets ratio.

The coefficient of real GDP growth is negative as expected, confirming the impact of the business cycle on loan quality. Government debt is positively related to the non-performing loans, suggesting a feedback loop between the fiscal stance of public sector and credit risk. Financial development is negatively related to credit risk. Economic concentration positively affects non-performing loans.

Following Chen et al. (2017) who demonstrate that foreign banks take more risk than their domestic competitors, we investigate the impact of capital ownership on credit risk. To this end, we construct a dummy variable that equals to 1 if banks are majority-owned by foreign banks, individuals, corporations, or other organizations. We also distinguish foreign banks in two categories: foreign banks from African countries (86 banks) and foreign banks from advanced economies (48). In order to capture a possible non-linear relationship between market power and credit risk that depends on bank ownership, we include an interaction variable between all types of foreign banks and the two terms of the Lerner Index. The coefficients of these variables are not significant, suggesting that the U-shaped relationship is similar across domestic and foreign banks (specifications V, VI, VII).

We also adopt a similar approach and test the impact of public bank on credit risk. We construct a dummy variable that equals to 1 if banks are majority-owned by government or public enterprises/organizations. The coefficients associated with the two interaction variables are not significant (specification VIII).

We also test the impact of larger banks[14] on non-performing loans. The coefficients associated with the two interaction variables are not significant. This suggests that the bank size does not affect the U-shaped relationship (specification IX).

We also examine the impact of the global financial crisis and commodities shock[15]. Our findings confirm the view that African banking sector have been spared by the global financial crisis in 2008-20010 due to the low international exposure of local financial systems (specification X) but are vulnerable to the reversal of commodity prices in 2014-2015,

[14] We construct a dummy variable that is equal to 1 if the relative size of a bank (total assets to the country's total asset) is larger than or equal to 75th percentile of distribution.

[15] Financial crisis is measured by a dummy variable that takes the value of 1 for the period 2008-2010, and 0 otherwise. We also construct a dummy variable that is equal 1 in 2015 to capture commodities shock.

confirming the importance of the business cycle and economic structure on NPL(specification XI).

Finally, Barth et al. (2013a), Gonzalez (2005) and Laeven and Levine (2009) consider the regulatory rules as an important determinant of bank stability. In line with these studies, we investigated the impact of regulatory and macroprudential indicators on credit risk (Table 7). By using data provided by Barth et al. (2013)[16], we test the impact of private monitoring, bank entry requirements and bank financial transparency, respectively on loan quality[17]. Bank entry requirements positively influence credit risk, suggesting, as in other empirical studies (Birchwood et al., 2017), that excessively stringent bank entry requirements have a regulatory cost (less competition and higher credit cost), which must be balanced with its benefits. , banks could charge high interest rates that, in turn, may generate self-selection and moral hazard dilemmas (Stiglitz and Weiss, 1981; Besanko and Thakor, 1992). Bank transparency negatively affects non-performing loans. This implies that higher level of reporting transparency (or financial disclosures) improves loan quality (specification XIV).

We also inspect the effect of macroprudential policies on loan quality. We use the new database on macroprudential indicators provided by Cerruti et al. (2017). This database shows that African countries have mainly implemented three internal macroprudential indicators: reserve requirements, concentration and credit growth limits. These three variables are not significant. With most African banking sectors being structurally over-liquid, the ability of "Reserve requirements" to curb credit growth is impaired. Global concentration limits on private borrowers do not significantly reduce exposure to credit risk as access to credit of households and enterprises limits the impact of associated credit risk, contrary to developed countries. As shown by our study, a significant portion of risk stems from public indebtedness.

Robustness checks

In this section, we discuss several tests applied to assess the robustness of our regression results. To test whether the results are skewed by larger banking markets[18], we excluded in our regression Angola, Ghana, Kenya, Nigeria and Tanzania. The results reported in Table 8, and suggest that the results are only marginally affected by these exclusions. The U-shaped relationship between bank competition and credit risk remains valid.

Second, we test whether the results are sensitive to the definition of bank competition (Table 9). We use Herfindahl-Hirschamn index (HHI) as an alternative measure of bank competition

[16] Where yearly surveys are absent, we carried forward the values the latest available data until the release of a subsequent survey (similar to Birchwood et al., 2017).

[17] "Bank entry requirements" is an index that ranges from 0 to 8 and a higher index value indicates greater stringency. "Reporting transparency" is an index on a scale of 0–6 and a higher value of the index indicates higher level of reporting transparency.

[18] We consider as a larger banking sector, any market made up of more than 10 banks in our sample associated with country's total assets greater than or equal to 9 billion USD in 2015 (see Table 1).

(structural view). It is calculated by summing the market share of each bank in the country's banking sector[19]. The baseline model steps are subsequently applied. We achieve the same findings as before.

Finally, we also use three alternative measures of credit risk: non-performing loans to total deposit, non-performing loans to total assets (Berger et al, 2009) and reserves for non-performing loans (or provisions) to gross loans ratio (Fungacova and Weil, 2013; Beck et al., 2013b). In all cases, the relationship between credit risk and bank competition remains significant and a non-linear.

[19] Database developed at Banque de France using Bankscope and Fitch connect databases as well as reports from individual banks.

Conclusion

While it mainly investigates the relationship between competition and credit risk, this paper brings light to important determinants of credit risk that may inform adaptation of prudential indicators in developing countries.

Firstly, in line with recent literature on this topic, we find robust evidence of a non-linear or U-shaped relationship between bank competition (measured by the Lerner Index) and credit risk. Such results suggest that the efficiency gains of bank competition are reduced by growing bank instability. The channels by which increased competition increase bank instability may include margin erosion, increased risk taking by banks and their inability to create adequate buffers to cover for bank loss fluctuations over the business cycle.

Second, our study brings light to the importance of business cycles, economic structure and financial deepening in determining non-performing loans fluctuations. More diversified countries experience lower non-performing loans levels. Our study also brings to light the impact of government deficit and indebtedness in credit risk fluctuations. In SSA countries, government interactions with the banking systems are multifaceted – concentration of bank portfolios in government securities, large share of public servants and public enterprises in the client base, frequency of public domestic arrears that may hinder SME activity – and further work is needed to study the components of this feedback loop between the public fiscal stance and bank liquidity and solvency.

Finally, such results contribute to the current debate on what regulatory and prudential frameworks are relevant for SSA countries. First, our results show that selected prudential indicators do not affect credit risk, except for transparency of financial disclosures and bank entry requirements. Overall, this suggests that, contrary to developed countries where much attention has been given to household credit, authorities should monitor closely public net liabilities in bank portfolios, particularly when facing exogenous shocks and economic turnarounds, as since 2014-2015. We believe further research is needed to uncover credit risk determinants specific to developing countries, as well as financial regulations that do not hinder the financial deepening and inclusion necessary to their economic development while ensuring the financial stability necessary to make it sustainable.

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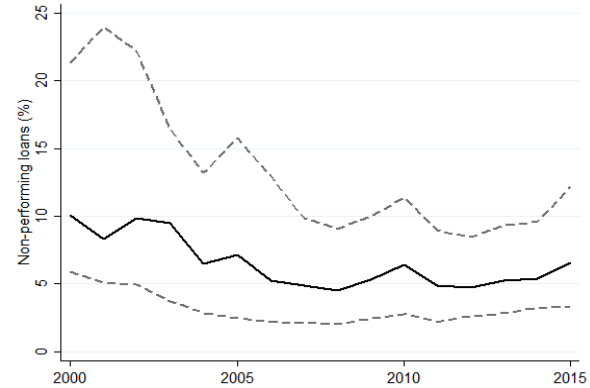
Tables and figures

Figure 1: Credit risks in Africa and the advanced economies, 2000-2015

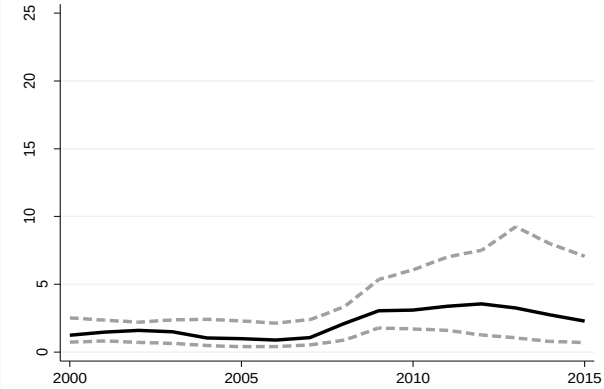
(I) Non-performing loans in Sub-Saharan Africa

Percent of total loans



(II) Non-performing loans in the advanced economies

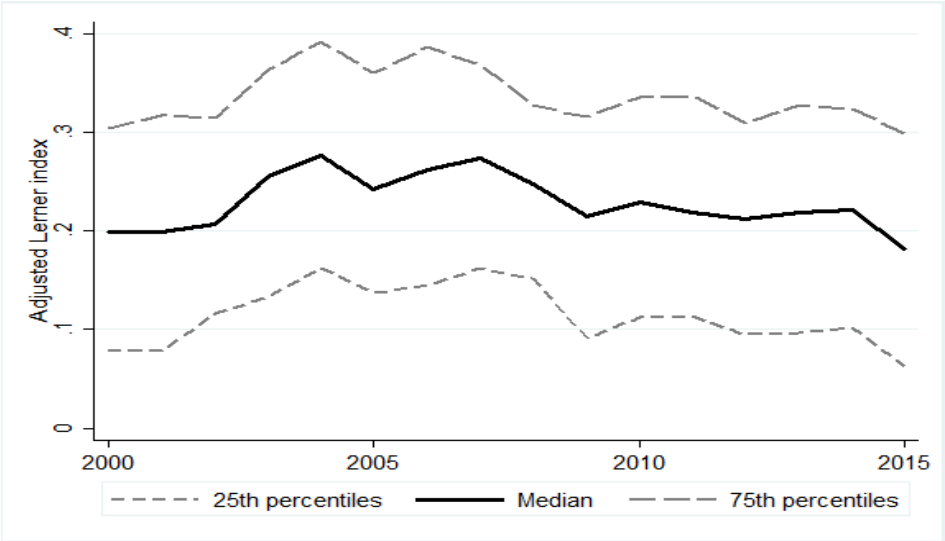
Percent of total loans



Note: The figure provides information on the non-performing loan ratio defined as impaired loans to total loans. It shows the 25th, 50th (median) and 75th percentiles of the distribution of non-performing loans. The figure reported for the "Advanced Economies" is based on a sample of 105 major banks from the G10 countries plus Austria, Australia, and Spain (Brei and Gambacorta, 2016). All values are unweighted averages across banks and countries.

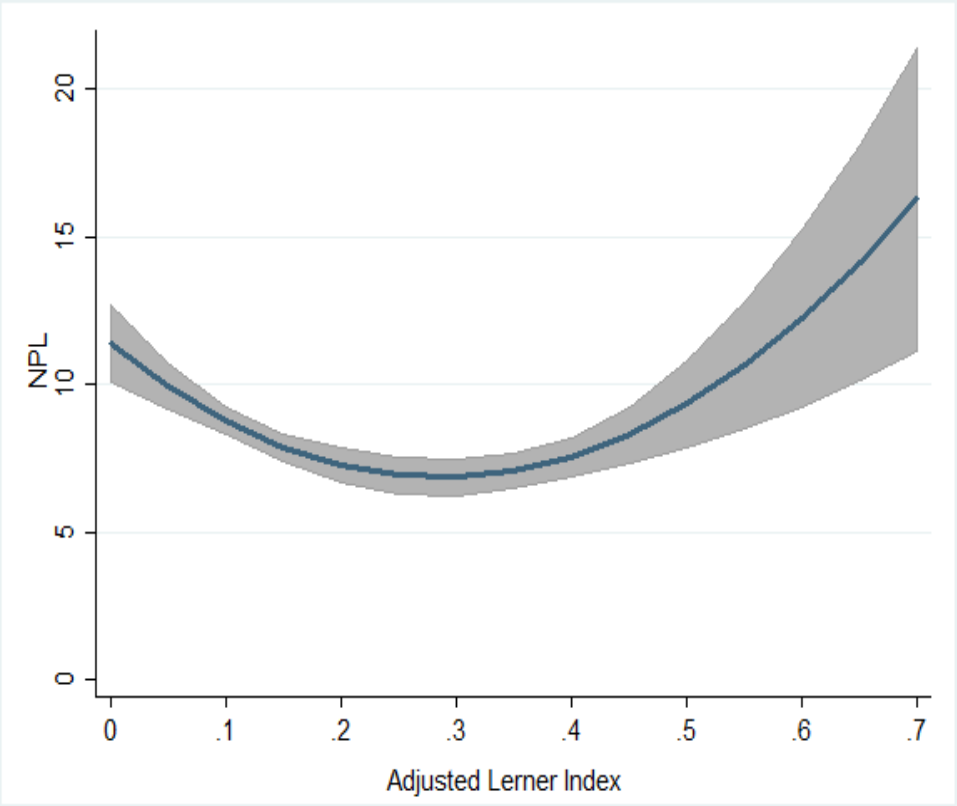
Sources: Fitch Connect and authors' own calculations.

Figure 2: Adjusted Lerner index (2000-2015)



Sources: Fitch Connect and authors' own calculations.

Figure 3: Relationship between credit risk and bank completion in SSA



Sources: Fitch Connect and authors' own calculations.

Table 1: Characteristics of the database (2000–2015)

Country	Banks	Foreign Banks	GDP (2015, USD bn.)	Country's total assets (2015, USD bn.)	Total assets (2015, % of GDP)	Real GDP growth	CPI inflation
Angola	13	5	103.91	43.83	42.18	7.58	38
Benin	3	3	8.76	1.41	16.11	4.25	2.84
Botswana	10	7	16.01	7.04	43.95	4.25	7.72
Burkina Faso	1	1	11.67	1.17	9.98	5.51	2.33
Burundi	1	1	2.31	0.20	8.69	2.88	10.16
Cameroon	6	5	30.43	5.46	17.95	3.95	2.46
Cape Verde	3	2	1.82	1.49	82.09	5.13	1.94
Central African Republic	1	1	1.43	0.16	11.05	1.85	6.71
Chad	2	1	13.36	0.63	4.69	7.62	4.23
Congo, Democratic Republic	4	4	29.7	1.56	5.24	4.9	27.07
Cote d'Ivoire	2	2	33.96	3.58	10.53	2.62	2.62
Equatorial Guinea	1	1	16.42	0.69	4.22	9.49	5.12
Ethiopia	3	0	48.33	16.37	33.88	9	12.9
Gabon	2	2	18.55	0.55	2.94	2.44	1.93
Ghana	15	11	46.5	9.88	21.25	6.25	16.1
Guinea	2	2	5.26	0.81	15.43	2.46	14.83
Kenya	35	13	52.2	35.32	67.66	4.46	9.72
Lesotho	2	2	2.92	0.34	11.60	3.97	7.1
Madagascar	2	2	9.93	0.68	6.87	3.2	9.34
Malawi	6	2	8.5	1.20	14.07	4.39	15.73
Mali	3	3	12.68	1.96	15.48	4.77	2.4
Mozambique	13	11	14.3	6.16	43.06	7.43	8.93
Namibia	3	2	14.75	4.71	31.91	4.92	6.73
Niger	2	2	7.63	0.44	5.72	4.67	2.15
Nigeria	20	3	461.85	136.00	29.45	6.84	11.54
Rwanda	4	4	8	0.66	8.20	7.66	6.53
Senegal	7	5	15.77	5.39	34.17	4.04	1.61
Sierra Leone	4	2	3.16	0.29	9.21	6.86	8.31
Swaziland	4	3	5.22	1.04	19.87	3.26	7.18
Tanzania	20	14	43.73	10.49	23.98	6.6	7.66
Togo	1	0	4.04	0.56	13.94	2.86	2.62
Uganda	17	15	26.26	5.37	20.46	6.5	7.25
Zambia	9	9	26.06	4.55	17.44	6.51	13.7
Total*/Average	**221***	**140***	**33.50**	**9.39**	**21.31**	**5.12**	**8.65**

Sources: Fitch Connect, WDI, IMF-IFS and author's own calculations.

Note: This table provides information on the macroeconomic statistics for the sample countries. "Banks" denotes the total number of deposit-taking institutions (domestic and foreign-owned) in a particular country of our sample. The Real GDP growth and CPI inflation (annual inflation rate) are expressed as unweighted averages over the period 2000-2015.

Table 2: Description of the variables

Variables	Description	Expected sign	Sources
	Dependent variable		
NPL	Loan quality or credit risk is measured as the ratio between the bank's impaired loans and the total gross loans.		Fitch Connect
	Independent variables		
Lerner	Adjusted Lerner Index	+/-	Own estimation
$Lerner^2$	Adjusted Lerner Index, squared term	+/-	
NIM	The ratio of gross interest and dividend income minus total interest expense to total assets.	+	Fitch Connect
Loans	The ratio of gross loans to total assets.	+	Fitch Connect
Income diversification	The ratio of total non-interest operating income to total assets.	+/-	Fitch Connect
Capitalization	The ratio of total equity to total assets.	-	Fitch Connect
Bank size	Natural logarithm of bank's total assets.	+/-	Fitch Connect
GDP growth	Real GDP growth (year-on-year) of a country.	-	WDI
Government debt	Government public debt as percentage of GDP.	+	IMF-WEO
Financial development	Domestic credit to private sector as percentage of GDP.	-	
Inflation	The annual inflation rate.	+/-	IMF-IFS
Economic concentration	Economic concentration index is a measure of how much a country's economy and trade are concentrated in one or a few products.	+	UNCTAD
Regulatory Quality	It captures perceptions of the ability of the government to promote private sector development.	-	WGI

Table 3: Summary statistics for the regression variables

The sample period goes from 2000 to 2015. "Unit" denotes the measurement units of the model's variables. "Obs." denotes the number of observations for the respective variable. Columns 4-7 denote the mean, standard deviation, minimum and maximum, respectively.

Variable	Unit	Obs.	Mean	Std. Dev.	Min	Max
NPL	Percentage	1644	8.48	9.01	0.07	58.39
Adjusted Lerner Index	Index	1644	0.23	0.14	0.00	0.84
NIM	Percentage	1644	5.95	3.35	0.62	31.18
Loans	Percentage	1644	52.88	14.60	8.03	87.95
Income diversification	Percentage	1644	3.87	2.18	0.10	15.36
Capitalization	Percentage	1644	12.90	6.65	0.42	71.82
Bank size	Logarithm	1644	12.82	1.39	8.91	16.33
GDP growth	Percentage	1644	5.53	3.18	-6.91	22.59
Government debt	Percentage	1644	38.68	21.37	7.28	150.23
Inflation	Percentage	1644	9.07	8.96	-1.89	108.90
Financial development	Percentage	1644	19.88	10.11	1.07	65.28
Economic concentration	Index	1644	0.40	0.24	0.17	0.97
Regulatory quality	Index	1644	-0.40	0.40	-1.82	0.79

Table 4: Results for the baseline model

	(I)	(II)	(III)	(IV)
NPL, t-1	0.716***	0.698***	0.685***	0.681***
	(0.0709)	(0.0649)	(0.0642)	(0.0642)
Adjusted Lerner Index	-0.0428*	-0.325***	-0.332***	-0.318***
	(0.0250)	(0.0946)	(0.0996)	(0.106)
Adjusted Lerner Index (squared)		0.00584***	0.00571***	0.00553***
		(0.00185)	(0.00198)	(0.00208)
NIM	0.00254	0.0319	0.0277	0.0890
	(0.0933)	(0.0965)	(0.0994)	(0.126)
Loans	0.0534***	0.0681***	0.0822***	0.0874***
	(0.0165)	(0.0175)	(0.0188)	(0.0184)
Income diversification	0.123	0.130	0.0844	0.0235
	(0.147)	(0.144)	(0.157)	(0.157)
Capitalization	0.0580	-0.0124	0.0158	-0.00053
	(0.0578)	(0.0527)	(0.0607)	(0.0599)
Bank size	0.216	0.164	0.378**	0.199
	(0.188)	(0.147)	(0.172)	(0.190)
GDP Growth			-0.126***	-0.133***
			(0.0413)	(0.0448)
Government Debt			0.0304***	0.0314***
			(0.0112)	(0.0121)
Financial Development			-0.0567**	-0.0534**
			(0.0224)	(0.0241)
Inflation			-0.00366	-0.00954
			(0.0184)	(0.0196)
Economic Concentration				1.784**
				(0.856)
Regulatory Quality				-0.290
				(0.547)
Constant	-3.579	-0.760	-3.354	-2.249
	(3.144)	(2.835)	(3.389)	(3.265)
Observations	1644	1644	1644	1644
Banks	221	221	221	221
Hansen (1)	0.304	0.353	0.254	0.212
AR2 (2)	0.722	0.361	0.354	0.326
Inflection point				0.287

Note: The sample goes from 2000 to 2015. All estimations are based on the Arellano and Bover (1995) System GMM estimator. Robust standard errors are reported in brackets. (***, **, *) indicate significance at the 1%, 5%, 10% level. Significant coefficients are in bold. (1) Reports p-values for the null hypothesis that the instruments used are not correlated with the residuals. (2) Reports p-values for the null hypothesis that the errors in the first difference regression exhibit no second-order serial correlation.

Table 5: Ownership effect

	(V)	(VI)	(VII)	(VIII)
NPL, t-1	0.682***	0.679***	0.690***	0.677***
	(0.0667)	(0.0716)	(0.0696)	(0.0670)
Adjusted Lerner Index	-0.332***	-0.269***	-0.346***	-0.302***
	(0.126)	(0.103)	(0.132)	(0.104)
Adjusted Lerner Index (squared)	0.00639**	0.00429**	0.00659**	0.00525**
	(0.00297)	(0.00190)	(0.00298)	(0.00208)
Adjusted Lerner Index * Foreign banks	0.0723			
	(0.0841)			
Adjusted Lerner Index (squared) * Foreign banks	-0.00237			
	(0.00239)			
Adjusted Lerner Index * African foreign banks		-0.103		
		(0.153)		
Adjusted Lerner Index * African foreign banks		0.00279		
		(0.00467)		
Adjusted Lerner Index * Foreign banks (advanced economies)			0.139	
			(0.0857)	
Adjusted Lerner Index (squared) * Foreign banks (advanced economies)			-0.00393	
			(0.00250)	
Adjusted Lerner Index * Public banks				0.0251
				(0.109)
Adjusted Lerner Index (squared) * Public Banks				-0.000727
				(0.00243)
NIM	0.0440	0.0143	0.0274	0.0399
	(0.120)	(0.104)	(0.118)	(0.116)
Loans	0.0897***	0.0904***	0.0925***	0.0888***
	(0.0190)	(0.0189)	(0.0193)	(0.0196)
Income diversification	-0.0464	-0.0346	-0.0437	-0.0114
	(0.158)	(0.179)	(0.155)	(0.157)
Capitalization	0.0131	0.0170	0.0177	0.00299
	(0.0698)	(0.0603)	(0.0683)	(0.0622)
Bank size	0.170	0.154	0.184	0.170
	(0.180)	(0.183)	(0.183)	(0.180)
GDP Growth	-0.112***	-0.111***	-0.112***	-0.120***
	(0.0413)	(0.0405)	(0.0404)	(0.0412)
Government Debt	0.0347***	0.0321***	0.0314**	0.0338***
	(0.0111)	(0.0124)	(0.0123)	(0.0111)
Financial Development	-0.0517**	-0.0539**	-0.0531**	-0.0522**
	(0.0243)	(0.0252)	(0.0242)	(0.0257)
Inflation	-0.00566	-0.0109	-0.00811	-0.00803
	(0.0181)	(0.0176)	(0.0170)	(0.0174)
Economic Concentration Index	1.963**	1.832**	1.923**	1.923**
	(0.817)	(0.822)	(0.816)	(0.868)
Regulatory Quality	-0.258	-0.300	-0.283	-0.285
	(0.540)	(0.571)	(0.544)	(0.544)
Constant	-2.252	-1.544	-2.311	-1.984
	(3.227)	(3.173)	(3.104)	(3.005)
Observations	1644	1644	1644	1644
Banks	221	221	221	221
Hansen (1)	0.397	0.380	0.399	0.335
AR2 (2)	0.360	0.352	0.326	0.354

Note: The sample goes from 2000 to 2015. All estimations are based on the Arellano and Bover (1995) System GMM estimator. Robust standard errors are reported in brackets. (***, **, *) indicate significance at the 1%, 5%, 10% level. Significant coefficients are in bold. (1) Reports p-values for the null hypothesis that the instruments used are not correlated with the residuals. (2) Reports p-values for the null hypothesis that the errors in the first difference regression exhibit no second-order serial correlation.

Table 6: Bank size, financial and commodities crises effects

	(IX)	(X)	(XI)
NPL, t-1	0.679***	0.673***	0.675***
	(0.0660)	(0.0665)	(0.0640)
Adjusted Lerner Index	-0.322***	-0.309***	-0.297***
	(0.122)	(0.104)	(0.0964)
Adjusted Lerner Index (squared)	0.00584**	0.00526***	0.00512***
	(0.00251)	(0.00203)	(0.00192)
Adjusted Lerner Index * Large banks	0.0583		
	(0.0972)		
Adjusted Lerner Index (squared) * Large banks	-0.00205		
	(0.00260)		
NIM	0.0485	0.0224	0.0144
	(0.131)	(0.114)	(0.112)
Loans	0.0971***	0.0941***	0.0913***
	(0.0195)	(0.0194)	(0.0188)
Income diversification	0.0503	0.00513	0.0200
	(0.168)	(0.151)	(0.152)
Capitalization	0.00326	0.0129	0.0168
	(0.0651)	(0.0617)	(0.0637)
Bank size	0.207	0.207	0.154
	(0.188)	(0.188)	(0.182)
GDP Growth	-0.115***	-0.117***	-0.111***
	(0.0418)	(0.0426)	(0.0419)
Government Debt	0.0362***	0.0358***	0.0321***
	(0.0120)	(0.0115)	(0.0115)
Financial Development	-0.0541**	-0.0577**	-0.0559**
	(0.0272)	(0.0256)	(0.0247)
Inflation	-0.00736	-0.0110	-0.00514
	(0.0195)	(0.0178)	(0.0181)
Economic Concentration	2.244**	1.947**	1.880**
	(0.892)	(0.858)	(0.820)
Regulatory Quality	-0.249	-0.219	-0.122
	(0.517)	(0.534)	(0.533)
Financial crisis		0.338	
		(0.293)	
Commodities shock			0.811*
			(0.456)
Constant	-3.272	-2.635	-1.999
	(3.108)	(3.109)	(3.075)
Observations	1644	1644	1644
Banks	221	221	221
Hansen (1)	0.287	0.273	0.346
AR2 (2)	0.371	0.350	0.365

Note: The sample goes from 2000 to 2015. All estimations are based on the Arellano and Bover (1995) System GMM estimator. Robust standard errors are reported in brackets. (***, **, *) indicate significance at the 1%, 5%, 10% level. Significant coefficients are in bold. (1) Reports p-values for the null hypothesis that the instruments used are not correlated with the residuals. (2) Reports p-values for the null hypothesis that the errors in the first difference regression exhibit no second-order serial correlation.

Table 7: Regulatory frameworks

	(XII)	(XIII)	(XIV)	(XV)	(XVI)	(XVII)
NPL, t-1	0.668***	0.676***	0.671***	0.706***	0.703***	0.704***
	(0.0835)	(0.0780)	(0.0804)	(0.0740)	(0.0761)	(0.0749)
Adjusted Lerner Index	-0.368***	-0.454***	-0.487***	-0.231***	-0.249***	-0.240***
	(0.114)	(0.155)	(0.163)	(0.0856)	(0.0853)	(0.0865)
Adjusted Lerner Index * (squared)	0.00661***	0.00871***	0.00937***	0.00445***	0.00470***	0.00457***
	(0.00231)	(0.00315)	(0.00322)	(0.00126)	(0.00127)	(0.00129)
NIM	-0.0702	-0.0524	-0.0475	-0.0731	-0.0181	-0.0254
	(0.0850)	(0.0905)	(0.0872)	(0.0943)	(0.0818)	(0.0858)
Loans	0.0915***	0.111***	0.108***	0.103***	0.0881**	0.0899***
	(0.0263)	(0.0280)	(0.0288)	(0.0364)	(0.0348)	(0.0337)
Income diversification	0.00340	-0.0414	-0.0889	0.0379	0.0374	0.0145
	(0.148)	(0.181)	(0.175)	(0.230)	(0.231)	(0.239)
Capitalization	-0.0298	-0.0634	-0.0686	-0.0725	-0.0774	-0.0792
	(0.0565)	(0.0624)	(0.0599)	(0.0646)	(0.0652)	(0.0651)
Bank size	0.255	0.103	0.186	-0.00801	0.0280	0.000958
	(0.232)	(0.201)	(0.210)	(0.316)	(0.297)	(0.304)
GDP Growth	-0.0778*	-0.0820*	-0.107**	-0.177***	-0.165***	-0.174***
	(0.0458)	(0.0476)	(0.0483)	(0.0576)	(0.0579)	(0.0584)
Government Debt	0.0407**	0.0472***	0.0519***	0.0166	0.0227	0.0198
	(0.0175)	(0.0157)	(0.0160)	(0.0152)	(0.0153)	(0.0153)
Financial Development	-0.0633**	-0.0590**	-0.0624**	-0.0756**	-0.0762**	-0.0810**
	(0.0299)	(0.0277)	(0.0288)	(0.0370)	(0.0370)	(0.0369)
Inflation	-0.00482	0.00649	0.00682	-0.00988	-0.0129	-0.0104
	(0.0295)	(0.0278)	(0.0281)	(0.0156)	(0.0165)	(0.0169)
Economic Concentration	2.746***	2.757**	2.352**	1.164	1.018	1.021
	(0.989)	(1.099)	(1.131)	(1.163)	(1.168)	(1.446)
Regulatory Quality	0.238	0.588	0.631	-0.131	0.191	0.228
	(0.648)	(0.572)	(0.635)	(0.688)	(0.633)	(0.737)
Private Monitoring	-0.0522					
	(0.129)					
Bank entry requirements		0.985**				
		(0.484)				
Bank transparency			-0.273*			
			(0.164)			
Limits credit growth				1.220		
				(0.813)		
Reserve requirements					-0.361	
					(0.858)	
Concentration limits						0.0238
						(0.721)
Constant	-1.479	-8.272*	0.715	1.710	2.098	2.588
	(3.073)	(4.471)	(3.134)	(4.040)	(3.793)	(3.746)
Observations	1105	1353	1334	766	766	766
Banks	174	196	193	131	131	131
Hansen (1)	0.576	0.369	0.318	0.286	0.298	0.272
AR2 (2)	0.730	0.698	0.711	0.413	0.391	0.399

Note: The sample goes from 2000 to 2015. All estimations are based on the Arellano and Bover (1995) System GMM estimator. Robust standard errors are reported in brackets. (***, **, *) indicate significance at the 1%, 5%, 10% level. Significant coefficients are in bold. (1) Reports p-values for the null hypothesis that the instruments used are not correlated with the residuals. (2) Reports p-values for the null hypothesis that the errors in the first difference regression exhibit no second-order serial correlation.

Robustness tests

Table 8: Excluding large banking sector's

	Angola out (XVIII)	Ghana out (XIX)	Kenya out (XX)	Nigeria out (XXI)	Tanzania out (XXII)
NPL, t-1	0.668***	0.694***	0.617***	0.678***	0.713***
	(0.0672)	(0.0671)	(0.0861)	(0.0677)	(0.0613)
Adjusted Lerner Index	-0.294***	-0.326***	-0.369**	-0.264***	-0.295***
	(0.103)	(0.117)	(0.167)	(0.0903)	(0.113)
Adjusted Lerner Index (squared)	0.00454**	0.00585**	0.00632*	0.00438**	0.00518**
	(0.00204)	(0.00240)	(0.00325)	(0.00174)	(0.00222)
NIM	0.0342	-0.0118	0.0719	0.0107	0.0411
	(0.112)	(0.112)	(0.129)	(0.0950)	(0.122)
Loans	0.0841***	0.100***	0.0862***	0.0832***	0.0983***
	(0.0194)	(0.0190)	(0.0246)	(0.0181)	(0.0209)
Income diversification	-0.0311	0.00185	0.0141	0.0224	0.00471
	(0.164)	(0.143)	(0.151)	(0.150)	(0.184)
Capitalization	0.0436	-0.0176	-0.00808	0.0194	0.0105
	(0.0605)	(0.0569)	(0.0732)	(0.0627)	(0.0679)
Bank size	0.286	0.111	0.246	0.326	0.177
	(0.181)	(0.174)	(0.214)	(0.223)	(0.205)
GDP Growth	-0.118**	-0.135***	-0.0934**	-0.133***	-0.130***
	(0.0459)	(0.0419)	(0.0438)	(0.0440)	(0.0415)
Government Debt	0.0336***	0.0263**	0.0383***	0.0362***	0.0308**
	(0.0115)	(0.0114)	(0.0116)	(0.0118)	(0.0120)
Financial Development	-0.0645**	-0.0423*	-0.0658**	-0.0699***	-0.0583**
	(0.0261)	(0.0240)	(0.0311)	(0.0253)	(0.0276)
Inflation	-0.00424	-0.00938	-0.0287	-0.0113	-0.00354
	(0.0287)	(0.0170)	(0.0240)	(0.0178)	(0.0177)
Economic Concentration	1.159	1.657**	2.916***	1.600**	1.867**
	(0.995)	(0.809)	(0.978)	(0.764)	(0.915)
Regulatory Quality	0.0296	-0.850	0.0247	0.111	-0.422
	(0.594)	(0.548)	(0.593)	(0.513)	(0.539)
Constant	-2.618	-1.393	-1.977	-3.379	-2.829
	(3.115)	(2.879)	(3.678)	(3.185)	(3.615)
Observations	1547	1552	1295	1543	1495
Banks	208	206	186	201	201
Hansen (1)	0.294	0.404	0.303	0.314	0.339
AR2 (2)	0.438	0.669	0.267	0.271	0.331

Note: The sample goes from 2000 to 2015. All estimations are based on the Arellano and Bover (1995) System GMM estimator. Robust standard errors are reported in brackets. (***, **, *) indicate significance at the 1%, 5%, 10% level. Significant coefficients are in bold. (1) Reports p-values for the null hypothesis that the instruments used are not correlated with the residuals. (2) Reports p-values for the null hypothesis that the errors in the first difference regression exhibit no second-order serial correlation.

Table 9: Alternative measure of bank competition

	(XXIII)	(XXIV)	(XXV)	(XXVI)
NPL, t-1	0.731***	0.737***	0.712***	0.705***
	(0.0700)	(0.0683)	(0.0671)	(0.0671)
HHI	-0.0427*	-0.177***	-0.113**	-0.154***
	(0.0244)	(0.0595)	(0.0504)	(0.0527)
HHI (squared)		0.00320***	0.00170*	0.00234**
		(0.00108)	(0.000972)	(0.00103)
NIM	-0.0360	-0.0279	-0.0404	-0.0185
	(0.0797)	(0.0787)	(0.0693)	(0.0834)
Loans	0.0528***	0.0526***	0.0631***	0.0780***
	(0.0166)	(0.0163)	(0.0192)	(0.0202)
Income diversification	0.121	0.114	0.0983	0.0337
	(0.165)	(0.164)	(0.153)	(0.149)
Capitalization	0.0280	0.0206	0.0344	0.0194
	(0.0510)	(0.0494)	(0.0452)	(0.0444)
Bank size	-0.0122	-0.0344	0.116	-0.109
	(0.174)	(0.170)	(0.160)	(0.169)
Real GDP Growth			-0.130***	-0.133***
			(0.0423)	(0.0421)
Government Debt			0.0339***	0.0371***
			(0.0123)	(0.0118)
Financial Development			-0.0400*	-0.0301
			(0.0227)	(0.0232)
Inflation			0.000485	-0.00942
			(0.0161)	(0.0162)
Economic Concentration				2.543***
				(0.741)
Regulatory Quality				-0.469
				(0.429)
Constant	-0.583	0.794	-1.825	-0.357
	(3.679)	(3.707)	(3.484)	(3.479)
Observations	1627	1627	1627	1627
Banks	221	221	221	221
Hansen	0.303	0.318	0.304	0.303
AR2	0.739	0.742	0.738	0.692

Note: The sample goes from 2000 to 2015. All estimations are based on the Arellano and Bover (1995) System GMM estimator. Robust standard errors are reported in brackets. (***, **, *) indicate significance at the 1%, 5%, 10% level. Significant coefficients are in bold. (1) Reports p-values for the null hypothesis that the instruments used are not correlated with the residuals. (2) Reports p-values for the null hypothesis that the errors in the first difference regression exhibit no second-order serial correlation.

Table 10: Alternative measures of credit risk

	(XXVI)	(XXVIII)	(XXIX)
NPL/total deposits, t-1	0.665***		
	(0.0674)		
NPL/ total assets, t-1		0.730***	
		(0.0547)	
Reserves for NPL/total loans, t-1			0.681***
			(0.0577)
Adjusted Lerner Index	-0.299**	-0.148**	-0.264***
	(0.140)	(0.0597)	(0.0612)
Adjusted Lerner Index (squared)	0.00555*	0.00275**	0.00465***
	(0.00298)	(0.00111)	(0.00118)
NIM	-0.0457	-0.0101	0.0292
	(0.0894)	(0.0431)	(0.0729)
Loans	0.105***	0.0475***	0.0677***
	(0.0245)	(0.0143)	(0.0150)
Income diversification	-0.0584	-0.0470	0.116
	(0.122)	(0.0685)	(0.133)
Capitalization	0.0330	0.000413	-0.0153
	(0.0667)	(0.0314)	(0.0445)
Bank size	0.0840	0.0423	0.267**
	(0.154)	(0.0961)	(0.127)
Real GDP Growth	-0.0738**	-0.0519**	-0.0915***
	(0.0324)	(0.0224)	(0.0317)
Government Debt	0.0271***	0.0136**	0.0275***
	(0.00778)	(0.00538)	(0.00621)
Financial Development	-0.0345	-0.0142	-0.0356**
	(0.0247)	(0.0123)	(0.0174)
Inflation	0.00170	-0.00312	-0.0288***
	(0.0143)	(0.00967)	(0.0111)
Economic Concentration Index	1.950**	0.568	1.849***
	(0.895)	(0.422)	(0.556)
Regulatory Quality	-0.137	-0.110	-0.484
	(0.456)	(0.225)	(0.350)
Constant	-2.591	-0.526	-3.662*
	(2.769)	(1.648)	(2.200)
Observations	1643	1644	1550
Banks	220	221	217
Hansen	0.442	0.241	0.178
AR2	0.955	0.694	0.882

Note: The sample goes from 2000 to 2015. All estimations are based on the Arellano and Bover (1995) System GMM estimator. Robust standard errors are reported in brackets. (***, **, *) indicate significance at the 1%, 5%, 10% level. Significant coefficients are in bold. (1) Reports p-values for the null hypothesis that the instruments used are not correlated with the residuals. (2) Reports p-values for the null hypothesis that the errors in the first difference regression exhibit no second-order serial correlation.