Does the expansion of regional cross-border banks affect competition in Africa? Indirect evidence

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Abstract

Banking systems in Africa have witnessed profound structural changes in recent years with the penetration of regional cross-border banks. This article investigates how bank competition has evolved in Africa following the expansion of regional cross-border banks. Specifically, this paper examines changes in competition in the banking industry of seven African countries highly affected by the entry of African cross-border banks over the past decade. The evolution of competition is evaluated through three different non-structural measures of competition (Lerner index, Panzar-Rosse model, and Boone indicator). With the exception of the Lerner index, results show an intensification of competition since the mid-2000s. This period corresponds to the rapid expansion of regional cross-border banks in the zone, indicating that the expansion of regional banks has promoted competition in banking sectors in Africa.

Keywords: Bank competition, foreign banks, Africa, NEIO

JEL classification: G20, L1

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1 Introduction

During recent years, cross-border banking has become an increasingly important feature of banking systems in developing and emerging countries. The landscape of banking has substantially changed in Africa through the expansion of regional banks over the past decades (Beck et al., 2014; Claessens and van Horen, 2014a,b). African economies have traditionally had a relatively high share of foreign banks on average. Over the past decade, however, African banking systems have witnessed dramatic transformations with the expansion of regional cross-border banks. Cross-border banks from Africa have not only increased their geographic footprints[1], but have also become economically significant beyond their home countries. A number of these banks hold a significant share of assets in host country banking systems and can be considered as major players.

The expansion of regional banks raises some questions about its effect on competition, financial deepening and inclusion and financial stability across the continent. The effect on competition is probably the most important change in the short-run because incumbents may anticipate future transformations and react by changing their behaviors. Moreover the degree of competition has important implications on the functioning and stability of financial systems in developing countries (Turk Ariss, 2010).

The academic provides nuanced messages about the consequences of foreign and regional banks on competition. Commentators often argue that the entry of foreign banks spurs competition. First, the entry of foreign banks increase the number of players when banks enter in the form of greenfield investment. Second, cross-border banks have a comparative advantage when entering new markets in terms of better access to capital, risk diversification, scale economies, skill and management expertise. Regional banks have an additional competitive advantage dealing with countries sharing similar institutional, cultural and economic characteristics. Their lending technologies and financial products

[1]For instance, Ecobank, a Togolese bank, tripled its affiliated network in Africa between 2000 and 2013 from 11 to 35 countries. United Bank for Africa from Nigeria, increased its footprints from 1 to 19 countries. Other African banks, such as Standard Bank, Bank of Africa, BSIC, Attijariwafa, BMCE, BCP or Access Bank, more than tripled their footprints in Africa over the past decade. Orientating from their home country, these banks have generally expanded first to neighboring countries, then across the region and even across the continent.

are thus more adapted to local context than those offer by foreign banks from outside continents. Ultimately, this will increase competitive pressure on the other players in the banking markets. Several factors, however, may limit the ability of African cross-border banks to increase competition in host markets. First, the entry of new banks can exert any effect on competition in a non-saturated market in which only a fringe of demand is served by incumbents. Second, the effect of foreign banks entry on competition is conditional to market strategies and degrees of engagement in host countries. The entry decision remains often driven by the need to follow their client abroad or the pursuit of business opportunities (Beck et al., 2014). In both cases, entries of foreign banks have a modest impact on the degree of competition in host countries. More skeptics argue that the entry of foreign banks might exert a negative impact on competition in financial systems with limited number of actors. A foreign bank might become a dominant player (especially when a foreign bank enters by acquiring a major incumbent bank) and reduce contestability. In addition, the fact that cross-border banks interact in many markets may reduce their willingness to compete. Multi-market contacts may reinforce collusive behaviors instead of enhancing competition (Bernheim and Whinston, 1990).

The question is whether the expansion of regional in Africa has contributed to raising competition. In this paper, we provide an indirect test by studying the evolution of competition over the period 2002-2009 in a sample of seven West African countries (Benin, Burkina-Faso, Côte d'Ivoire, Mali, Niger, Senegal, Togo). Different measures of competition based on the New Empirical Industrial Organization (NEIO) approach are employed: the Lerner index, the Panzar-Rosse H-statistic and the Boone indicator. Countries under consideration, all members of the West African Economic and Monetary Union (WAEMU), have a major advantage for our purpose. Since the mid-2000s, the WAEMU banking landscape has been dramatically changed through the arrival and expansion of new banks from Africa. African cross-border banks began their expansion in the zone ten years ago, while this change has occurred very recently elsewhere in the continent. This is explained by the presence of two major banking groups in the WAEMU (Ecobank and Bank of Africa) and the proximity of Nigeria and Morocco. As a result, banking groups originate from Africa have become significant actors in these countries. The share of assets held by regional banking groups exceeds today 10% in the seven coun-

tries under consideration. Meanwhile, the Western foreign banks (mainly from France) have reduced their implication in the zone.

The findings reveal that the penetration of regional banks goes hand-in-hand with more competition among banks. Data exploration shows that concentration in the WAEMU's banking industry decreased over the second part of the 2000s. The econometric results show that the degree of competition has increased since the mid-2000s, with the exception of the results from the Lerner index. This period corresponds to the rapid expansion of regional banks in the zone. Put differently, the expansion of regional banks seems to spur competition in Africa.

This paper makes several contributions to the literature on the measures of bank competition in Africa. The NEIO approach has been widely applied to assess the degree of competition in the financial services sector for developed and emerging economies. However, less attention has been paid to Africa due to the lack of reliable data and often focus on the degree of competition at a given period of time in spite of recent dramatic changes in these industries. In addition, there has been a bias towards a handful of former English colonies. Studies focusing on or including other African countries are rather limited (Saab and Vacher, 2007; Fosu, 2013). This essay is the first to employ the NEIO approach to assess the degree of competition in the WAEMU and study evolution of competition over time. Second, there are few studies, even if one includes those on industrialized countries, that compare the results from different non-structural measures of competition. There is no consensus in the literature regarding the best measure by which to gauge competition (Liu et al., 2013). Comparing different models offers a more complete picture of competition insofar as each measure proxies a specific aspect of competition.

This article also contributes to the literature on the effect of foreign banks presence on competition. Papers have documented the impact of entry of foreign banks on bank competition in developing and emerging countries (Claessens and Laeven, 2004; Gelos and Roldos, 2004; Yeyati and Micco, 2007). To our knowledge, no paper has investigated this issue in Africa. In addition, little is known about the importance of the origin of the foreign investors. van Horen (2007) documents that the origin of foreign banks matters to gauge their effect on host financial systems, especially in developing countries. Pohl (2011) provides indirect evidence of the competitive pressure induces by foreign banks

from developing countries in Africa. Foreign bank entry has little effect on domestic banks' net margins. When foreign banks are split out in two groups according to their host country, the results show that the entry of foreign banks from developing countries induces lower margins. These banks force domestic banks to improve their efficiency, certainly by enhancing competition. In this paper, we provide a more direct evidence of the positive effect of penetration of African cross-border banks on competition.

The rest of the paper is organized as follows. Section 2 presents some background information about recent developments in the banking sector in the WAEMU. Section 3 discusses measures of competition and reviews existing studies on Africa. Section 4 details the econometric estimation methods, and Section 5 presents the results. The final section concludes.

2 Recent developments in banking industry

The West African Economic and Monetary Union (WAEMU) is made up of eight countries (Benin, Burkina-Faso, Côte d'Ivoire, Guinea-Bissau, Mali, Niger, Senegal, and Togo), which are members of the Franc Zone and share common banking regulatory and supervisory frameworks. The WAEMU's financial system is bank-based.[2] The WAEMU's banking sector experienced a decade of huge transformation in their structures. In the end of 2012, 105 banks were formally approved compared with 65 banks ten years before. Côte d'Ivoire has the largest number of banks (23) followed by Senegal (19), while only 4 banks operate in Guinea-Bissau. The number of institutions ranges between 10 and 13 in Benin, Burkina-Faso, Mali, Niger, and Togo. The WAEMU banking industry is currently dominated by 9 cross-border banking groups. These banks cumulated two thirds of assets and the three largest groups (*Ecobank*, *Société Générale* and *Bank of Africa*) hold more than a third of assets.

The last decade was a period of profound change in the market structure with the emergence of cross-border banks from Africa. Among the 9 groups dominating the market, 7

[2]The stock and debt markets are not well developed and other segments of financial systems, such as the insurance sector, are still in their infancy. In spite of the rapid growth of microfinance, the microfinance institutions' total loan amount represents only 8% of total bank credit.

originate from Sub-Saharan Africa or North Africa. The crises to the end of the 1980s and subsequent reforms profoundly changed the banking landscape. Some State-owned banks were privatized. The French banks, highly impacted by the crises, left the market (*BIAO* and *Crédit Lyonnais/Crédit Agricole*) or reduced their presence in Africa (*Société Générale* and *BNP Paribas*). At the same time, young African banks have become important actors in the banking industry of the WAEMU. From the 1990s to the mid-2000s, two West African banks (*Ecobank* and *Bank of Africa*) began expanding throughout the zone. Since the mid-2000s, Nigerian (eg. *United Bank for Africa*) and Moroccan banks (eg. *Attijariwafa Bank*, *BCP* and *BMCE*) have also begun to expand their activity in the WAEMU. As a consequence, the African banks have gained market share, while French banks have lost their dominant position. Figure 1 documents that the cumulated market share of the five largest African banking groups in the WAEMU sharply increased over the past decade from 18% in 2003 to 44% in 2010. Meanwhile, the cumulated share of the five non-African largest banking groups decreased from 40% to 17%. In 2003, *Société Générale* and *BNP Paribas* were the two major holdings with 27.5% of market share. They were in 2012 the second and sixth, respectively, with a cumulated market share of 16.2% while *Ecobank* and *Bank of Africa* were in first and third place. While the emergence of pan-African banking groups brings new risks (Beck et al., 2014), this change may also spur competition in the WAEMU banking industry.

[Insert here Figure 1]

Despite the entry of new banks and the expansion of African cross-border banks, a high level of concentration characterizes the WAEMU banking industry. Table 1 shows that the three largest banks hold 60% of assets and the five largest banks 80% of assets. The level of HHI gives a more nuanced picture insofar as its value is lower than 1800 (a value that characterizes the more concentrated market according to the U.S. Anti-trust agency). Côte d'Ivoire is the least concentrated banking market even if the five largest banks hold two thirds of assets. By contrast, the banking market is highly concentrated in Guinea-Bissau. Other countries with a similar number of banks present different levels of concentration. For instance, the Beninese banking industry is more concentrated than the Togolese one due to the domination of two leading banks in Benin. The recent changes

have been followed by a slight decrease in the market concentration. Different indicators of concentration show a downward trend since the mid-2000s in the WAEMU. However, the diminution is less marked than in other SSA countries, as documented by Fosu (2013).

[Insert here Table 1]

An important question is how competition has evolved following these changes in the banking market. Recent changes such as the increase of the number of banks and expansion of regional groups appear as a positive trend. However, several arguments (exposed above) nuance this optimistic view.

3 Literature review

In order to measure the degree of competition in banking markets, empirical studies have usually made use of two different methodologies: the structural approach and the New Empirical Industrial Organization (NEIO) approach. The structural approach infers the degree of competition from the structure of the market. Based on Structure-Conduct-Performance (SCP) paradigm, it assumes lower competition in concentrated markets. Authors raise concerns about the reliability of the SCP paradigm and therefore of the structural approach to assess the degree of competition (Liu et al., 2013). For instance, the linkage from structure to conduct is less obvious than the SCP paradigm argues, eg. an oligopoly may be the place of intense competition. The NEIO approach provides non-structural tests to circumvent the problems with structural measures of competition. The aim of the NEIO approach is to obtain a direct measure of firms' conduct.

A popular measure is the Lerner index (or price-cost margin). It measures the divergence between the price and marginal cost (relative to price). The price and marginal cost should be equal in perfect competition, but will diverge in less competitive environments. The main reasons for the popularity of the Lerner index are its simplicity, its straightforward interpretation, and the fact that it does not pose stringent data requirements. In addition, the Lerner index has the main advantage to be bank-specific and to vary over time, allowing comparison of market power among banks and/or over the period. Although it is widely-used in the literature, the Lerner index is a measure of pricing market

power and not a proxy of competition. An increase of average market power over time can be consistent with an increase in the intensity of competition. Due to reallocation effect from inefficient to efficient firms, which are able to extract more rents, the average Lerner index can increase, decrease or remain stable following an intensification of competition as documented by Boone et al. (2013). Few studies have computed the Lerner index for African banking industries. Turk Ariss (2010) estimates the value of the Lerner index in a sample of 61 countries including 14 Sub-Saharan African countries over the 1999-2005 period. Banks tend to extract larger rents in Africa than in others regions. Sanya and Gaertner (2012) study the evolution of the Lerner indices for a sample of 4 countries of the East African Community (Kenya, Rwanda, Tanzania, and Uganda). The average Lerner indices are around 30%, with no real change over the past decade.

Another proxy of competition widely computed in the literature is the Panzar-Rosse (PR) model. The PR model is based on the evaluation of the transmission of variations in input prices, and then marginal costs, on firms' revenues. Panzar and Rosse (1987) showed that under certain assumptions, the transmission of input price variation on revenues differs according to the degree of competition in the market. The elasticity of bank revenues relative to input prices, also called the H-statistic, therefore assess the degree of competition. In a market where banks collude, the value of the H-statistic is less than or equals to zero. The H-statistic equals to one in a competitive market and lies between 0 and 1 if banks operate under monopolistic competition. The success of the PR model can be explained by its simplicity and the fact that it does not pose stringent data requirements. Nonetheless, these benefits come at the cost of other shortcomings. The major pitfall concerns the econometric identification and the interpretation of the H-statistic. The interpretation of the values of the H-statistic requires respecting many assumptions regarding the market equilibrium, demand elasticity, cost structure or exogeneity of input prices (Bikker et al., 2012). Some studies have assessed the degree of competition in Africa using the PR model (see Table A5). The findings are generally consistent with monopolistic competition. The competitiveness of the banking systems in non-former English colonies is, however, rarely investigated. Saab and Vacher (2007) reveal that the degree of competition in the *Communauté Economique et Monétaire d'Afrique Centrale* is relatively low. In a recent contribution, Fosu (2013) goes further by analyzing the

differences between sub-regional African regions. He finds that Southern African banks face lower competitiveness than their counterparts in Africa.

Boone (2008) has recently developed a new indicator that is not based on a static model. The basic intuition underlying this indicator is that more efficient firms achieve superior performance in the sense of higher profits, and that this effect is stronger the heavier the competition is. The Boone indicator has the advantage of being more theoretical robust and requires the same data as the Lerner index. In addition, the Boone indicator does not capture the price competition but the non-price competition and dynamics in the market. Delis (2012) assesses the Boone indicator for a large sample of developing and developed countries, including some SSA economies. Among the 11 African economies under consideration, the degree of competition is higher than the world mean for only three countries (Cameroon, Kenya, and Senegal).

The different indicators catch different aspects of competition. The Lerner index measures the average market power in the market and not really the degree of competition. The Panzar-Rosse H-statistic assesses the degree of competition in a static model. The Boone indicator captures the dynamics of markets and are more relevant when markets are in a transition phase. One might expect that this situation occurred in the WAEMU over the past decade with the growth of African cross-border banks. In the following, we apply the three different indicators to gauge the evolution of bank competition during the 2000s.

4 Data and Methodology

4.1 Data and variables

The data have been obtained from annual individual bank balance sheets and bank income statements published in the Banking Commission's annual reports.[3] A number of data exclusion criteria are applied. First, all banks from Guinea-Bissau are excluded for econometric analysis. Indeed, the banking industry in Guinea-Bissau is relatively young

[3]While the coverage of the Bankscope has improved over time, its coverage of banks in low-income countries was limited. The database obtained from the Banking Commission has the main advantage of being exhaustive. For instance, the coverage of the Bankscope database ranges between 50% and 70% of the banks in the WAEMU over the 2000s.

and has been dominated for a long period of time by only one bank. Second, observations for which output and input prices cannot be calculated are excluded. The final sample considers 92 banks (610 observations). Table A1 reports the number of observations by country and year. The analysis is conducted for the region as a whole. Indeed, the introduction of a single banking license in 1998 has created a common regional market. Financial integration is particularly advanced in the WAEMU in comparison with other regional zones (Sy, 2007). A practical reason also explains this choice: Analyzing the degree of competition country by country poses econometric problems due to the lack of degrees of freedom.

Different measures of competition require computing output and prices and then choosing a banking firm model. Insofar as traditional intermediation remains the crux of banking activity in countries under consideration, the intermediation approach is adopted. The output is assessed by the total assets. Contrary to total loans, total assets allow us to consider non-interest earning assets. Output price is computed as the ratio of total revenue to total assets.[4] In the intermediation approach, three inputs are considered: labor, physical capital and deposit. The price of labor is measured by the ratio of personnel expenses to the total number of employees, the price of funds by the ratio of interest expenses to total funds, and the price of physical capital by the ratio of other expenses (operational and depreciation) to total fixed assets. A short description of the main variables used as well as the evolution of these variables over time are reported in the Appendix (Tables A2 and A3).

4.2 The Lerner index

The Lerner index reflects firms' ability to set prices over marginal costs. It is defined as the difference between price and marginal cost, divided by price. The price is defined as the ratio of total revenues to total assets. Marginal costs are inferred from estimation of a translog cost function with one output (total assets) and three inputs (labor, physical capital and funds). One common cost function to all WAEMU countries is considered due to the lack of data. Nonetheless, technology differences between countries are taken

[4]Substituting the total assets by total loans (and the price of output by the average interest revenue) provide similar results.

into account by including interactions between country dummies and output as well as interactions between dummies and input prices. As usual, the estimation is done under the restrictions of symmetry and of degree one homogeneity in the prices of inputs. The cost function takes the following form:

$$\begin{aligned} ln(TC_{it}) =& \beta_0 + \beta_1(lny_{it}) + \frac{1}{2}\beta_2(lny_{it})^2 + \sum_{l=1}^{3} b_l(lnw_{l,it}) + \frac{1}{2}\sum_{l=1}^{3} b_{3+l}(lnw_{l,it})^2 \\ &+ \sum_{l=1}^{3} \beta_{2+l}(lny_{it})(lnw_{l,it}) + \sum_{l\neq l'} b_{6+l}(lnw_{l,it})(lnw_{l',it}) \\ &+ \gamma_1 T + \frac{1}{2}\gamma_2 T^2 + \gamma_3 T(lny_{it}) + \sum_{l=1}^{3} \gamma_{3+b} T(lnw_{l,it}) + \sum_{j=1}^{J} \delta_j C_j \\ &+ \sum_{j=1}^{J} \zeta_j C_j(lny_{it}) + \sum_{j=1}^{J}\sum_{l=1}^{3} \kappa_{jl} C_j(lnw_{l,it}) + \sum_{j=1}^{J}\sum_{k=1}^{K} \mu_k Z_{k,jt} + \varepsilon_{it} \end{aligned} \tag{1}$$

where i, j, t, and l refer to bank, country, period and input respectively. TC is the total costs, w_l the price of the l^{th} inputs, y total assets, T a trend that captures the effect of technical progress, and C_j the country-dummies and $Z_{k,jt}$ a matrix of time-variant country variables (GDP per capita, population density, inflation, and growth). Total costs are the sum of operational costs and interest costs. The individual Lerner index can be easily calculated from the price-cost margin. The marginal costs are obtained as follows:

$$MC_{it} = \frac{\partial TC_{it}}{\partial y_{it}} = \left(\beta_1 + \beta_2(lny_{it}) + \sum_{l=1}^{3} \beta_{2+l}(lnw_{l,it}) + \gamma_3 T + \sum_{j=1}^{J} \zeta_j C_j\right) \frac{TC_{it}}{y_{it}} \tag{2}$$

The (weighted) average Lerner index for each year is then computed as follows:

$$L_t = \sum_{i=1}^{N} s_{it} L_{it} = \sum_{i=1}^{N} s_{it} \frac{p_{it} - MC_{it}}{MC_{it}} \tag{3}$$

where s_{it} is the market share and MC_{it} the marginal cost of bank i in period t.

4.3 The Panzar-Rosse model

The Panzar-Rosse model, popularized by Panzar and Rosse (1987), is an approach to measuring competition that is based on a reduced-form revenue equation. The degree of competition is inferred from the sum of elasticities of revenues with respect to input

prices. The estimated value ranges between $-\infty$ to 1. Under perfect competition, the H-statistic equals one, while its value is negative under collusion. Finally, in a situation of imperfect competition, the H-statistic is positive but below one. The H-value is obtained by regressing revenue on input prices and controls (Liu et al., 2013).

The specification of the PR model employed in this paper differs from existing literature in three ways. First, studies often include total assets as a control variable. Other articles estimate a price function instead of a revenue equation, in which the dependent variable is revenue divided by total assets (cf. Table A5). Bikker et al. (2012) prove that the properties of the price equation and the scaled revenue equation function cannot identify imperfect competition, disqualifying a large number of studies. They show that the appropriate H-statistic should be based on an unscaled revenue equation. Second, Goddard and Wilson (2009) point out that the static PR model is biased in the case where there is not instantaneous adjustment towards equilibrium in response to factor input price shocks. A dynamic model is then more appropriate than a static one.[5] In order to take into account the partial adjustment, a lagged dependent variable is included. Third, contrary to studies focusing on mature banking systems, we cannot run different equations by year due to the lack of observations. Therefore, evolution over time is taken into account by including interactive terms between input prices and year-dummies.

Thus the following equation is estimated:

$$ln(TR_{it}) = \alpha ln(TR_{i,t-1}) + \sum_{l=1}^{L}\sum_{t=1}^{T} \beta_{lt} D_t ln(w_{l,it}) + \sum_{k=1}^{K} \gamma_k Z_{k,it} + \sum_{t=1}^{T} \delta_t D_t + \varepsilon_{it} \quad (4)$$

where TR denotes total revenue, w_l the price of lth input factor, D_t the time-dummies and Z a set of K control variables. In line with the intermediation approach, three inputs are considered: labor, deposit and physical capital. The H-value for period t is computed as the sum of input price elasticities: $H_t = \sum_{l=1}^{3} \beta_{lt}$. Control variables include the ratio of equity to total assets to control for a bank's risk aversion. The income diversification index (IDI) proposed by Laeven and Levine (2007) and increasing with the degree of product diversification is included to control for product structure. Credit risk exposure is taken into account by including the ratio of loans to customers to total assets. Finally,

[5] This issue is particularly relevant in our case insofar as the banking market under consideration witnessed profound changes over the past decade.

the ratio of customers' deposits to short-term funding is included to consider the bank's funding mix.

A number of working assumptions are required to apply the PR approach to banks. In particular, banks should be observed from a long-run equilibrium perspective (Shaffer, 1982). An equilibrium test should be performed by using an indicator of firm return as the dependent variable, with the same econometric specification. The equilibrium statistic E is calculated as the sum of the input price elasticities. If the E-statistic equals zero, this implies that the banking market is in long-run equilibrium.[6]

In the presence of a lagged dependent variable, the within estimator is no longer consistent. In order to control for such endogeneity bias, the difference GMM estimator proposed by Arellano and Bond (1991) and the system-GMM estimator developed by Blundell and Bond (1998) are used. The lagged endogenous variable and other explanatory variables are considered as weakly exogenous. Although precision is gained by considering additional moment restrictions, it is not desirable to have too many instruments (Roodman, 2009). For this reason, the set of instruments is limited to two lags. In order to ascertain the validity of the instrument set, several usual specification tests are implemented (Arellano-Bond tests for serial correlation and overidentification test).

4.4 The Boone indicator

Recently, Boone (2008) developed a new measure of competition. The basic intuition underlying this indicator is that more efficient banks achieve superior performance in the sense of higher profit and that this effect is stronger the heavier the competition is. This measure has gained considerable support in banking more recently (van Leuvensteijn et al., 2011; Delis, 2012).

The Boone indicator is obtained by estimating the relationship between marginal costs and profits. Interactions between marginal costs and time-dummies are included to study the changes in competitiveness following the method proposed by van Leuvensteijn et al.

[6]The profit is independent to price in the long-run equilibrium (Shaffer, 1982). However, according to Bikker et al. (2012), this equilibrium is a joint test for competitive conduct and market equilibrium.

(2011)

$$ln\pi_{it} = \alpha + \sum_{t=1}^{T} \beta_t D_t lnMC_{it} + \sum_{t=1}^{T} \delta_t D_t + \varepsilon_{it} \quad (5)$$

where π_{it} stands for profits, D_t is a time dummy, MC_{it} denotes marginal costs for bank i in period t. The coefficient β_t captures the profit elasticity in period t and is in theory negative, reflecting the fact that higher marginal costs are associated with lower profits. Its value should be lower the more competitive market conditions are.

An alternative method consists to assess the market share elasticity by using the logarithm of market share instead of profit as the dependent variable (van Leuvensteijn et al., 2011).

$$lns_{it} = \alpha + \sum_{t=1}^{T} \beta'_t D_t lnMC_{it} + \sum_{t=1}^{T} \delta'_t D_t + \varepsilon'_{it} \quad (6)$$

where s_{it} is the market share of the ith bank in period t. β' captures therefore the market share elasticity and its interpretation is similar the interpretation of β_t.

Both models are run by implementing the within estimator to take into account the unobserved firm heterogeneity. Previous contributions highlight the possibility of joint determination of performance and cost, inducing a possible endogeneity issue. In the first step, a Hausman-based test is applied to gauge the validity of within estimator. The test compares the equation where marginal costs are treated as endogenous and the equation where marginal costs are treated as exogenous. Consequently, if this problem is confirmed, a two-step method with one lag of marginal costs as instrument is used. Otherwise, the efficient within estimator is employed.

5 Results

5.1 The Lerner index

Table 2 presents the evolution of market power measured by the weighted average Lerner index. The estimation result for the cost function that is required to compute the marginal costs is reported in the Appendix (Table A4). The Lerner indices range from 31% in Côte d'Ivoire to 37% in Niger. The average Lerner index is higher in Benin, Togo, and Niger. The average degree of market power is around 34%. These figures are comparable to

what is observed in other studies. Using a similar approach and the Bankscope database, Turk Ariss (2010) reveals that conventional Lerner indices are around 30-32% for the three countries of the WAEMU considered (Burkina-Faso: 32.8; Côte d'Ivoire: 32.9; and Senegal: 30.0).

[Insert here Table 2]

In terms of evolution, the results suggest the absence of dramatic change over the last decade. The degree of market power slightly decreased in 2006 and increased in 2007-2008 but decreased afterwards. According to this measure, the recent changes in the banking industry have not induced profound modifications in terms of market power. However, Boone et al. (2013) point out that intensification of competition may not always be reflected in average Lerner index due to reallocation effect from inefficient to efficient firms. Reallocation induces that weighted average Lerner index can increase even if individual Lerner indices reduce. Efficient firms, gaining market shares, are able to extract more rents than inefficient ones. In order to provide robust evidence, two additional measures of competition are computed in the following.

5.2 The Panzar-Rosse H-statistic

The Panzar-Rosse model is run to provide more insightful about evolution of competition over the period. In the first part, the average degree of competition for the whole period is investigated by removing interactions between time-dummies and input prices. Table 3 reports the results of the static and dynamic PR model. For the dynamic H-statistic, in addition to (biased) within estimator, Arellano-Bond's (AB) and Blundell-Bond's (BB) estimators are used. The usual tests are implemented to gauge the validity of these methods (see Table 3). The different tests tend to validate the BB method, while results using the AB estimator are subject to caution. The lag dependent variable is positive and significant. While the values of the H-statistic differ greatly among different specifications, findings suggest a monopolistic competition in both the static and dynamic models. The conjoint test allows for rejecting the hypothesis of collusion among banks. The hypothesis of perfect competition also appears invalid, although not always rejected. This finding is in line with the vast majority of studies on African banking systems (cf. Table A5).

[Insert here Table 3]

It is not sufficient to observe how strong competition is for the period as a whole. Therefore, we are also interested in observing the time evolution of the degree of competition. To assess this time development, interactions between time-dummies and input prices are included. In Table 4, the H-value over time is reported.[7] Figure 2 reports the results using the Blundell-Bond estimator. According to Panzar and Rosse (1987), not only the sign of the H-statistic matters, but also its magnitude.[8] After a decrease in 2006, the level of competition has increased since 2007. In other words, the PR model shows that the banking sector in the WAEMU has become more competitive since 2007, a period corresponding to significant changes in the structure of the market.

[Insert here Table 4]

5.3 The Boone indicator

Boone (2008) has recently presented a new measure of competition assessing the sensitivity of profits to changes in competition relative to firm's efficiency. This measure assumes a different hypothesis than existing static methodologies, and it is more robust when markets are in a transitional phase such as the banking system in the WAEMU over the past decade. Two empirical approaches have been developed to assess the degree of competition from the Boone indicator. The log of marginal cost is then regressed on log of profit (profit elasticity) and on log of market share (market share elasticity). The value of marginal costs for each bank at each period is obtained from the estimation of cost function reported in Table A4.

The results of the endogeneity test indicate that marginal costs have been considered endogenous only for market share elasticity equation. Thus, a two-step estimator is employed for this equation, and a within estimator is run for the profit elasticity equation. The results are presented in Table 5. The estimated β is in absolute terms larger for

[7] Details on estimations are not reported but are available upon request

[8] Shaffer (2004) casts doubt on the use of the H-statistic as a continuous measure of competition although Vesala (1995) proves that the H-statistic is a continuum under certain conditions. In empirical studies, the H-value is often considered as a continuum value (Bikker et al., 2012).

market share elasticity than for profit elasticity. The values of market share elasticity and profit elasticity are not comparable. Due to the lack of studies, it is also impossible to compare the degree of competition in the WAEMU with other African countries.

[Insert here Table 5]

The Boone indicator is more useful in gauging the evolution of competition over time. Market share elasticity is again subject to the endogeneity issue, while profit elasticity is not. PE and MSE results show that the competitiveness of the banking industry has risen since the mid-2000s, while dates differ. The estimated β value decreases over time. Differently phrased, banks operate under more competition at the end of the decade. As shown in Figure 2, the evolution of profit elasticity is in line with conclusions from PR models. The profit elasticity value has decreased since 2007.

To sum up, both the Panzar-Rosse model and Boone indicator highlight that the competitiveness of the banking markets has increased since the mid-2000s. This period corresponds to the penetration of regional banks in the banking industry.

[Insert here Figure 2]

6 Conclusion

African banking sectors have witnessed significant changes in their structure over the past several decades. In particular, African banking groups have expanded their activity throughout the continent. This paper analyzes how such changes have induced transformation in the competitiveness of the banking industry. Employing an original database on seven West African countries, this paper investigates the degree and evolution of competition over the past decade. The countries considered, members of the WAEMU, provide an excellent foundation for testing the consequences of recent changes in competition. These banking systems have encounted substantial structural change during the past ten years with the entry and expansion of banks from West Africa and from North Africa.
With the exception of the Lerner index, the different empirical assessments of competition (Panzar-Rosse model and Boone indicator) show an intensification of competition since

the mid-2000s. This period corresponds to the rapid expansion of African banking groups and the relative decline of incumbents European banks. The entry of new actors appears to have added a new dynamic to the banking industry in West Africa.

According to our findings, facilitate the expansion of African banks may help to enhance competition in the banking industry. By spurring competition, the entry of African cross-border banks could affect efficiency, stability and outreach of banking systems. The penetration of foreign banks may also exert a direct impact of the functioning of African banking systems. A large literature has tried to assess the consequences of foreign banks in developing countries. The origin of foreign banks plays a role in explaining the positive or negative impact of foreign banks in host country on efficiency and outreach (van Horen, 2007; Claessens and van Horen, 2014a). The growth of these pan-African groups induces a risk for the financial stability in host countries insofar as authorities have a limited control on these banks. Further research should analyze the consequences of the development of cross-border banks on banking efficiency, stability and outreach. In particular, these future works should consider the importance of modes of entry, host country's characteristics or the degree of intra-group integration.

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7 Tables and figures

Table 1: Evolution of concentration indices, by country

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	*Mean*
	Share of assets owned by the three-largest banks										
Benin	78.33	79.91	79.04	74.99	71.12	68.67	66.30	64.86	66.81	67.58	*71.76*
Burkina	66.93	61.18	60.64	59.34	57.40	54.53	50.20	49.38	46.00	55.65	*56.12*
Côte d'I.	51.33	51.02	51.57	50.58	49.01	46.95	45.62	43.62	42.26	42.98	*47.50*
Guinée-B.		100	100	100	100	100	100	94.06	95.20	94.05	*98.15*
Mali	54.53	65.04	63.37	61.10	60.84	60.12	56.86	55.04	51.83	49.67	*57.84*
Niger	71.28	69.98	74.19	70.75	71.08	69.53	64.87	66.22	63.76	62.26	*68.39*
Sénégal	54.90	56.29	59.43	58.50	59.03	57.31	57.30	60.64	74.06	55.40	*59.29*
Togo	56.64	56.26	65.17	67.11	72.51	69.19	65.57	64.97	65.53	61.08	*64.40*
WAEMU	**61.99**	**62.81**	**64.77**	**63.19**	**63.00**	**60.90**	**58.10**	**57.82**	**58.61**	**56.38**	**60.76**
	Share of assets owned by the five-largest banks										
Benin	99.09	98.39	97.53	92.27	86.96	84.48	82.27	78.81	80.65	82.06	*88.25*
Burkina	85.55	82.33	82.28	81.53	79.75	78.13	75.01	74.83	71.55	81.18	*79.21*
Côte d'I.	73.85	71.54	71.88	68.45	65.75	63.75	63.55	61.32	62.76	63.65	*66.65*
Guinée-B.		100	100	100	100	100	100	100	100	100	*100*
Mali	76.91	84.33	85.37	82.85	81.63	79.29	76.30	76.65	74.94	71.19	*78.95*
Niger	91.01	93.36	93.20	93.63	91.76	91.82	87.27	88.77	87.49	86.35	*90.47*
Sénégal	74.97	75.95	77.18	76.46	76.36	74.64	72.94	75.21	87.86	73.00	*76.46*
Togo	79.34	78.94	93.95	94.48	98.48	95.19	90.66	87.17	85.59	80.60	*88.44*
WAEMU	**82.96**	**83.55**	**85.91**	**84.24**	**82.96**	**81.04**	**78.29**	**77.54**	**78.69**	**76.86**	**81.20**
	Herfindahl-Hirschman index										
Benin	2671	2851	2749	2535	2425	2199	1950	1852	1921	1941	*2309*
Burkina	1947	1723	1738	1650	1578	1494	1378	1340	1286	1502	*1564*
Côte d'I.	1299	1315	1295	1205	1124	1086	1064	1054	1055	1091	*1159*
Guinée-B.		10000	10000	10000	10000	8287	4960	3427	3434	3319	*7048*
Mali	1506	2181	2067	1930	1819	1808	1593	1450	1345	1249	*1695*
Niger	2015	2021	2134	2082	2042	2009	1785	1867	1766	1710	*1943*
Sénégal	1445	1447	1522	1455	1470	1387	1405	1477	2246	1341	*1520*
Togo	1458	1463	1899	1945	2113	1959	1788	1703	1726	1562	*1762*
WAEMU	**1763**	**1857**	**1915**	**1829**	**1796**	**1706**	**1566**	**1535**	**1621**	**1485**	**1707**

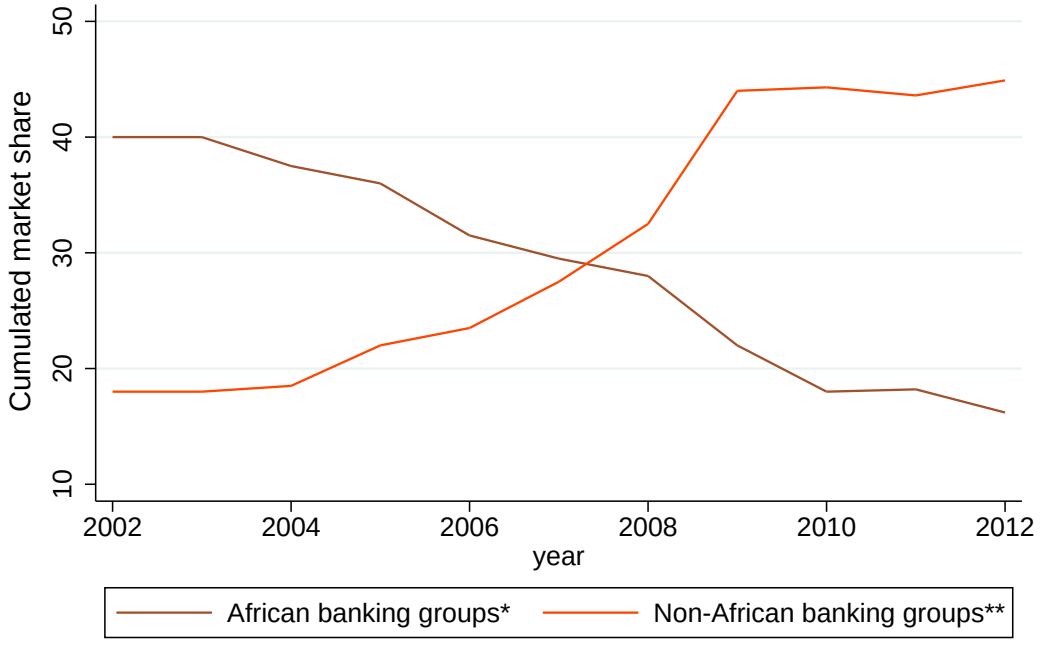
The Table displays the common concentration indicators. The last column reports the average of each indicator for each country over the period. The last line shows the average of each indicator in the WAEMU for each year, excluding Guinea-Bissau.

Table 2: Evolution of Lerner indices, by country

	2002	2003	2004	2005	2006	2007	2008	2009	*Aver.*
Benin	0.3964	0.3807	0.3789	0.3220	0.3097	0.3531	0.3449	0.4298	*0.3644*
Burkina-Faso	0.3711	0.3722	0.3370	0.3580	0.2855	0.3320	0.3222	0.3190	*0.3371*
Côte d'Ivoire	0.2426	0.3005	0.2902	0.3301	0.3268	0.3146	0.3881	0.2909	*0.3105*
Mali	0.3185	0.3884	0.3245	0.3570	0.3193	0.3337	0.3493	0.3070	*0.3372*
Niger	0.3385	0.3481	0.3348	0.3866	0.3655	0.3784	0.4214	0.4114	*0.3731*
Sénégal	0.3374	0.3016	0.3163	0.3156	0.3338	0.3146	0.3431	0.3178	*0.3225*
Togo	0.3021	0.3046	0.4013	0.4038	0.2954	0.4227	0.5139	0.3716	*0.3769*
WAEMU	**0.3295**	**0.3423**	**0.3404**	**0.3533**	**0.3194**	**0.3499**	**0.3833**	**0.3497**	**0.3460**

The table displays the average of Lerner index for each year and each country. The last column reports the average Lerner index for each country over the period. The last line shows the average Lerner index in the WAEMU for each year.

Figure 1: Evolution of cumulated market shares of African and non-African banking groups



* Ecobank, BoA, Attijariwafa, AFG, UBA; ** Sté Gén., BNP, Belgolaise, CA, Citi

Table 3: Panzar-Rosse model results

	Static	Dynamic		
	FE	Dynamic FE	AB	BB
$ln(TR_{t-1})$	-	0.368***	0.230***	0.615***
	-	(8.95)	(3.51)	(10.18)
$ln(w_1)$	-0.0943	-0.00594	0.0781	0.622***
	(-0.73)	(-0.08)	(0.40)	(3.38)
$ln(w_2)$	0.557***	0.168*	0.319**	-0.0905
	(6.95)	(1.92)	(2.47)	(-0.84)
$ln(w_3)$	0.380***	0.155***	-0.0688	0.141*
	(5.12)	(3.14)	(-0.26)	(1.73)
IDI	-0.0301	-0.186	-0.302	0.206
	(-0.13)	(-1.01)	(-0.51)	(0.55)
E/TA	0.158	0.330	-0.748	0.758
	(0.53)	(0.99)	(-0.85)	(1.44)
CreditRisk	0.00390	-0.0130	0.193	0.0256
	(0.03)	(-0.21)	(1.20)	(0.23)
FundMix	-0.666**	-0.405*	-0.239	-0.848***
	(-2.22)	(-1.96)	(-0.61)	(-2.63)
Intercept	11.33***	6.536***		2.196***
	(23.85)	(10.09)		(4.02)
H-statistic	0.842	0.317	0.328	0.673
H=0 (F-test)	21.57***	7.29***	0.63	10.50***
F=0 (F-test)	0.75	33.90***	2.69*	2.47
E=0 (F-test)	0.00	0.00	0.19	0.19
Obs.	510	487	399	487
# banks	87	87	86	87
R^2	0.65	0.69	-	-
AR(1) [p-value]	-	-	0.222	0.015
AR(2) [p-value]	-	-	0.059	0.292
Hansen [p-value]	-	-	0.566	0.249
# instruments	-	-	30	39

Dependent variable is the logarithm of total revenue [$ln(TR)$]. *, ** and *** indicate significance at the 10%, 5% and 1% respectively . Time-dummies are included in all models. Arellano-Bond order 1 (2) are tests for first (second)-order serial correlation, asymptotically N(0, 1). These test the first-differenced residuals in the system GMM estimators. The Hansen test is a test of overidentification restrictions. Under the null hypothesis, the test statistic is distributed as a chi-squared in the number of overidentifyng restrictions, p-values are presented in square brackets. System GMM results are two-step estimates. The two-step standard errors are computed in accordance to the Windmeijer (2005) finite-sample correction. The reported t-statistics are based on robust standard errors.

Table 4: Evolution of H-statistic over time

		Tests	
	H-statistic	$H_0 : H = 0$	$H_0 : H = 1$
2003	0.120	0.32	17.51***
2004	0.135	0.78	31.89***
2005	0.138	0.45	17.27***
2006	-0.008	0.00	37.61***
2007	0.352	1.55	5.26**
2008	0.428	3.72*	6.62**
2009	0.607	8.85***	3.70**
Obs.	487		
# banks	87		
AR(1) [p-value]	0.028		
AR(2) [p-value]	0.110		
Hansen test [p-value]	0.413		
# Instruments	93		

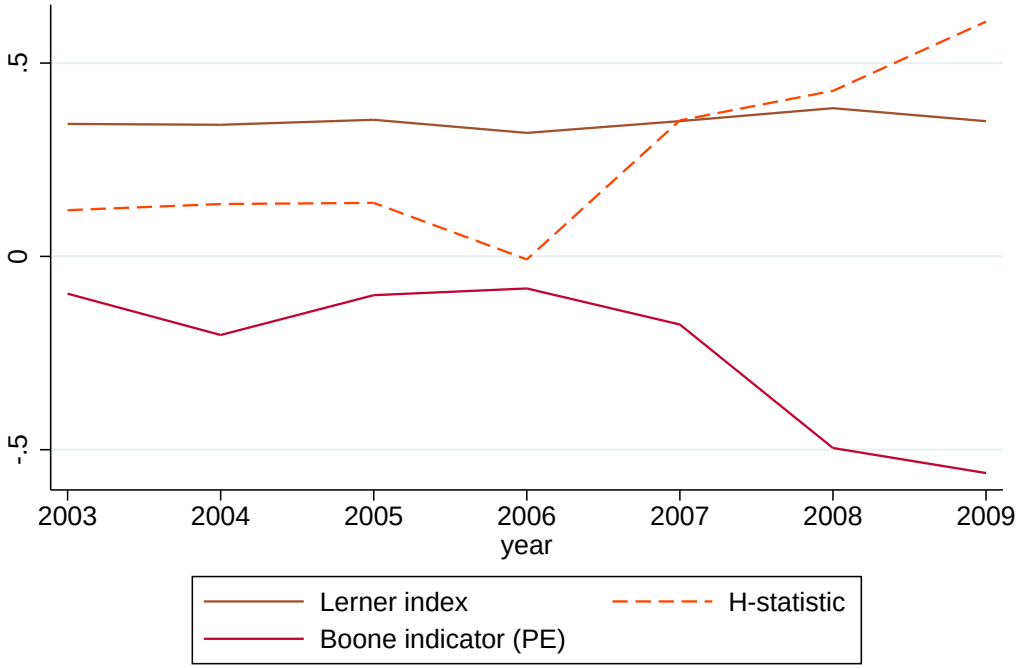
*, ** and *** indicate significance at the 10%, 5% and 1% respectively.
Results are extracted from PR model (cf. Eq. 4)

Table 5: Profit elasticity and market share elasticity

	Profit elasticity		MS elasticity	
	Within	Within	IV-FE	IV-FE
$Ln(MC)$	-0.1539***		-2.1429**	
	(-5.57)		(-2.23)	
$Ln(MC_{2002})$		-0.1140		
		(-1.47)		
$Ln(MC_{2003})$		-0.0963		-1.1825
		(-1.37)		(-1.50)
$Ln(MC_{2004})$		-0.2033***		-1.3922*
		(-4.15)		(-1.81)
$Ln(MC_{2005})$		-0.1003*		-1.9228**
		(-1.79)		(-2.18)
$Ln(MC_{2006})$		-0.0829		-2.2221
		(-1.44)		(-1.62)
$Ln(MC_{2007})$		-0.1761***		-2.5319*
		(-3.54)		(-1.78)
$Ln(MC_{2008})$		-0.4956***		-2.6450**
		(-10.21)		(-2.15)
$Ln(MC_{2009})$		-0.5603***		-2.2696**
		(-12.80)		(-1.99)
Time dummies	Incl.	Incl.	Incl.	Incl.
Obs.	610	610	510	510
# banks	92	92	91	91
Endogeneity test (p-value)	0.8340	0.7915	0.00	0.00
F test / Wald test	4.57***	9.19***	273.03***	269.38***

Dependent variables are the natural logarithm of profit (PE) and of market share (ME). *, ** and *** indicate significance at the 10%, 5% and 1% respectively . Within refers to within estimator and IV-FE to instrumental variable model. Standards errors are clustered at the bank level and t-Statistics reported in parentheses. F-test and Wald-test test the conjoint significance of all variables. Endogeneity test is a Hausman-based test comparing results from OLS and 2SLS models. Under the null hypothesis, both models give similar results.

Figure 2: Evolution of competition over time



Appendix A Additional tables

Table A1: Number of banks by country and by year

	2002	2003	2004	2005	2006	2007	2008	2009	Total
Benin	6	7	9	11	12	12	12	11	80
Burkina-Faso	7	7	8	8	11	11	11	10	73
Côte d'Ivoire	14	14	16	16	18	17	18	17	130
Mali	8	9	10	10	12	13	13	13	88
Niger	7	7	8	7	9	9	9	10	66
Sénégal	11	11	12	13	16	16	12	16	107
Togo	7	7	6	7	10	10	10	9	66
Total	60	62	69	72	88	88	85	86	610

Table A2: Description of key variables by year

		Description	Mean	Std. Dev	Min	Max
Total assets (output)	y	Total assets	93739.9	106680.5	892	659880
Revenue	TR	Interest and non-interest revenues	9992.6	13803.6	0	221171
Cost	TC	Financial and non-financial costs	7034.1	7142.5	103	44309
Profit	π	Profit before taxes	1161.2	4155.0	-26889	25633
Price of output	p	Total revenue/Total assets	0.1011	0.0374	0.0000	0.3962
Price of labor	w_1	Personnel expenses/Total number of employees	11.5843	6.6850	0.0212	67.1621
Price of deposits	w_2	Interest expenses/Total funds	0.0225	0.0112	0.0000	0.1188
Price of physical capital	w_3	Other expenses/Total fixed assets	0.9958	1.0427	0.0000	9.9419

Table A3: Mean values of key variables by year

	2002	2003	2004	2005	2006	2007	2008	2009
Total assets	85939.94	88931.54	89669.94	82624.73	80017.14	92406.98	104320.30	119938.70
Total revenue	8873.92	8930.72	9135.94	8695.03	8142.15	9329.40	13325.21	12586.40
Total cost	6394.94	6429.14	6510.49	6370.56	6074.56	6957.88	7893.35	9084.76
Profit	1282.02	1199.83	1590.58	1020.08	1014.87	705.47	799.29	1787.44
Price of output	0.1027	0.0984	0.1012	0.0969	0.0901	0.0994	0.1166	0.1030
Price of labor	10.575	11.406	11.101	11.186	11.678	12.195	11.157	12.876
Price of deposits	0.0249	0.0233	0.0212	0.0201	0.0201	0.0225	0.0245	0.0242
Price of physical capital	1.0634	0.9388	1.0033	0.8132	0.7921	0.9209	1.1424	1.2751

Table A4: Estimation of translog cost function

Variable	Coef	t-stat
$log(y_{it})$	0.340*	(1.86)
$log(y_{it})^2$	0.042***	(5.98)
$log(w_{1,it})$	1.576***	(6.87)
$log(w_{2,it})$	0.306	(1.29)
$log(w_{3,it})$	-.882***	(-5.02)
$log(w_{1,it})^2$	0.000	(0.02)
$log(w_{2,it})^2$	0.070***	(5.19)
$log(w_{3,it})^2$	-.007	(-0.54)
$log(y_{1,it})log(w_{1,it})$	-.112***	(-6.41)
$log(y_{1,it})log(w_{2,it})$	0.050***	(3.32)
$log(y_{1,it})log(w_{3,it})$	0.062***	(4.41)
$log(w_{1,it})log(w_{2,it})$	-.038***	(-3.22)
$log(w_{1,it})log(w_{3,it})$	0.038***	(4.07)
$log(w_{2,it})log(w_{3,it})$	-.031***	(-3.32)
T	0.063***	(8.10)
T^2	0.000	(0.50)
$Tlog(y_{it})$	-.005***	(-10.45)
$Tlog(w_{1,it})$	0.004**	(2.24)
$Tlog(w_{2,it})$	0.005***	(4.40)
$Tlog(w_{3,it})$	-.001	(-1.26)
Country variables		
POPdens_{jt}	-.020***	(-4.00)
GDPpc_{jt}	-0.000	(-0.29)
Inflation_{jt}	0.000	(0.30)
Growth_{jt}	-.002	(-0.35)
Country dummies		
- Levels		Incl.
- Interactions with output		Incl.
- Interactions with input prices		Incl.
F-test	7.61***	
Obs.		610
# banks		92
R^2		0.96

*, ** and *** indicate significance at the 10%, 5% and 1% respectively (t-statistics are reported in parentheses). F-test tests the conjoint significance of the country dummies and their interactions with output and prices.

Table A5: Summary of empirical Panzar-Rosse studies on or including SSA countries

Author(s)	Country	Period	# banks (obs.)	H-value (average)	Dependent Variable	Dynamic	Scaled	Data source
Individual country								
Buchs and Mathisen (2005)	Ghana	1998-2003	13 (65)	0.53-0.59	TR, IR	No	Yes	Central bank
Hauner and Peiris (2008)*	Uganda	1999-2004	15 (307)	0.43	TR	No	Yes	Central bank
Kasekende et al. (2009)	Nigeria	1993-2008	na	0.53-0.70	TR	No	Yes	Bankscope
Mwega (2011)	Kenya	1998-2007	43 (349)	0.38	IR/TA	No	Yes	Central bank
Mwenda and Mutoti (2011)	Zambia	1999-2008	11 (440)	0.83	IR	Yes	No	Central bank
Simpasa (2011)	Tanzania	2004-2008	26 (101)	0.66	TR	No	No	Bankscope
Biekpe (2011)	Ghana	2000-2007	17 (119)	0.66	TR, TI	No	Yes	Bankscope
Simpasa (2013)	Zambia	1998-2011	18 (641)	0.46	TR/TA	No	No	Central Bank
Claessens and Laeven (2004)	Kenya	1994-2001	34 (106)	0.58	IR/TA	No	Yes	Bankscope
	Nigeria	1994-2001	42 (186)	0.67	IR/TA	No	Yes	Bankscope
Schaeck et al. (2009)	Kenya	1998-2005	na	0.36	IR/TA	No	No	Bankscope
	Nigeria	1998-2005	na	0.53	IR/TA	No	No	Bankscope
Bikker et al. (2012)	Kenya	1994-2004	38 (187)	0.27-0.44	TR, IR	No	No	Bankscope
	Nigeria	1994-2004	64 (318)	0.24-0.38	TR, IR	No	No	Bankscope
Sanya and Gaertner (2012)	Kenya	2001-2008	29 (na)	0.6	TR/TA	No	Yes	Bankscope
	Rwanda	2001-2009	7 (na)	0.24	TR/TA	No	Yes	Bankscope
	Tanzania	2001-2010	17 (na)	0.56	TR/TA	No	Yes	Bankscope
	Uganda	2001-2011	12 (na)	0.55	TR/TA	No	Yes	Bankscope
Groups of countries								
Saab and Vacher (2007)**	CEMAC (6)	1993-2004	30 (140)	0.27	TR/TA	No	No	Central bank
Fosu (2013)	Southern Africa (13)	2002-2009	152 (487)	0.52	TR, IR	Yes	Yes	Bankscope
	West Africa (14)	2002-2009	145 (427)	0.59	TR, IR	Yes	Yes	Bankscope
	East Africa (6)	2002-2010	99 (375)	0.61	TR, IR	Yes	Yes	Bankscope

IR: Interest revenue; TR: total revenue; TA; Total assets; na: not available (dependent variables are in log)

* The value of H-statistics is 0.31 before liberalization and 0.50 after.

** CEMAC includes Cameroun, Gabon, Equatorial Guinea, Central African Republic, Congo, and Chad.