https://economix.fr/

CREDIT RISK AND BANK COMPETITION IN SUB-SAHARAN AFRICA

Document de Travail
Working Paper
2018-27

Alphonse Noah
Luc Jacolin
Michael Brei

UMR 7235

EconomiX - UMR7235
Université Paris Nanterre
Bâtiment G - Maurice Allais, 200, Avenue de la République
92001 Nanterre cedex

Email : secretariat@economix.fr

Credit risk and bank competition in Sub-Saharan Africa*

Michael Brei[a,b], Luc Jacolin[c] and Alphonse Noah[a,c]

May 2018

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 2000-15, we find a non-linear or U-shaped relationship between bank competition and credit risk. In other words, increased bank competition has the potential to lower credit risk via efficiency gains (lower credit cost, operational gains). However, the positive effects may be outweighed by adverse effects of excessive competition (lower profit margins, increased risk incentives). We also find that credit risk in Sub-Saharan Africa is not only related to macroeconomic determinants, such as growth, public debt, economic concentration, financial deepening and inclusion, but also to the business and 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, Africa

JEL classification: G21, G28, D4, O55

[a] Department of Economics, The University of the West Indies, Cave Hill Campus
[b] EconomiX-CNRS, University of Paris Nanterre
[c] International Relations and Economics General Directorate, Banque de France

* The authors wish to thank Michel Boutillier, Florian Léon, Ouarda Merrouche, Samuel Guerineau, Laurence Scialom, and Tatiana Yongoua for helpful comments, as well as participants of the Banque de France-FERDI Partnership seminar, the CSAE 2018 conference and University Paris Nanterre doctoral workshop. The opinions expressed in this paper are those of the authors and do not necessarily reflect those of the Banque de France.

1. Introduction

Banking sectors in Sub-Saharan Africa have been growing rapidly during 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 and contributed to higher, albeit still limited, financial integration. The concerns about financial stability have grown accordingly, notably as a result of the Nigerian banking crisis of 2009-10. Whereas considerable attention has been devoted to financial stability in developed countries affected by the global financial crisis, few empirical studies have focused on Sub-Saharan Africa (SSA) so far. With credit risk being relatively high and rising since the drop in commodity prices and the ensuing African economic slowdown in 2014 (Figure 1), 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 support 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, the reliance on banking sectors to ensure adequate financing is increasing, however, at the same time there are high risks of macroeconomic instability which often arises from external shocks. In this context, the linkages between growing competition in SSA banking sectors and credit risk have become salient. Even if banking systems remain weak and isolated in SSA (Marchettini and Maino, 2015), banking crises arising from financial development and 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, similarly to the trends observed in the advanced economies.

The relationship between bank competition and credit risk is less than straightforward. Bank competition might arguably spur efficiency gains (through, for example, lower credit costs, improved operational and risk management practices, or better allocation of capital), and it thus might contribute to higher potential growth and translate into sounder credit portfolios. However, it might also encourage additional risk taking by financial intermediaries, making banks more fragile in the face of economic fluctuations and deterioration in the quality of credit books.[1] Shedding light on 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; Fungáčová and Weill, 2013; Beck et al., 2006; Jiménez et al., 2013).

In addition to extending the focus on the recent experience in Sub-Saharan Africa, the main contribution of our research is to provide new empirical insight on how bank competition has affected credit risk in SSA countries, controlling for macroeconomic determinants, bank-specific characteristics, and the regulatory environment. Our study also seeks to contribute to the ongoing discussion about whether and to what extent regulatory and policy design should be adapted to the determinants of credit risk that are specific to developing countries.

Using data on the financial statements of 221 banks (of which 140 are foreign-owned) from 33 countries in SSA over the period 2000–15, we find evidence 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

[1] 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.

financial instability effects. Our study also highlights the importance of macroeconomic variables in determining credit risks, such as growth, financial deepening and economic concentration, as well as bank portfolios and the regulatory environment. More specifically, we find that credit risks have been lower in countries where there operate more branches, credit registry coverage is higher, and the tenure of supervisors is shorter. Finally, we show that public indebtedness has an impact on bank credit risk in these countries, where government and public enterprises make up a significant portion of the formal economy.

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

2. Literature review on bank competition and stability

2.1 Competition-fragility versus competition-stability

The theoretical literature provides conflicting predictions on the relationship between competition and stability (Beck, 2008). One strand of the literature suggests that less competitive banking systems are more stable. A central argument is that higher interest revenues (or oligopoly rents) provide banks a cushion against unexpected shocks and reduce incentives for risk-taking (Marcus, 1984; Keeley, 1990). In systems with limited competition, banks tend to have better profit opportunities, higher franchise values and capital cushions, and thus fewer incentives to take on risks. Another argument is that banks in more competitive systems earn less informational rents from relationship lending, which reduces their screening incentives and results in riskier loan books (Boot et al., 1993; Allen and Gale, 2000,

2004).[2] In addition, Allen and Gale (2000) argue that competition can lead to instability in the interbank bank market and payment system, as banks might be unwilling to provide funds to liquidity-constrained competitors. Hellmann et al. (2000) show that competition in the deposit market can lead to instability. Moreover, to the extent that less competitive markets are associated with fewer but larger banks, benefits could arise from economies of scale and diversification (Diamond, 1984) and improved ability of regulators to supervise the banking system (Allen and Gale, 2000). The aforementioned theories thus provide arguments in favour of the *'competition-fragility'* (or franchise value) view and predict that competition will lead to more fragile banking systems.

In contrast, other theoretical models predict that more competitive banking systems are more stable. For instance, Boyd and de Nicolo (2005), who introduce in their model loan market competition, argue that higher loan rates in more concentrated systems induce bank borrowers to assume greater risk which results in increased loan defaults. This effect can be amplified if less competition is associated with less credit rationing, adverse selection and larger loans (Stiglitz and Weiss, 1981; Caminal and Matutes, 2002). Other models suggest that less competitive environments with larger banks increase incentive distortions linked to implicit government guarantees and other too-big-to-fail subsidies (Mishkin, 1999; Cerasi and Daltung, 2000; Fahri and Tirole, 2012). Systems with fewer and larger banks might also be more interconnected and lead to higher systemic risk (Kroszner, 2010). These arguments would thus favour the *'competition-stability'* view according to which competition is associated with more stable banking systems.

[2] Theory and empirical work suggest that market power entices banks to invest in long-term and soft-information-based relationships with small and opaque firms as they know that they can regain the initial investment in the relationship at a later stage (Peterson and Rajan, 1995; Bonaccorsi di Patti and Dell'Aricca, 2004).

Martinez-Miera and Repullo (2010) extend the model of Boyd and de Nicolo (2005) and introduce imperfect correlation of loan defaults. Their model implies a U-shaped relationship between bank competition and bank failure: at the beginning, more competition leads to more stability but after a certain threshold it can lead to more fragility. The authors highlight two opposing effects of competition: (i) it leads to lower loan rates, lower borrower default probabilities, and thus sounder loan books (risk-shifting effect), and (ii) lower interest revenues from performing loans erode bank cushions stemming from revenues (margin effect) and have an adverse effect on bank stability. The model implies that beyond a certain threshold of competition the risk-shifting effect is always dominated by the margin effect, so competition leads to more fragility by eroding interest revenues. Below this threshold with less competition the effect is ambiguous but numerical simulations suggest that the risk-shifting effect dominates and that competition leads to more stability by improving borrowers' repayment capacity.

Theoretical work has also been conducted on the impact of competition on different aspects of financial stability and the role of the liability structure of banks (Freixas and Ma, 2014). While in a classical originate-to-hold banking industry competition might increase financial stability, the opposite can be true for an originate-to-distribute banking industry in which banks are funded by a larger fraction of market short-term funding. Moreover, it has been highlighted that regulatory and institutional factors play an important role in determining bank responses to competition. Capital requirements and restrictions on interest rates and bank activities are seen as fostering stability (Hellmann, Murdock, and Stiglitz, 2000), but they might as well lead to rent-seeking and prevent banks from gaining diversification and scale benefits. The role of deposit insurance schemes has also been debated. While deposit insurance serves to protect depositors and prevent

bank runs, it might as well increase banks' risk-taking incentives (Diamond and Dybvik, 1983). Other regulatory measures that have been highlighted in this context include entry requirements, barriers to entry for domestic and foreign banks, and other restrictions that might prevent new entrants from challenging incumbents (Beck, 2008).

Empirical studies generally find ambiguous results (see Zigraiova and Havranek (2016) for a meta-analysis). In favour of the competition-fragility view are the results reported by Keeley (1990) and Dick (2006) for the United States, Yeyati and Micco (2007) for Latin America, Jiménez et al. (2013) for Spain, Agoraki et al. (2011) for Central and Eastern Europe, Fungáčová and Weill (2013) for Russia, Turk Ariss (2010) for developing countries, Soedarmono and Tarazi (2016) for Asia-Pacific, and Beck et al. (2013a) for countries with stricter activity restrictions, lower systemic fragility, better developed stock exchanges, more generous deposit insurance and more effective systems of credit information sharing. Studies supporting the competition-stability view include Jayaratne and Strahan (1998) and Goetz (2017) on the United States, Salas and Saurina (2003) on Spain, Schaeck and Čihák (2014) on the United States and Europe, Craig and Dinger (2013) on Central and Eastern Europe, Kasman and Kasman (2015) on Turkey, Fu et al. (2014) on Asia-Pacific, and Beck et al. (2006) for developed and developing countries. Finally, IJtsma et al. (2017) do not find any economically significant effect of competition on stability for the European Union.

More recently, some empirical studies have tested for the presence of a nonlinear relationship between competition and stability. For instance, Berger et al. (2009) support the view of a nonlinear relationship using bank-level data on 23 industrialized countries. Their results suggest that, consistent with the competition-fragility view, banks with a higher degree of market power also have less overall risk exposure. However, their data also provide some support for the competition-

stability view, namely that market power increases loan risk. As the authors argue, even if market power in the loan market results in riskier loan portfolios, banks may protect the higher franchise value through accumulating more capital, limiting the size of their loan portfolio, or by employing other risk-mitigating strategies. In contrast to the prediction of Martinez-Miera and Repullo (2010), Tabak et al. (2012) find for Latin America that high/low competition is associated with more stability, whereas the average competition displays the highest fragility. As they argue, capital is the stabilizing factor in less competitive environments and bank size in more competitive markets. Using data on 10 European countries, Liu et al. (2013) highlight that there is an inverted U-shaped relationship between regional bank competition and stability. This result suggests that a moderate level of bank competition is associated with higher stability. Otero Gonzalez et al. (2017) provide evidence of a U-shaped relationship between competition and bank risk-taking for MENA countries. For Gulf countries, the authors provide evidence that an increase in competition leads to a reduction in financial stability, whereas in the case of non-Gulf countries, an increase of competition in uncompetitive markets can lead to more stability.

2.2 Other determinants of credit risk

A large body of studies focusses on the impact of the macroeconomic environment, bank characteristics and the regulatory framework on credit risk. The theoretical literature highlights the business cycle itself as a systematic factor influencing bank losses (Carey, 1998; Ruckes, 2004). By increasing the net present value of investments and borrowers' repayment capacity, improved macroeconomic conditions tend to reduce the risk of loan defaults. A number of empirical studies[3] confirms this view by establishing a negative relationship between non-performing loans and economic growth in advanced economies, along with employment (Nkusu, 2011; Castro, 2013).

[3] For extensive reviews, see Beck et al. (2015), Škarica (2014) and Zhang et al. (2016).

Other research has emphasized the role of bank-specific characteristics in explaining non-performing loans. For instance, Salas and Saurina (2002) find that credit risk in Spain is not only explained by GDP growth but also by bank size, cost efficiency and the net interest margin (see also Quagliarielli (2007) for Italy). For Greek banks, Louzis et al. (2012) find that portfolio risks are related to the quality of bank management and macroeconomic conditions (GDP growth, unemployment, interest rates, public debt). Similar findings are reported by Klein (2013) for 16 European countries and Ghosh (2015) for the United States who find that credit risks are linked to bank size, profitability, cost efficiency, capitalization, loan growth and macroeconomic factors.

Studies focusing on developing countries have highlighted their vulnerability to external factors. For 16 Sub-Saharan African countries, Fofack (2005) finds evidence that non-performing loans have been driven by macroeconomic volatility, reflecting the influence of external shocks and insufficient economic diversification. In addition, he highlights that the real interest rate, real exchange rate, economic growth, net interest margin and interbank lending are significant determinants of non-performing loans. Love and Turk Ariss (2014) find for Egyptian banks that positive shocks to capital inflows and GDP growth improve banks' loan quality. For four African countries (Kenya, Uganda, Zambia and Nigeria), Brownbridge (1998) finds that credit risks are linked to insider lending which itself depends on the concentration of ownership, political pressure and the degree of capitalization. For the Middle East and North Africa (MENA) region, Boudriga et al. (2009) find that foreign participation, coming especially from developed countries, and the institutional environment have a significant impact on non-performing loans.

Other research has addressed the relationship between the regulatory framework and credit risk (Jappelli and Pagano, 2002; Barth et al., 2004; Fernandez and

Gonzalez, 2005; Houston et al. (2010); Klomp and de Haan, 2012; Chen et al., 2017). For instance, Barth et al. (2004) and Fernandez and Gonzalez (2005) show that private monitoring reduces credit risks by increasing market discipline. Klomp and de Haan (2012) find for banks from OECD countries that supervisory, capital and market entry regulations have an effect on capital and asset risk, while supervisory control and regulations on activity restrictions, private monitoring, market entry restrictions, and liquidity influence liquidity and market risk. Finally, Jappelli and Pagano (2002) as well as Houston et al. (2010) find that greater information sharing is associated with lower bank risk.

The empirical validation of the competition-stability nexus faces a number of challenges. Apart from the fact that the relationship might change over time or depend on the country or region considered, there are potential measurement errors and issues related to endogeneity. One difficulty relates to the measurement of competition. Earlier studies tended to use the Herfindahl-Hirschman index (HHI) or n-firm concentration ratio as an exogenous indicator of market power or inverse indicator of competition (Berger et al., 2004).[4] These measures however have been criticized because the market shares of all sizes and types of banks are treated equally in the computation. In reality, responses to higher market shares might differ across large/small, foreign/domestic, or public/private banks. Moreover, Claessens and Laeven (2004) argue that such measures of banking system concentration do not necessarily capture the degree of effective competition, as it depends on the contestability of the system. More recent studies have thus moved to the industrial organization literature and use financial information on banks' pricing and cost structure to infer their market power. These measures typically use price mark-ups or

[4] 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 followed by the HHI (27%) and the n-firm concentration ratio (16%).

demand elasticities and include the Lerner index, Boone indicator, or H-statistic. In our econometric analysis, we will use the Lerner index but cross-check our results with other measures of competition.

The second challenge relates to the measurement of risk which can be measured indirectly for individual banks or the entire system.[5] A commonly used measure of individual bank risk is the non-performing loan ratio which only covers the credit risk of a bank's overall risk profile (Beck, 2008). Even though bank failures and credit risks are typically highly correlated, especially in small and retail-oriented banking systems, banks might hedge credit risks through diversified asset portfolios or set aside capital to cope with eventual credit defaults. Other studies have used the Z-Score or distance-to-default (Boyd and Runkle, 1993; Lepetit et al., 2008; Laeven and Levine, 2009; Čihák and Hesse, 2010). Even though the Z-Score is a measure of a bank's overall risk, its empirical implementation is challenging as the standard deviation of the return on assets is often estimated by a rolling-window with small sample sizes in large panel settings. To the extent that similar concerns apply to our data on African banks, we decided to use the non-performing loan ratio but check for robustness using other measures of bank risk (such as impaired loan reserves and the Z-Score). And finally, the estimations may be subject to endogeneity as prices, profitability, risk and concentration are jointly determined (Bresnahan, 1989; Berger et al., 2004). As a result, we have to use instruments for our concentration measure and the other bank-specific characteristics in the econometric investigation.

3. Data description

We obtain bank-level data on financial statements from Fitch Connect over the period 2000-15. Our initial sample covers 526 financial institutions located in 37 Sub-

[5] Many studies use the term financial stability to refer to both bank-level stability and banking sector stability, as justified by, amongst others, Carletti and Hartmann (2002), Beck (2008) and Vives (2010).

Saharan Africa countries. Where possible, we gather consolidated financial statements of banks making the assumption that banks manage the entire set of assets on a consolidated basis. If no consolidated statement exists, we use the unconsolidated financial statement. Our study focuses on the credit risk of deposit-taking institutions and as consequence, we exclude non-deposit-taking institutions from the sample.[6] Further, we eliminate banks and countries from the study for which we were unable to obtain relevant information to compute non-performing loans[7] or the macroeconomic and regulatory variables to parameterise the empirical model. After applying our filters, the final sample covers 221 deposit-taking institutions from 33 Sub-Saharan African countries.[8] 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 other emerging markets).

Table 1 reports the list and summary information for the sampled countries. As can be seen, total assets of the banks amounted to 310 billion USD at the end of 2015, corresponding to an average of 21.5 percent of GDP (or 72% of the entire SSA banking sector).[9] The lowest asset-to-GDP ratios are observed in Gabon, Equatorial Guinea, Chad and Democratic Republic of the Congo (below 5%), whereas in Cape Verde and Kenya bank assets amounted to more than 65% of GDP. These figures clearly point to the fact that the banking sectors in the region are still in the early stage of development and that financial deepening is low. Banks in the region faced

[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.

[7] Some banks do not publicly disclose certain balance sheet items including impaired loans.

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

[9] At the end of 2015, total assets of the entire banking sector (excluding South Africa) amounted to 429 billion USD (Jacolin and Noah, 2017).

a much higher fraction of non-performing loans compared to advanced economies (see Figure 1). On average, 8.4% of loans have become non-performing in SSA (compared to 1.8% in the advanced economies) over the entire sample period, even though there is important cross-country variation (see also Table 1). Moreover, as can be observed non-performing loans have declined importantly during the period 2000-08, however, since 2009 credit risks have increased and peaked in 2010 and 2015, respectively. The recent development is likely to be associated with the drop in commodity prices, the Nigerian banking crisis of 2009, and the regional slowdown in economic growth. In parallel, Figure 2 shows that market power (measured by the Lerner index) has decreased over time, reflecting changes in the African banking sector such as an increase in number of banks and a rapid expansion of pan-African banks in recent years (Enoch et al. 2015; Jacolin and Noah, 2017).

4. Econometric framework

4.1 Baseline model

To examine the determinants of credit risks, we use a dynamic panel regression. The baseline model is specified as follows:

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

where NPL_{ijt} denotes the non-performing loan ratio 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, and 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 (Salas and Saurina, 2002; Louzis et al., 2012; Jiménez et al., 2013).

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 that have been 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), capitalization (total equity divided by total assets), and bank size (logarithm of total assets). We instrument all these variables by their lagged values in order to mitigate any possible endogeneity problem, we may have in our model specification (Roodman, 2009).

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

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

The relationship between credit risk and bank competition can then be summarized by:

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

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 (as measured inversely by the Lerner index). In such a case, at lower levels, increased competition would be associated with lower credit risks (competition-stability view). However, once a certain threshold of competition is reached, heightened competition would lead to higher credit risks (competition-fragility view).

4.2 Bank competition indicator

We decided to measure bank competition by the Lerner index which is a measure of a bank's market power and defined as the ratio between the mark-up (price minus

marginal cost) and price, and it should be zero in perfect competition but will increase in less competitive banking markets. By taking this measure, we make the assumption that there is a one-to-one mapping between market structure and competitive behaviour of banks: less competitive banking markets enhance market power and are associated with a higher Lerner index. The conventional form of Lerner index can be computed as follows:

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

where P_{it} is the average price of the banking output of bank i at time t, and MC_{it} is the marginal cost. The price is measured by the implicit interest rate on loans (interest income divided by total loans), whereas banking output is measured by the stock of outstanding loans, as has been done in Solís and Maudos (2008), Williams (2012) and Lapteacru (2017). Marginal costs are calculated via the estimation of the following trans-log cost function:

$$\ln(\boldsymbol{TC_{it}}) = \boldsymbol{\alpha_0} + \boldsymbol{\alpha_1}\ln(\boldsymbol{Q_{it}}) + \frac{1}{2}\boldsymbol{\alpha_2}\ln(\boldsymbol{Q_{it}})^2 + \sum_{n=1}^{3}\boldsymbol{\beta_n}\ln(\boldsymbol{w_{int}}) + \sum_{m=1}^{3}\sum_{n=1}^{3}\boldsymbol{\beta_{mn}}\ln(\boldsymbol{w_{imt}w_{int}}) + \sum_{n=1}^{3}\boldsymbol{\gamma_n}\ln(\boldsymbol{Q_{int}})\ln(\boldsymbol{w_{int}}) + \boldsymbol{\delta_1 T} + \frac{\delta_2}{2}\boldsymbol{T^2} + \boldsymbol{\delta_3 T}\ln(\boldsymbol{Q_{it}}) + \sum_{k=1}^{3}\boldsymbol{\varphi_k T}\ln(\boldsymbol{w_{ikt}}) + \boldsymbol{\varepsilon_{it}} \quad (5)$$

Total costs TC_{it} are measured by the sum of personnel expenses, other non-interest and interest expenses, output Q_{it} by total loans, and w_{int} are three input prices (i.e., for labour, capital and funding). The price of labour 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 time trend (T) and various interaction terms to control for unobserved determinants of total costs that are common to all banks over the time (such as technical progress) and other time-variant factors (Maudos and Fernández de Guevara, 2004, 2007; Turk Ariss, 2010).

The estimated coefficients of the total cost function are then applied to compute marginal cost:

$$\boldsymbol{MC_{it}} = \frac{\partial TC_{it}}{\partial Q_{it}} = \frac{TC_{it}}{Q_{it}}\left(\alpha_1 + \alpha_2 \ln(Q_{it}) + \sum_{n=1}^{3} \gamma_n \ln(w_{int}) + \delta_3 T\right) \quad (6)$$

Koetter et al. (2012) argue that the conventional approach of computing the Lerner index 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 would 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:

$$\textbf{Adjusted Lerner}_{\mathbf{it}} = \frac{\widehat{\mathbf{PBT}}_{\mathbf{it}} + \widehat{\mathbf{TC}}_{\mathbf{it}} - \widehat{\mathbf{MC}}_{\mathbf{it}}}{\widehat{\mathbf{PBT}}_{\mathbf{it}} + \widehat{\mathbf{TC}}_{\mathbf{it}}} \quad (7)$$

where $\widehat{PBT_{it}}$ and $\widehat{TC_{it}}$ are the predicted values of pre-tax profit and total cost, respectively, scaled by bank output (total loans). We estimate Equation (5) by employing a Stochastic Frontier Approach (SFA) with the cost efficiency option and extract $\widehat{TC_{it}}$ and $\widehat{MC_{it}}$. To estimate $\widehat{PBT_{it}}$, we use pre-tax profit as the dependent variable in the Equation (5) and run the SFA with the production efficiency option (Berger and Mester, 2003; Bos and Koetter, 2011).[10]

4.3 Other control variables

The net interest margin (NIM) is calculated as the ratio of gross interest and dividend income minus total interest expenses to total assets. The effect of the net interest margin on credit risks is ambiguous. On the one hand, higher margins could be an indication of higher credit risks, because they may point to banks that charge high interest rates due to a risky credit portfolio and/or the anticipation of losses (Angbazo, 1997; Maudos and Fernández de Guevara, 2004; Carbo and Rodriguez,

[10] The adjusted version of the Lerner index has also been used by Clerides et al. (2015), Kasman and Kasman (2015) and Lapteacru (2017).

2007). On the other hand, higher margins provide banks with an additional cushion to absorb adverse shocks, increase franchise values and thus lead to lower risk-taking incentives.

Loan growth is considered as a major determinant of loan defaults (Podpiera and Weill, 2008, Jiménez 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 strong credit growth. But excessive growth can result in 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 use the loan-to-assets ratio to measure banks' credit growth history, as banks with larger loan portfolios are likely to have grown faster in the past, similar to Ghosh (2015) and Klein (2013).

Income diversification is measured by non-interest income as a proportion of total assets. The relationship between non-performing loans and income 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 some banks may also neglect screening and monitoring of borrowers when focusing on non-banking activities.[11]

Capitalization is measured by the leverage ratio (total equity as a proportion of total assets), much like Louzis et al. (2012), Klein (2013), and Zhang et al. (2016). The impact of bank capitalization on credit risk is ambiguous. On the one hand, a higher capitalization may reflect that the bank is more risk averse and thus operates with higher capital buffers and potentially with less non-performing loans. On the other hand, higher capitalization may be an indication that a bank's regulatory capital

[11] Also see Wagner (2010).

requirements are high due to a riskier asset portfolio. Managers in banks with low equity ratios (high leverage) may have incentives to engage in riskier banking activities, while releasing expenses on credit scoring and the monitoring of borrowers (Keeton and Morris, 1987; Berger and DeYoung, 1997).

Bank size (natural logarithm of total assets) is another potential determinant of credit risks. 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 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; Brei and Gadanecz, 2012), and they hence may operate with higher non-performing loan ratios.

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; Klein, 2013). 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 price fluctuations, we expect a feedback loop between public revenue, spending and public debt on the one hand and defaults of both households and firms (through the accumulation or arrears for instance) on the other.

We control for both economic structure and the institutional environment. Following Fofack (2005), we include a measure of economic concentration[12] to capture macroeconomic vulnerability to external shocks. We expect a positive link between economic concentration and credit risk in Sub-Saharan Africa where most export sectors depend on external commodity demand. 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 the rule of law to capture the quality of contract enforcement, property rights, and the political and legal system (Kaufmann et al., 2011).

5. Results

We estimate four separate models for non-performing loans. The first includes the bank-specific control variables and simple term of the adjusted Lerner index, the second in addition its square, and the third includes on top macroeconomic variables. The final specification incorporates all four sets of determinants: bank competition, bank-specific variables, macroeconomic and 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, confirming the persistence of credit risk over time. This reflects that non-performing loans remain on the balance sheet for a certain time before they are written off. The Hansen test also validates the instruments used in all model specifications since we cannot reject the null hypothesis that the instruments are exogenous.

[12] Economic concentration is a measure of the degree of product concentration provided by UNCTAD. An index value closer to 1 indicates that a country's trade sector is highly concentrated on a few products. On the contrary, values closer to 0 reflect diversification.

In the linear specification I shown in Table 4, a higher Lerner index (i.e. lower bank competition) is associated with better loan quality, giving support to the competition-fragility view. In specifications II, III and IV, the coefficient of the bank competition indicator is negative for the linear term but positive for the quadratic term and both coefficients are statistically significant. This implies that bank competition has been associated more bank stability, but only up to a certain threshold after which more competition has increased bank fragility in Sub-Saharan Africa. As suggested by Martinez-Miera and Repullo (2010), the results indicate that the reduction in the cost of credit brought about by more competition reduces borrowing costs, improves borrowers' repayment capacity and hence the share of non-performing loans falls. However, as competition further increases, the loss of revenue stemming from price competition across banks erodes their cushions stemming from revenues (margin effect) with adverse effects on risk-taking incentives (Berger et al., 2009; Liu et al., 2013). In specification IV, the inflection point is equal to a Lerner index of 0.59 (compared to an average of 0.49, see Table 3), which suggests that bank competition (lower Lerner index) has improved credit risks only up to this point, below more competition has resulted in an increase of credit risks. Figure 3 visualizes the estimated relationship. For instance, banks from Swaziland, Madagascar, Central African Republic, Chad, Equatorial Guinea, Sierra Leone, and Ethiopia recorded a higher market power than this threshold over the sample period (see Table 1), whereas the banks from the other countries faced higher competition.

Apart from the market power of banks, the only significant bank-specific determinant in Sub-Saharan Africa is the loan-to-assets ratio. Banks that are more involved in lending also report relatively more non-performing loans. This could be related to a high past growth of the loan book or lower screening standards due to

the relatively higher cost of borrower screening and monitoring compared to other types of investments. 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 non-performing loans, suggesting a feedback loop between the fiscal stance of public sector, credit ratings for corporates, and credit risk. Economic concentration has an adverse effect on non-performing loans pointing to the vulnerability of highly concentrated economies to external shocks.

Next, we examine whether the ownership of banks and their size has an impact on the relationship between bank competition and credit risk. To this purpose, we interact the Lerner index and its square with different indicator variables on: (i) foreign banks, (ii) foreign banks with headquarters in the advanced economies, (iii) foreign banks from the African region, (iv) government-owned banks, and (v) large banks. The different bank types are identified using a dummy variable that is equal to one if a bank is controlled by a foreign institution (48 entities are from the advanced economies, 86 from Africa) or a governmental institution (17 entities). The bank size variable is measured by a dummy variable that is equal to one if the relative size of a bank (total assets to the country's total assets) is larger than the 75^{th} percentile of the distribution.

There is no consensus in the empirical literature on the impact of foreign bank entry on stability. On the one hand, foreign banks might be a source of stability in periods of local stress by virtue of their geographic diversification and access to internal capital markets (Dages et al., 2000; Crystal et al., 2001; De Haas and Van Lelyveld, 2010). Set against those benefits are fears of contagion from external crises, aggressive growth strategies, or the crowding-out of domestic lending to small firms (Peek an Rosengren, 2000; Clarke et al., 2005; Claessens and van Horen, 2012; De Haas and Van Lelyveld, 2014; Mian, 2006; Gormley, 2010; Chen et al., 2017). The

results reported in columns V to VII of Table 5 suggest that in Sub-Saharan Africa foreign ownership (independent of the headquarters' origin) did not influence the U-shaped relationship between bank competition and credit risk.

Recent research also has focused on differences in the way private and state-owned banks may compete, a topic of interest in developing nations where state-owned institutions often hold substantial market shares. State-owned banks may have objectives other than profit maximization, such as fostering export, sectoral or regional development, or they may take into account lending externalities (Brei and Schclarek, 2015). In addition to their impact on these market segments where lending can be unprofitable and risky, these institutions usually operate with government subsidies and may be subject to politically connected lending problems, reducing market discipline and the incentives of these to compete (Krueger, 1974; La Porta et al., 2002; Berger et al., 2004). However, as has been highlighted in the literature this depends on the institutional background of a country (Adrianova et al., 2010). As can be observed in column VIII of Table 5, government ownership does not affect the relationship between competition and credit risk in Sub-Saharan Africa after controlling for the quality of public institutions.

The literature has also investigated the impact of bank size on competitive conditions. Relative to large banks, small banks in developed nations tend to serve smaller local customers and provide more retail-oriented financial services (DeYoung et al., 2004). Banks of different sizes may also deliver their services using different technologies, with large banks developing costlier lending technologies (i.e. credit scoring) based on "hard" quantitative data, whereas small banks may rely more on technologies (i.e. relationship lending) based on "soft" information (Stein 2002). As can be observed in column IX of Table 5, we do not find evidence that the competition-stability relationship is affected by the relative size of the banks.

The next set of regressions investigates the impact of external shocks on credit risks. To this end, we include a variable identifying the global financial crisis (equal to one during 2008-10) and the commodity price shock of 2015 (equal to one in 2015). Our findings confirm the view that the African banking sector has been spared by the global financial crisis which might be due to the lower international exposure of local financial systems (Table 5, column X), but it has been vulnerable to the recent reversal in commodity prices (Table5, column XI).

We also inspect the effect of financial development on loan quality by using a measure on financial depth (domestic credit to the private sector divided by GDP) and the number of bank branches that operate in a given country (as a financial inclusion measure). As suggested by Honohan and Beck (2007), small financial systems are usually associated with inefficiencies in financial intermediation (e.g. due to high fixed costs). A more extensive coverage of bank branches helps reducing information asymmetries through better monitoring of borrowers. A large network of branches also provides better geographical coverage of banking services and thus diversification of local shocks, and it facilitates the transition from the informal to the formal sector. Our results indicate that both indicators reduce credit risks (Table 5, columns XII and XIII) suggesting that policies aimed at improving financial deepening and financial inclusion both lead to improvements in loan quality.

Finally, the literature has considered the regulatory framework as an important determinant of bank stability (e.g., Jappelli and Pagano, 1993, 2002; Houston et al. 2010, Barth et al., 2013a; Laeven and Levine, 2009). As suggested by Jappelli and Pagano (1993, 2002), information sharing among lenders attenuates the problems of information asymmetries, and can therefore increase lending activity and reduce default probabilities. In line with these studies, we investigate the impact of information sharing using data provided by the World Bank (Doing Business

database).[13] We find that credit bureau (registry) coverage is associated with lower credit risk in SSA (Table 5, column XIV). This implies that loan quality is higher in countries where lenders share information, irrespective of the public or private character of the information sharing mechanism. Next, we use data provided by Barth et al. (2013)[14] and examine the impact of bank entry requirements and longer supervisor tenure on credit risk.[15] While bank entry requirements are not significant (Table5, column XV), longer supervisor tenure is associated with higher credit risk (Table5, column XVI). This result suggests a need to improve supervision quality, to the extent that supervisor mobility or turnover is an indicator of staff quality. Further research is however welcome to disentangle how the determinants of staff turnover (availability of staff and administrative capacity, experience and training, corruption) interplay to justify this result.

6. Robustness checks

In this section, we discuss several tests applied to assess further robustness of our regression results. To test whether the results are biased by larger banking markets[16], we excluded in our regressions Angola, Ghana, Kenya, Nigeria and Tanzania, respectively. The results reported in Table 6 (columns XVII-XXI). The U-shaped relationship between bank competition and credit risk remains valid.

Second, we test whether the results are sensitive to the measure of bank competition and use the Herfindahl-Hirschman index (HHI). It is calculated by summing the

[13] We measure information sharing by credit bureau (registry) coverage, which is defined as the number of individuals and firms listed in a credit bureau or registry.

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

[15] "Bank entry requirements" is an index that ranges from 0 to 8 and a higher index value indicates greater stringency. "Longer supervisor tenure" is equal to 1 if the average tenure of current supervisors is greater than 10 years (which corresponds to the 75th percentile of distribution).

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

squares of the market share of each bank in a country's banking sector.[17] Two specifications are estimated, the first only includes the HHI and the second includes in addition its square. We find similar results as before on the U-shaped relationship between bank competition and credit risk (Table 6, columns XXII and XXIII).

Third, we use two alternative measures of bank risk: (i) loan loss provisions as a ratio over total loans (Fungáčová and Weill, 2013; Beck et al., 2013b) and (ii) the Z-score (Laeven and Levine, 2009; Houston et al., 2010; Tabak et al., 2012; Chen et al. 2017). The Z-score is a measure of overall bank risk and it captures how distant a particular bank is from insolvency. It is calculated as follows:

$$\mathbf{Z-score_{ijt}} = \frac{\overline{\mathbf{ROA_{ijt}}}+\mathbf{Equity_{ijt}}}{\boldsymbol{\sigma}(\mathbf{ROA})_{\mathbf{ijt}}} \quad (8)$$

where ROA_{ijt} denotes the return on assets of a bank (with the mean in the numerator), $Equity_{ijt}$ represents the ratio of total equity over total assets, and $\sigma(ROA)_{ijt}$ is the standard deviation of ROA. A higher score suggests a lower probability of bank insolvency. With implementation of both measures (using a 3-year rolling window to estimate the mean and standard deviation), the U-shaped relationship between credit risk and bank competition remains significant.

As outlined previously, competition affects credit risk through two channels: operational efficiency and profitability. We assess the importance of these channels by replacing the dependent variable with a bank inefficiency indicator (non-interest expenses over total assets), and a profit margin measure (net income over total revenue). The results are reported in Table 7. We also find a non-linear relationship between bank competition, inefficiency and profitability. More specifically, the findings suggests that an increase in competition initially increases bank profitability by efficiency gains associated with better practices (reduction in administrative

[17] The database on the HHI was developed at the Banque de France using BankScope and Fitch Connect as well as reports from individual banks.

expense, lower cost of borrower screening and monitoring). Above a certain threshold, however, further competition is associated with lower profit margins and higher inefficiencies enticing banks to engage in riskier activities.

7. Conclusion

While this study mainly investigates the relationship between competition and credit risk, this paper sheds light on many other determinants of credit risk in Sub-Saharan Africa. Its results are thus both informative and important for policy makers concerned with financial stability in developing countries.

First, in line with recent literature on this topic, we find robust evidence of a non-linear or U-shaped relationship between bank competition and credit risk. Our results suggest that the efficiency gains of heightened bank competition have to be counterweighted against the potential risks. The channels by which increased competition increases 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. As competition increases, there is thus need for policies that specifically target the financial stability of deeper and more integrated banking systems.

Second, our study sheds light on the importance of business cycles, economic structure and financial deepening in determining credit risks. More diversified countries experience lower levels of non-performing loans. Both financial deepening and financial inclusion may help to manage credit risk, for instance by lowering the concentration of bank portfolios. Our study also highlights the impact of government deficits and indebtedness in determining 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 the activity of small firms – and further work is needed to study the components of this feedback loop between the fiscal stance, bank liquidity and solvency.

Finally, our results contribute to the current debate on the importance of the business environment in which banks operate. Our study points to the impact of credit registries in lowering credit risk, suggesting that other structural and institutional characteristics (quality of accounting, fiscal issues, easy mobilization of collateral, and the reduction of the informal sector) may be instrumental in reducing information asymmetries. Turning to regulatory and prudential frameworks, our study finds that, while much attention has been given to household credit in developed countries, the banks-sovereign nexus appears to play an important role in Sub-Saharan African countries. This suggests that authorities should monitor closely rising public indebtedness and public net liabilities in bank portfolios, particularly when facing exogenous shocks and economic turnarounds, as since 2014-15. The quality of supervision also matters in reducing the share of non-performing ratios, pointing to the need to reinforce staff and administrative capacity of domestic supervisors.

We believe further research is needed to uncover credit risk determinants specific to developing countries, as well as macrofinancial (or prudential) regulations that will not hinder the financial development necessary for their economic development while ensuring the financial stability necessary to make it sustainable.

References

Agoraki, M.-E.K., Delis, M.D., Pasiouras, F., 2011. Regulations, competition and bank risk-taking in transition countries. Journal of Financial Stability 7, 38–48.

Allen, F., Gale, D., 2000. Comparinf financial systems. MIT press.

Allen, F., Gale, D., 2004. Competition and financial stability. Journal of Money, Credit, and banking 36, 453–480.

Andrianova, S., Demetriades, P., Shortland, A., 2010. Is Government Ownership of Banks Really Harmful to Growth? DIW Berlin Discussion Paper.

Angbazo, L., 1997. Commercial bank net interest margins, default risk, interest-rate risk, and off-balance sheet banking. Journal of Banking & Finance 21, 55–87.

Arellano, M., Bover, O., 1995. Another look at the instrumental variable estimation of error-component. Journal of Econometrics 68, 29-51.

Barth, J.R., Caprio Jr, G., Levine, R., 2013. Bank Regulation and Supervision in 180 Countries from 1999 to 2011. Journal of Financial Economic Policy 5, 111–219.

Barth, J.R., Caprio, G., Levine, R., 2004. Bank regulation and supervision: what works best? Journal of Financial intermediation 13, 205–248.

Beck, R., Jakubik, P., Piloiu, A., 2015. Key determinants of non-performing loans: new evidence from a global sample. Open Economies Review 26, 525–550.

Beck, T., 2008. Bank Competition and Financial Stability: Friends or Foes? World Bank Policy Research Working Paper.

Beck, T., De Jonghe, O., Schepens, G., 2013a. Bank competition and stability: cross-country heterogeneity. Journal of financial Intermediation 22, 218–244.

Beck, T., Demirgüç-Kunt, A., Levine, R., 2006. Bank concentration, competition, and crises: First results. Journal of Banking & Finance 30, 1581–1603.

Beck, T., Demirgüç-Kunt, A., Merrouche, O., 2013b. Islamic vs. conventional banking: Business model, efficiency and stability. Journal of Banking & Finance 37, 433–447.

Berger, A.N., Demirguc-Kunt, A., Levine, R., Haubrich, J.G., 2004. Bank Concentration and Competition: An Evolution in the Making. Journal of Money, Credit, and Banking 36, 433–451.

Berger, A.N., DeYoung, R., 1997. Problem loans and cost efficiency in commercial banks. Journal of Banking & Finance 21, 849–870.

Berger, A.N., Klapper, L.F., Turk-Ariss, R., 2009. Bank competition and financial stability. Journal of Financial Services Research 35, 99–118.

Berger, A.N., Mester, L.J., 2003. Explaining the dramatic changes in performance of US banks: technological change, deregulation, and dynamic changes in competition. Journal of Financial Intermediation 12, 57–95.

Birchwood, A., Brei, M., Noel, D.M., 2017. Interest margins and bank regulation in Central America and the Caribbean. Journal of Banking & Finance 85, 56–68.

Bonaccorsi di Patti, E., Dell'Ariccia, G., 2004. Bank Competition and Firm Creation. Journal of Money, Credit, and Banking 36, 225-251.

Boot, A.W.A., Thakor, A.V., 1993. Self-Interested Bank Regulation. The American Economic Review 83, 206–212.

Bos, J.W.B., Koetter, M., 2011. Handling losses in translog profit models. Applied Economics 43, 307–312.

Boudriga, A., Boulila Taktak, N., Jellouli, S., 2009. Banking supervision and nonperforming loans: a cross-country analysis. Journal of financial economic policy 1, 286–318.

Boyd, J.H., De Nicolo, G., 2005. The theory of bank risk taking and competition revisited. The Journal of finance 60, 1329–1343.

Boyd, J.H., Runkle, D.E., 1993. Size and performance of banking firms: Testing the predictions of theory. Journal of Monetary Economics 31, 47–67.

Brei, M., Gadanecz, B., 2012. Public Recapitalisations and Bank Risk: Evidence from Loan Spreads and Leverage. BIS Working paper.

Brei, M., Gambacorta, L., 2016. Are bank capital ratios pro-cyclical? New evidence and perspectives. Econ Policy 31, 357–403.

Brei, M., Schclarek, A., 2015. A theoretical model of bank lending: Does ownership matter in times of crisis? Journal of Banking & Finance 50, 298–307.

Bresnahan, T.F., 1989. Empirical studies of industries with market power, in: Handbook of Industrial Organization.

Elsevier, pp. 1011–1057.
Brock, P.L., Suarez, L.R., 2000. Understanding the behavior of bank spreads in Latin America. Journal of development Economics 63, 113–134.
Brownbridge, M., 1998. Financial distress in local banks in Kenya, Nigeria, Uganda and Zambia: causes and implications for regulatory policy. Development Policy Review 16, 173–188.
Caminal, R., Matutes, C., 2002. Market power and banking failures. International Journal of Industrial Organization 20, 1341–1361.
Carbo-Valverde, S.C., Fernández, F.R., 2007. The determinants of bank margins in European banking. Journal of Banking & Finance 31, 2043–2063.
Carey, M., 1998. Credit risk in private debt portfolios. The Journal of Finance 53, 1363–1387.
Carletti, E., Hartmann, P., 2002. Competition and stability: What's special about banking? ECB Working paper No. 146.
Castro, V., 2013. Macroeconomic determinants of the credit risk in the banking system: The case of the GIPSI. Economic Modelling 31, 672–683.
Cerasi, V., Daltung, S., 2000. The optimal size of a bank: Costs and benefits of diversification. European Economic Review 44, 1701–1726.
Chauvet, L., Jacolin, L., 2017. Financial Inclusion, Bank Concentration, and Firm Performance. World Development 97, 1–13.
Chen, M., Wu, J., Jeon, B.N., Wang, R., 2017. Do foreign banks take more risk? Evidence from emerging economies. Journal of Banking & Finance 82, 20–39.
Čihák, M., Hesse, H., 2010. Islamic Banks and Financial Stability: An Empirical Analysis. J Financ Serv Res 38, 95–113.
Claessens, S., Laeven, L., 2004. What Drives Bank Competition? Some International Evidence. Journal of Money, Credit, and Banking 36, 563–583.
Claessens, S., Van Horen, N., 2012. Being a foreigner among domestic banks: Asset or liability? Journal of Banking & Finance 36, 1276–1290.
Clarke, G.R.G., Cull, R., Martinez Peria, M.S., Sanchez, S.M., 2005. Bank Lending to Small Businesses in Latin America: Does Bank Origin Matter? Journal of Money, Credit and Banking 37, 83–118.
Clerides, S., Delis, M.D., Kokas, S., 2015. A new data set on competition in national banking markets. Financial Markets, Institutions & Instruments 24, 267–311.
Craig, B.R., Dinger, V., 2013. Deposit market competition, wholesale funding, and bank risk. Journal of Banking & Finance 37, 3605–3622.
Crystal, J., Dages, B.G., Goldberg, L.S., 2001. Does Foreign Ownership Contribute to Sounder Banks in Emerging Markets? The Latin American Experience. FRB of New York Staff Report.
Dages, B.G., Goldberg, L.S., Kinney, D., 2000. Foreign and Domestic Bank Participation in Emerging Markets: Lessons from Mexico and Argentina. Economy Policy Review 6.
De Haas, R., Van Lelyveld, I., 2010. Internal capital markets and lending by multinational bank subsidiaries. Journal of Financial Intermediation 19, 1–25.
De Haas, R., Van Lelyveld, I., 2014. Multinational Banks and the Global Financial Crisis: Weathering the Perfect Storm? Journal of Money, Credit and Banking 46, 333–364.
DeYoung, R., Hunter, W.C., Udell, G.F., 2004. The Past, Present, and Probable Future for Community Banks. Journal of Financial Services Research 25, 85–133.
Diamond, D.W., 1984. Financial Intermediation and Delegated Monitoring. Rev Econ Stud 51, 393–414.
Diamond, D.W., Dybvig, P.H., 1983. Bank Runs, Deposit Insurance, and Liquidity. Journal of Political Economy 91, 401–419.
Dick, A.A., 2006. Nationwide Branching and Its Impact on Market Structure, Quality, and Bank Performance. The Journal of Business 79, 567–592.
Enoch, C., Mathieu, P.H., Mecagni, M., Kriljenko, J.I.C., 2015. Pan-African Banks: Opportunities and Challenges for Cross-Border Oversight. International Monetary Fund.
Farhi, E., Tirole, J., 2012. Collective Moral Hazard, Maturity Mismatch and Systemic Bailouts. American Economic Review 102, 60–93.
Fernández, A.I., González, F., 2005. How accounting and auditing systems can counteract risk-shifting of safety-nets in banking: Some international evidence. Journal of Financial Stability 1, 466–500.
Fofack, H., 2005. Nonperforming Loans in Sub-Saharan Africa: Causal Analysis and Macroeconomic Implications.

World Bank Policy Research Working Paper.
Freixas, X., Ma, K., 2014. Banking Competition and Stability: The Role of Leverage. CEPR Discussion Paper.
Fu, X.M., Lin, Y.R., Molyneux, P., 2014. Bank competition and financial stability in Asia Pacific. Journal of Banking & Finance 38, 64–77.
Fungáčová, Z., Weill, L., 2013. Does competition influence bank failures? Economics of Transition 21, 301–322.
Ghosh, A., 2015. Banking-industry specific and regional economic determinants of non-performing loans: Evidence from US states. Journal of Financial Stability 20, 93–104.
Goetz, M.R., 2017. Competition and bank stability. Journal of Financial Intermediation.
González, L.O., Razia, A., Búa, M.V., Sestayo, R.L., 2017. Competition, concentration and risk taking in Banking sector of MENA countries. Research in International Business and Finance 42, 591–604.
Gormley, T.A., 2010. The impact of foreign bank entry in emerging markets: Evidence from India. Journal of Financial Intermediation 19, 26–51.
Hauswald, R., Marquez, R., 2006. Competition and strategic information acquisition in credit markets. The Review of Financial Studies 19, 967–1000.
Hellmann, T.F., Murdock, K.C., Stiglitz, J.E., 2000. Liberalization, Moral Hazard in Banking, and Prudential Regulation: Are Capital Requirements Enough? The American Economic Review 90, 147–165.
Honohan, P., Beck, T., 2007. Making finance work for Africa. World Bank Publications.
Houston, J.F., Lin, C., Lin, P., Ma, Y., 2010. Creditor rights, information sharing, and bank risk taking. Journal of Financial Economics 96, 485–512.
HU, J.-L., Li, Y., CHIU, Y.-H., 2004. Ownership and nonperforming loans: Evidence from Taiwan's banks. The Developing Economies 42, 405–420.
IJtsma, P., Spierdijk, L., Shaffer, S., 2017. The concentration–stability controversy in banking: New evidence from the EU-25. Journal of Financial Stability 33, 273–284.
Jacolin, L., Noah, A., 2017. The deconcentration of banking systems in Sub-Saharan Africa. Quaterly Selection of Articles - Banque de France Bulletin 47, 43–51.
Jappelli, T., Pagano, M., 1993. Information Sharing in Credit Markets. The Journal of Finance 48, 1693–1718.
Jappelli, T., Pagano, M., 2002. Information sharing, lending and defaults: Cross-country evidence. Journal of Banking & Finance 26, 2017–2045.
Jayaratne, J., Strahan, P.E., 1998. Entry restrictions, industry evolution, and dynamic efficiency: Evidence from commercial banking. The Journal of Law and Economics 41, 239–274.
Jiménez, G., Lopez, J.A., Saurina, J., 2013. How does competition affect bank risk-taking? Journal of Financial Stability 9, 185–195.
Jiménez, G., Salas, V., Saurina, J., 2006. Determinants of collateral. Journal of financial economics 81, 255–281.
Kasman, S., Kasman, A., 2015. Bank competition, concentration and financial stability in the Turkish banking industry. Economic Systems 39, 502–517.
Kaufmann, D., Kraay, A., Mastruzzi, M., 2011. The worldwide governance indicators: methodology and analytical issues. Hague Journal on the Rule of Law 3, 220–246.
Keeley, M.C., 1990. Deposit insurance, risk, and market power in banking. The American Economic Review 1183–1200.
Keeton, W.R., Morris, C.S., 1987. Why do banks' loan losses differ? Economic Review-Federal Reserve Bank of Kansas City 72, 3.
Klein, N., 2013. Non-Performing Loans in CESEE: Determinants and Impact on Macroeconomic Performance. IMF Working Papers.
Klomp, J., Haan, J. de, 2012. Banking risk and regulation: Does one size fit all? Journal of Banking & Finance, Systemic risk, Basel III, global financial stability and regulation 36, 3197–3212.
Koetter, M., Kolari, J.W., Spierdijk, L., 2012. Enjoying the quiet life under deregulation? Evidence from adjusted Lerner indices for US banks. Review of Economics and Statistics 94, 462–480.
Kroszner, R., 2010. Interconnectedness, fragility and the financial crisis. Financial Crisis Inquiry Commission.
Krueger, A.O., 1974. The Political Economy of the Rent-Seeking Society. The American Economic Review 64, 291–303.
La Porta, R., Lopez-de-Silanes, F., Shleifer, A., 2002. Government Ownership of Banks. The Journal of Finance 57, 265–301.
La Porta, R., Lopez-de-Silanes, F., Shleifer, A., Vishny, R.W., 1998. Law and finance. Journal of political economy 106, 1113–1155.

Laeven, L., Levine, R., 2009. Bank governance, regulation and risk taking. Journal of financial economics 93, 259–275.
Lapteacru, I., 2017. Market power and risk of Central and Eastern European banks: Does more powerful mean safer? Economic Modelling 63, 46–59.
Leon, F., 2015a. Does bank competition alleviate credit constraints in developing countries? Journal of Banking & Finance 57, 130–142.
Leon, F., 2015b. Measuring competition in banking: A critical review of methods.
Lepetit, L., Nys, E., Rous, P., Tarazi, A., 2008. Bank income structure and risk: An empirical analysis of European banks. Journal of Banking & Finance 32, 1452–1467.
Liu, H., Molyneux, P., Wilson, J.O., 2013. Competition and stability in European banking: a regional analysis. The Manchester School 81, 176–201.
Louzis, D.P., Vouldis, A.T., Metaxas, V.L., 2012. Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. Journal of Banking & Finance 36, 1012–1027.
Love, I., Ariss, R.T., 2014. Macro-financial linkages in Egypt: A panel analysis of economic shocks and loan portfolio quality. Journal of international financial markets, institutions and money 28, 158–181.
Marchettini, D., Maino, R., 2015. Systemic Risk Assessment in Low Income Countries: Balancing Financial Stability and Development. IMF Working Papers.
Marcus, A.J., 1984. Deregulation and bank financial policy. Journal of Banking & Finance 8, 557–565.
Martinez-Miera, D., Repullo, R., 2010. Does competition reduce the risk of bank failure? The Review of Financial Studies 23, 3638–3664.
Maudos, J., Fernández de Guevara, J., 2004. Factors explaining the interest margin in the banking sectors of the European Union. Journal of Banking & Finance 28, 2259–2281.
Maudos, J., Fernández de Guevara, J., 2007. The cost of market power in banking: Social welfare loss vs. cost inefficiency. Journal of Banking & Finance, Developments in European Banking 31, 2103–2125.
Mian, A., 2006. Distance Constraints: The Limits of Foreign Lending in Poor Economies. The Journal of Finance 61, 1465–1505.
Mishkin, F.S., 1999. Financial consolidation: Dangers and opportunities. Journal of Banking & Finance 23, 675–691.
Ncube, M., 2007. Financial Services and Economic Development in Africa. Journal of African Economies 16, 13–57.
Nkusu, M., 2011. Nonperforming Loans and Macrofinancial Vulnerabilities in Advanced Economies. IMF Working Papers.
Peek, J., Rosengren, E., 2000. Collateral damage: Effects of the Japanese bank crisis on real activity in the United States. American Economic Review 90 (1), 30–45.
Perotti, R., 1996. Fiscal consolidation in Europe: Composition matters. The American Economic Review 86, 105–110.
Petersen, M.A., Rajan, R.G., 1995. The Effect of Credit Market Competition on Lending Relationships. Q J Econ 110,
Podpiera, J., Weill, L., 2008. Bad luck or bad management? Emerging banking market experience. Journal of financial stability 4, 135–148.
Quagliariello, M., 2007. Banks' riskiness over the business cycle: a panel analysis on Italian intermediaries. Applied Financial Economics 17, 119–138.
Roodman, D., 2009. How to do xtabond2: An introduction to difference and system GMM in Stata. The Stata Journal 9, 86-136.
Ruckes, M., 2004. Bank competition and credit standards. Review of Financial Studies 17, 1073–1102.
Salas, V., Saurina, J., 2002. Credit risk in two institutional regimes: Spanish commercial and savings banks. Journal of Financial Services Research 22, 203–224.
Salas, V., Saurina, J., 2003. Deregulation, market power and risk behaviour in Spanish banks. European Economic Review 47, 1061–1075.
Schaeck, K., Cihák, M., 2014. Competition, efficiency, and stability in banking. Financial Management 43, 215–241.
Škarica, B., 2014. Determinants of non-performing loans in Central and Eastern European countries. Financial theory and practice 38, 37–59.
Soedarmono, W., Tarazi, A., 2016. Competition, Financial Intermediation, and Riskiness of Banks: Evidence from the Asia-Pacific Region. Emerging Markets Finance and Trade 52, 961–974.
Solís, L., Maudos, J., 2008. The social costs of bank market power: Evidence from Mexico. Journal of Comparative Economics 36, 467–488.

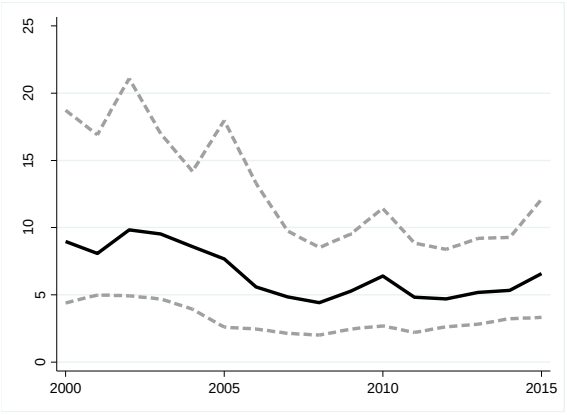
Stein, J.C., 2002. Information Production and Capital Allocation: Decentralized versus Hierarchical Firms. The Journal of Finance 57, 1891–1921.
Stiglitz, J.E., Weiss, A., 1981. Credit rationing in markets with imperfect information. The American economic review 71, 393–410.
Tabak, B.M., Fazio, D.M., Cajueiro, D.O., 2012. The relationship between banking market competition and risk-taking: Do size and capitalization matter? Journal of Banking & Finance 36, 3366–3381.
Turk Ariss, R., 2010. On the implications of market power in banking: Evidence from developing countries. Journal of banking & Finance 34, 765–775.
Vives, X., 2010. Competition and stability in banking. CESifo working paper series No. 3050.
Wagner, W., 2010. Diversification at financial institutions and systemic crises. Journal of Financial Intermediation 19, 373–386.
Williams, J., 2012. Efficiency and market power in Latin American banking. Journal of Financial Stability 8, 263–276.
Yeyati, E.L., Micco, A., 2007. Concentration and foreign penetration in Latin American banking sectors: Impact on competition and risk. Journal of Banking & Finance 31, 1633–1647.
Zhang, D., Cai, J., Dickinson, D.G., Kutan, A.M., 2016. Non-performing loans, moral hazard and regulation of the Chinese commercial banking system. Journal of Banking & Finance 63, 48–60.
Zigraiova, D., Havranek, T., 2016. Bank competition and financial stability: Much ado about nothing? Journal of Economic Surveys 30, 944–981.

Tables and figures

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

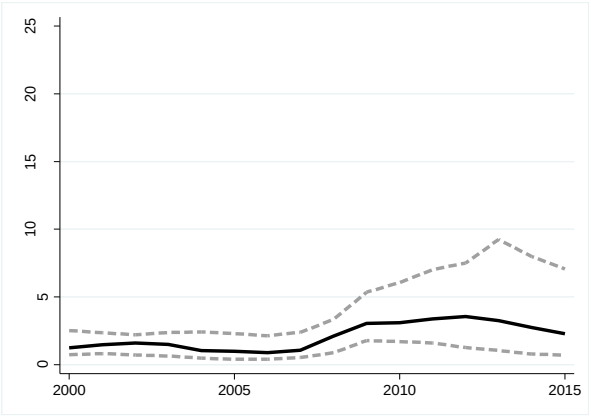
(I) Non-performing loans in Sub-Saharan Africa

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: Market power in Sub-Saharan Africa, 2000-2015

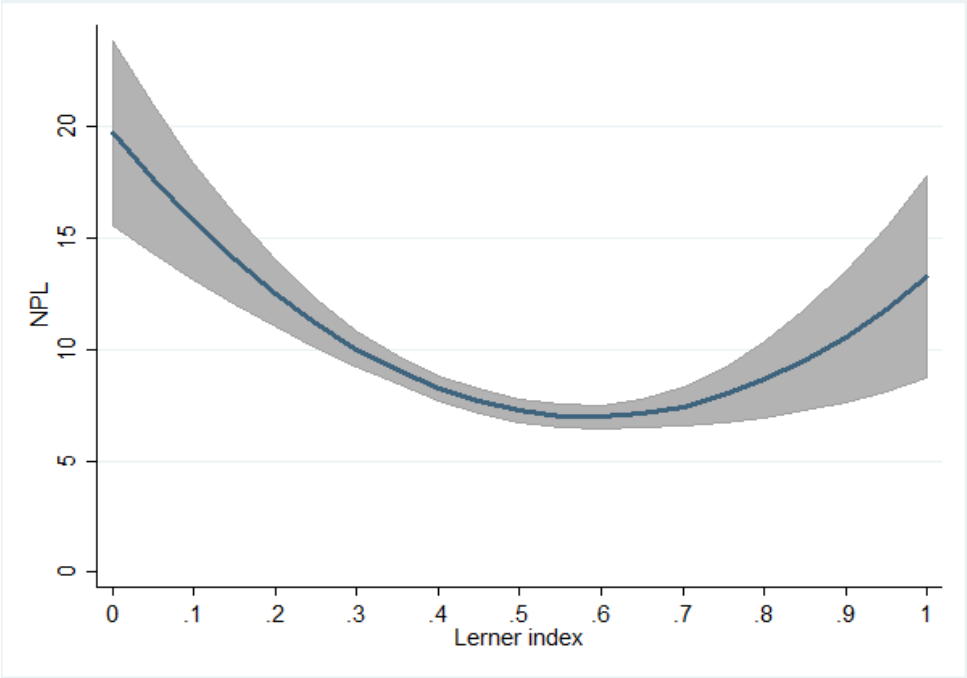
Adjusted Lerner index

Note: The figure provides information on adjusted Lerner index. A lower value indicates more competition. It shows the 25th, 50th (median) and 75th percentiles of the distribution. All values are unweighted averages across banks and countries.

Sources: Fitch Connect and authors' own calculations.

Figure 3: Market power and credit risk in Sub-Saharan Africa

Non-performing loans



Note: The figure shows the relationship between the adjusted Lerner index and the non-performing loan ratio based on regression (IV) in Table 4. The marginal effects are calculated at average values of the regression variables. The shaded area shows 95% confidence bands.

Sources: Fitch Connect and authors' own calculations.

Table 1: Characteristics of the database, 2000–2015

Country	Banks	Foreign banks	NPL (% of loans)	Adjusted Lerner Index	GDP (2015, USD bn.)	Bank assets (2015, USD bn.)	Total assets (2015, % of GDP)	Real GDP growth	CPI inflation
Angola	13	5	7.74	0.55	103.91	43.83	42.18	7.58	38.00
Benin	3	3	9.55	0.46	8.76	1.41	16.11	4.25	2.84
Botswana	10	7	4.50	0.52	16.01	7.04	43.95	4.25	7.72
Burkina Faso	1	1	6.74	0.55	11.67	1.17	9.98	5.51	2.33
Burundi	1	1	12.16	0.53	2.31	0.20	8.69	2.88	10.16
Cameroon	6	5	9.47	0.54	30.43	5.46	17.95	3.95	2.46
Cape Verde	3	2	8.64	0.33	1.82	1.49	82.09	5.13	1.94
Central African Republic	1	1	5.92	0.65	1.43	0.16	11.05	1.85	6.71
Chad	2	1	7.55	0.66	13.36	0.63	4.69	7.62	4.23
Congo, Dem. Rep.	4	4	3.96	0.43	29.70	1.56	5.24	4.9	27.07
Cote d'Ivoire	2	2	9.70	0.39	33.96	3.58	10.53	2.62	2.62
Equatorial Guinea	1	1	19.37	0.68	16.42	0.69	4.22	9.49	5.12
Ethiopia	3	0	7.55	0.74	48.33	16.37	33.88	9.00	12.9
Gabon	2	2	6.00	0.53	18.55	0.55	2.94	2.44	1.93
Ghana	15	11	11.24	0.55	46.50	9.88	21.25	6.25	16.1
Guinea	2	2	11.01	0.54	5.26	0.81	15.43	2.46	14.83
Kenya	35	13	11.00	0.49	52.20	35.32	67.66	4.46	9.72
Lesotho	2	2	4.59	0.50	2.92	0.34	11.60	3.97	7.10
Madagascar	2	2	7.36	0.62	9.93	0.68	6.87	3.2	9.34
Malawi	6	2	9.85	0.58	8.50	1.20	14.07	4.39	15.73
Mali	3	3	12.57	0.46	12.68	1.96	15.48	4.77	2.40
Mozambique	13	11	5.83	0.47	14.3	6.16	43.06	7.43	8.93
Namibia	3	2	1.74	0.41	14.75	4.71	31.91	4.92	6.73
Niger	2	2	5.38	0.56	7.63	0.44	5.72	4.67	2.15
Nigeria	20	3	10.23	0.37	461.85	136.00	29.45	6.84	11.54
Rwanda	4	4	11.62	0.37	8.00	0.66	8.20	7.66	6.53
Senegal	7	5	7.43	0.45	15.77	5.39	34.17	4.04	1.61
Sierra Leone	4	2	25.00	0.69	3.16	0.29	9.21	6.86	8.31
Swaziland	4	3	2.78	0.59	5.22	1.04	19.87	3.26	7.18
Tanzania	20	14	6.57	0.46	43.73	10.49	23.98	6.6	7.66
Togo	1	0	9.44	0.56	4.04	0.56	13.94	2.86	2.62
Uganda	17	15	4.90	0.47	26.26	5.37	20.46	6.5	7.25
Zambia	9	9	8.91	0.43	26.06	4.55	17.44	6.51	13.7
Total*/Average	**221***	**140***	**8.45**	**0.49**	**33.50**	**9.39**	**21.31**	**5.12**	**8.65**

Note: This table provides information for the sample countries. "Banks" denotes the total number of deposit-taking institutions (domestic and foreign) in a given country. Non-performing loans (NPL), real GDP growth and CPI inflation are expressed as percentages and are unweighted averages over the period 2000-2015.

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

Table 2: Description of the variables

Variables	Description	Expected sign	Sources
	Dependent variable		
NPL	Ratio of impaired loans to total loans		Fitch Connect
	Independent variables		
Lerner	Adjusted Lerner Index	+/-	Own estimation
Lerner^2	Adjusted Lerner Index, squared term	+/-	
NIM	Ratio of gross interest and dividend income minus total interest expense to total assets	+	Fitch Connect
Loans	Ratio of gross loans to total assets	+	Fitch Connect
Income diversification	Ratio of total non-interest operating income to total assets	+/-	Fitch Connect
Bank size	Natural logarithm of total assets	+/-	Fitch Connect
GDP growth	Real GDP growth (year-on-year)	-	WDI
Government debt	Government debt as percentage of GDP	+	IMF-WEO
Inflation	Annual inflation rate	+/-	IMF-IFS
Economic concentration	Index of how much a country's economy and trade are concentrated in one or a few products	+	UNCTAD
Rule of Law	Index of agents' perception on the quality of contract enforcement, property rights, the police and the courts.	-	WGI

Table 3: Summary statistics for the regression variables

Variable	Unit	Obs.	Mean	Std. Dev.	Min	Max
NPL	Percentage	1655	8.45	9.00	0.07	58.39
Adjusted Lerner Index	Index	1655	0.49	0.15	-0.20	0.82
NIM	Percentage	1655	5.93	3.34	0.62	31.18
Loans	Percentage	1655	52.80	14.61	8.03	87.95
Income diversification	Percentage	1655	3.87	2.18	0.10	15.36
Capitalization	Percentage	1655	12.90	6.64	0.42	71.82
Bank size	Logarithm	1655	12.82	1.39	8.91	16.33
GDP growth	Percentage	1655	5.56	3.19	-6.91	22.59
Government debt	Percentage	1655	38.74	21.34	7.28	150.23
Inflation	Percentage	1655	9.13	9.00	-1.89	108.90
Economic concentration	Index	1655	0.40	0.23	0.17	0.97
Rule of Law	Index	1655	-0.58	0.50	-1.70	0.67

Note: The sample period goes from 2000 to 2015. "Unit" denotes the measurement units of the regression variables. "Obs." denotes the number of observations for the respective variable. The last four columns show the mean, standard deviation, minimum and maximum.

Table 4: Results for the baseline model

	(I)	(II)	(III)	(IV)
NPL, t-1	0.690***	0.658***	0.645***	0.644***
	(0.062)	(0.068)	(0.068)	(0.070)
Lerner	**-10.679*** **	**-44.880*** **	**-45.081*** **	**-43.410*** **
	(3.334)	**(14.495)**	**(14.173)**	**(13.687)**
Lerner*Lerner		**38.328*** **	**38.617*** **	**36.949*** **
		(14.404)	**(14.110)**	**(13.685)**
NIM		0.007	0.002	0.028
		(0.093)	(0.098)	(0.111)
Loans		**0.045** **	**0.044** **	**0.052** **
		(0.019)	**(0.020)**	**(0.021)**
Income diversification		0.176	0.158	0.135
		(0.153)	(0.161)	(0.160)
Capitalization		0.027	0.045	0.043
		(0.047)	(0.048)	(0.052)
Bank size		-0.067	0.005	-0.120
		(0.125)	(0.122)	(0.135)
GDP Growth			**-0.092** **	**-0.094** **
			(0.045)	**(0.045)**
Government Debt			**0.028*** **	**0.030*** **
			(0.009)	**(0.009)**
Inflation			0.001	-0.002
			(0.016)	(0.017)
Economic Concentration				**1.740** **
				(0.743)
Rule of Law				-0.080
				(0.380)
Constant	7.596***	11.923**	10.571**	10.490**
	(1.843)	(4.787)	(4.804)	(4.691)
Observations	1655	1655	1655	1655
Banks	221	221	221	221
Hansen test (1)	0.450	0.592	0.519	0.500
AR(2) test (2)	0.593	0.388	0.408	0.394
Inflection point (3)		0.585	0.583	0.587

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. (3) Reports the inflection point (threshold) of the relationship between the Lerner index and non-performing loans.

Table 5: Bank type, external shocks and regulation

	(V) Foreign banks	(VI) Foreign, Africa	(VII) Foreign, Developed	(VIII) Public banks	(IX) Large banks	(X) External shocks	(XI)	(XII) Financial development and regulatory factors	(XIII)	(XIV)	(XV)	(XVI)
NPL, t-1	0.643***	0.642***	0.643***	0.643***	0.640***	0.642***	0.649***	0.644***	0.660***	0.644***	0.618***	0.658***
	(0.070)	(0.071)	(0.070)	(0.0702)	(0.069)	(0.069)	(0.068)	(0.068)	(0.076)	(0.076)	(0.089)	(0.073)
Lerner	**-42.923*** **	**-44.454*** **	**-41.195*** **	**-43.046*** **	**-46.731*** **	**-43.951*** **	**-43.729*** **	**-43.789*** **	**-39.976** **	**-38.397** **	**-47.325*** **	**-35.221** **
	(13.325)	**(13.219)**	**(13.786)**	**(13.577)**	**(14.527)**	**(13.235)**	**(13.726)**	**(14.106)**	**(15.804)**	**(16.704)**	**(15.246)**	**(14.800)**
Lerner*Lerner	**37.155*** **	**40.599*** **	**33.376** **	**36.503*** **	**40.316*** **	**37.659*** **	**37.128*** **	**37.034*** **	**31.878***	**31.464***	**41.268*** **	**30.442** **
	(13.86)	**(13.692)**	**(13.857)**	**(13.629)**	**(15.133)**	**(13.135)**	**(13.947)**	**(14.295)**	**(16.423)**	**(17.194)**	**(15.199)**	**(15.443)**
Lerner*Bank type	1.477	9.416	-9.051	-2.854	-1.031							
	(6.741)	(9.218)	(6.798)	(8.751)	(8.362)							
Lerner*Lerner*Bank type	-2.523	-17.916	17.170	4.946	2.258							
	(12.174)	(16.664)	(12.224)	(14.814)	(14.577)							
Financial crisis						0.078						
						(0.254)						
Commodities shock							**0.713***					
							(0.417)					
Financial development								**-0.062** **				
								(0.025)				
Bank Branches									**-0.121** **			
									(0.054)			
Credit registry coverage										**-0.030** **		
										(0.013)		
Bank entry requirements											0.271	
											(0.362)	
Longer Supervisor Tenure												**1.511** **
												(0.602)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1655	1655	1655	1655	1655	1655	1655	1645	1523	1466	1363	1134
Banks	221	221	221	221	221	221	221	221	221	221	197	170
Hansen (1)	0.432	0.422	0.492	0.488	0.380	0.472	0.452	0.465	0.443	0.345	0.228	0.569
AR2 (2)	0.390	0.343	0.373	0.397	0.387	0.391	0.379	0.397	0.257	0.332	0.941	0.788

Note: The sample goes from 2000 to 2015. All estimations are based on the Arellano and Bover (1995) System GMM estimator. In columns (V)-(IX), the adjusted Lerner index is interacted with a dummy for foreign banks (all, Africa, developed countries), public banks, and bank size. The remaining columns include additional regressors in the baseline specification. (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. Robust standard errors are reported in brackets. (***, **, *) indicate significance at the 1%, 5%, 10% level. Significant coefficients are in bold.

Table 6: Robustness checks (1)

	(XVII)	(XVIII)	(XIX)	(XX)	(XXI)	(XXII)	(XXIII)	(XXIV)	(XXV)
	Exclude Angola	Exclude Ghana	Exclude Kenya	Exclude Nigeria	Exclude Tanzania	HHI index		Reserves	Z-Score
Dependent variable, t-1	0.662***	0.667***	0.548***	0.688***	0.680***	0.715***	0.709***	0.702***	0.193***
	(0.071)	(0.072)	(0.091)	(0.069)	(0.072)	(0.066)	(0.067)	(0.067)	(0.061)
Lerner	**-42.667*** **	**-45.048*** **	**-60.998*** **	**-96.764** **	**-39.313** **			**-33.332*** **	**640.113*** **
	(14.434)	**(13.857)**	**(15.480)**	**(43.423)**	**(15.704)**			**(9.023)**	**(224.129)**
Lerner*Lerner	**35.018** **	**39.128*** **	**51.743*** **	**91.760** **	**32.540** **			**29.452*** **	**-713.386*** **
	(14.890)	**(13.855)**	**(15.662)**	**(45.030)**	**(16.021)**			**(9.628)**	**(263.234)**
HHI						**-0.039** **	**-0.183*** **		
						(0.017)	**(0.052)**		
HHI*HHI							**0.003*** **		
							(0.001)		
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1558	1563	1306	1554	1506	1638	1638	1561	1438
Banks	208	206	186	201	201	221	221	217	221
Hansen (1)	0.509	0.467	0.679	0.751	0.611	0.292	0.287	0.363	0.207
AR2 (2)	0.529	0.851	0.256	0.339	0.304	0.843	0.714	0.879	0.172

Note: The sample goes from 2000 to 2015. All estimations are based on the Arellano and Bover (1995) System GMM estimator. 'Exclude' indicates that regressions are done without banks from the particular country, 'HHI' indicates that the Herfindahl-Hirschman Index is used as a measure for competition, 'Reserves' that reserves for problem loans and 'Z-Score' that the Z-Score is the dependent variable. (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. Robust standard errors are reported in brackets. (***, **, *) indicate significance at the 1%, 5%, 10% level. Significant coefficients are in bold.

Table 7: Robustness checks (2)

	(XXVI)	(XXVII)	(XXVIII)	(XXIX)
	Efficiency indicator		Profitability indicator	
Dependent variable, t-1	0.435***	0.273***	0.279***	0.252***
	(0.120)	(0.069)	(0.066)	(0.057)
Lerner	**-6.374*** **	**-18.932*** **	**51.158*** **	**124.632*** **
	(1.477)	**(4.661)**	**(13.232)**	**(27.27)**
Lerner*Lerner		**17.087*** **		**-100.188*** **
		(5.609)		**(29.481)**
Control variables	Yes	Yes	Yes	Yes
Observations	1655	1655	1654	1654
Banks	221	221	221	221
Hansen (1)	0.253	0.321	0.186	0.566
AR2 (2)	0.271	0.564	0.544	0.682

Note: The sample goes from 2000 to 2015. All estimations are based on the Arellano and Bover (1995) System GMM estimator. Efficiency indicator is measured by non-interest expense as a proportion of total assets. We reach to the same results by using cost-income ratio as an alternative measure of bank efficiency. Profitability is measured by the ratio of net income to total banks' revenue. We also use return on equity and the results remain valid. (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. Robust standard errors are reported in brackets. (***, **, *) indicate significance at the 1%, 5%, 10% level. Significant coefficients are in bold.