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ANALYSIS OF BANK EFFICIENCY IN PRICING IN WAEMU CONTRIES

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Abstract: This paper analyses the effect of market power on the efficiency of banks in the WAEMU region. The aim is to identify the pricing scheme of the banking industries and to analyse the effect of the Lerner index on bank cost efficiency. The analysis covers the period from 2010 to 2015 and uses secondary data from balance sheets and income statements as well as the Central Bank of West African States (BCEAO) directories. The GMM method was used to analyse the relationship between market power as measured by the Lerner index and the cost efficiency of banks. The results of this study showed that banks in the WAEMU do not practice marginal cost pricing, and therefore market power has a positive and significant effect on the efficiency of banks in the WAEMU.

Keywords: Market power, efficiency, Lerner index, GMM method.

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1. Introduction

A widely shared idea among economists is that competition is a vector of efficiency. Over the last two decades, the banking system has undergone important changes following the liberalisation policies of 1989-1990. Subjected to the demands of the globalisation process and operating in an uncertain environment, banks have to improve their efficiency and performance in order to preserve their sustainability. The objective of these restructuring and modernisation programmes was to enable banks to consolidate

their financial bases, clean up their non-performing loan portfolios, and increase their efficiency levels in order to align themselves with the requirements of an increasingly liberalised financial landscape.

Within the West African Economic and Monetary Union (WAEMU), these changes have taken different forms. These changes are due, on the one hand, to the arrival of new players and the development of pan-African groups and, on the other hand, to the new foreign-owned private banks that have entered these markets, thus intensifying competition between banks. Since then, the Union's banks have generally seen their financial situation improved. In 2015, the profit of the Union's banks reached 321.629 billion CFA francs, up from 8.023 billion CFA francs in 1990 (BCEAO, 1990, 2015). The efforts made in the framework of these reforms were motivated by the idea of financial liberalisation, which assumes that by intensifying competition between banks, this should enable them to be more efficient. In the literature of industrial organisation, it is widely believed that the implementation of various privatisation and deregulation measures enhances competitive conditions and reshapes the market structure. Moreover, banking is not a business like any other. Thus, two arguments are raised to explain potential policy exceptions for the banking sector. The first is the vulnerability of the banking sector to instability, the second is the market imperfections. These two elements justify the specificity of the banking sector. Thus, since the work of Hicks (1935) and the Structure-Behaviour-Performance paradigm developed by Mason (1939); Bain (1956) and also the work of Tirole (1998), the relationship between competition and efficiency has been widely studied. Indeed, these research works between efficiency and competition focus on the causality from market structure to efficiency. These authors emphasise the beneficial effects of increased competition. This theory, known as the ***Quiet Life Hypothesis (QLH)***, states that managers will not behave in a profit-maximising way in a situation of limited competition. Thus, without competitive pressure, managers are driven to reduce their efforts (Selten, 1986) and/or divert resources to other objectives (Hermalin, 1992).

While this theory is well suited to most firms, the specificities of the banking sector have led to a rethinking of the ***QLH***. Traditional economic theory emphasises that

any deviation from the state of pure and perfect competition leads to an inefficient equilibrium and welfare losses. Specifically, this would lead to lower interest rates on savings in the banking sector. As a consequence, the macroeconomic volume of savings collected would decrease, which would negatively affect economic growth. Smith, for example, made this point in The Wealth of Nations, where he justified the regulation of banks and the infringement of their natural entrepreneurial freedoms by the dangers they pose to the whole of society (Smith, 1776). Exacerbated competition leads banks to reduce their investment in information research. This search for information would enable banks to manage their problem of information asymmetry. For Akerlof (1970), in an economy with imperfect information, the decentralised and competitive functioning of markets does not always lead to efficient results. The economic, social and institutional environment in which WAEMU banks operate, particularly the problems related to access to information or the possibility of diversifying the clientele, are more noticeable.

Like most developing countries, the banking industry plays a key role in financing the economy and is therefore the cornerstone of the financial system. The West African Economic and Monetary Union (WAEMU), made up of a group of developing countries, is not immune to this rule. Indeed, banks in the WAEMU region, subject to the demands of globalisation and operating in an uncertain environment, are obliged to improve their efficiency and performance in order to preserve their sustainability. Deregulation aimed at transforming socialist banking systems into market-oriented ones, for example by removing barriers to entry. However, financial regulation can affect both market power and efficiency. The question is whether these reform policies enhance bank competition, leading to better performance of WAEMU banks.

2. Literature review

In this section, we will first conduct an empirical study and then explain and clarify the measurement of market power

2.1. Empirical studies

The question of whether or not market power has a beneficial effect on banking efficiency is an empirical one. While many studies have attempted to characterise the determinants of efficiency, few have analysed the relationship between market power and efficiency.

Berger and Hannan (1998) have addressed this issue empirically. Using a concentration indicator on a sample of more than 5000 US banks in the 1980s, they highlight the beneficial effects of concentration on cost-efficiency[1] . The main criticism is the approximation of competition by a concentration indicator. This measure is only imperfectly related to competition (Angelini and Ceterolli, 2003; Claessens and Laeven, 2004) and only moderately reflects individual market power (Boone, 2008). Several recent studies have attempted to overcome this weakness by using a measure of individual market power of banks through the Lerner index. Indeed, Delis and Tsionas (2009), using the Lerner index, highlight a positive effect of market power on the efficiency of eleven (11) EU banks and US banks in the period 2000-2007. Koetter et al (2011) point out the problems induced by the measures of the Lerner index and efficiency in two independent models. Indeed, the presence of inefficiency tends to lead to an underestimation of market power. In order to circumvent this problem, Koetter et al (2011) propose an adjusted measure of the Lerner index. They highlight the positive effect of market power on the efficiency of US banks over the period 1986-2006. This method has been little used with the exception of the work of Turk Ariss (2010). Florian Léon (2012) used the method of Koetter et al. (2011) to analyse the effect of competition on banking efficiency in WAEMU countries. The main result is the robust negative effect of competition on the cost efficiency of WAEMU banks. Thus, market power improves the cost efficiency of banks.

2.2. Measuring market power: Lerner Index

Non-structural approaches such as Panzar and Rosse's (1987) H-statistic and Lerner's (Lerner, 1934) index of market power have been developed in the context of the empirical New Industrial Economics Organisation (NEIO) literature. Both methods

[1]*See the work of Florian Léon, January 2012*

assess market power and directly test the competitive conduct of firms without using explicit information about market structure. The Panzar and Rosse (PR) approach is based on the idea that market power is measured by the extent to which changes in input prices are reflected in the equilibrium revenues received by a specific firm. The disadvantage of the RP approach is that the competition condition derived from the H-statistic depends on the assumption of long-run equilibrium. This requires a separate test to check whether this condition is satisfied or not. Furthermore, the estimated H-statistic is measured at the industry level, not at the individual firm level.

An increasing number of studies in recent years have drawn attention to another indicator of market structure, the Lerner index, which is a well-established measure of market power at the firm level. The Lerner index of market power is defined as the difference between the price of a firm's output (P) and its marginal cost (C_m), the Lerner index is formally defined as the ability of a firm to charge above marginal cost[2] . The index should be non-negative. Thus, a zero value of the index implies that the market is perfectly competitive, while a positive value refers to a non-competitive market. The Lerner index is closely related to the competitive conditions faced by the firm. The higher the Lerner index, the larger the gap between the output price and the C_m The higher the Lerner index, the larger the gap between the price of output and the price of output, and consequently the greater the market power of the firm. Firms operating in a perfectly competitive market equalise the output price to the C_m (Conversely, monopolists exercise market power, charge output prices above their C_m The advantage of the Lerner index is that it is not the same as the one for the other. The advantage of the Lerner index is that it provides observational estimates of market power, which can be used in any subsequent analysis, as opposed to indicators such as the classical concentration ratios (HHI and CR) and the PR H statistic.

The existing literature creates potential problems with the measurement of the conventional Lerner Index. The calculation of the conventional Lerner index is done in two steps. The first step estimates the cost function (*translog*) to derive the marginal

[2] $Lerner = \frac{P-C_m}{P}$

cost C_m. The second step calculates the Lerner index using the C_m The second step calculates the Lerner index using the estimated and observed output price, which for banks is obtained by taking the ratio of total revenues to total assets. For example, Berger et al (2009), Turk-Ariss (2010). Koetter et al (2012) propose an adjusted Lerner index which requires an estimate of the profit frontier so that the average revenue (which is taken as the output price) can be estimated

3. Methodology

The analysis of the effect of market power on banking efficiency in the WAEMU area consists of a verification of the respective hypotheses based on the application of panel data econometrics. To do so, we will specify the model, then choose the appropriate econometric method for the estimations.

3.1. Conceptual model

The presentation of the model, the econometric specification and the definition of the variables are the subject of this section.

To empirically analyse the effect of market power on banking efficiency in the WAEMU area, we used a *translog* cost function that will be estimated by the stochastic frontier approach. This model has the advantage of allowing the estimation of efficiency. The specification chosen will be inspired by the model used in the study conducted by KumbhakarC.Subal and Tai-Hsin Huang (2017).

In order to represent the structure of banking markets, the Lerner index is favoured as a proxy for market power. The Lerner index is a commonly used measure to approximate competition. It expresses the ability of banks to drive their prices above their marginal cost. Formally, it is defined as the relative difference between price and marginal cost, expressed as a percentage of price; this is the inverse of the price elasticity of demand.

$$Lerner_{it} = \frac{p_{it} - Cm_{it}}{p_{it}} = -\frac{1}{e} \quad (1)$$

where p_{it} is the price of the output represented by the asset of bank i at time t, Cm_{it} its marginal cost and e the constant price elasticity of demand. Thus, the ratio takes values

between 0 and 1. The index is 0 in pure and perfect competition (very large or infinite elasticity of demand), the price being equal to the marginal cost. On the contrary, in concentrated markets, the increased market power of banks leads to an increase in the Lerner index towards 1, due to the ability to drive the price above marginal cost (in monopoly, the elasticity of demand is low). In other words, the index decreases as the degree of competition increases (Beck, 2008).

The main disadvantage of the index is that it requires an estimate of the price and marginal cost of the bank under consideration, which can be difficult. However, the literature offers several alternatives in this respect.

The conventional approach is to approximate the total asset price by the ratio of total revenues (interest and non-interest income) to total assets and estimate the marginal cost from a *translog* cost function[3] :

$$lnCT_{it} = \alpha_0 + \alpha_1 lnQ_{it} + \frac{\alpha_2}{2}(lnQ_{it})^2 + \sum_{k=1}^{3}\eta_k(lnW_{it}^k) + \frac{1}{2}\sum_{k=1}^{3}\sum_{h=1}^{3}\beta_{kh}(lnW_{it}^k)(lnW_{it}^h) + \sum_{k=1}^{3}\gamma_k lnQ_{it} lnW_{it}^k + \omega_1 Trend + \frac{1}{2}\omega_2 Trend^2 + \omega_3 Trend \times lnQ_{it} + \sum_{k=1}^{3}\varphi_k Trend \times \left(lnW_{it}^k\right) + \varepsilon_{it} \quad (2)$$

where CT indicates total costs, Q represents the output (total assets) , $W^k(k = 1,2,3)$ is the price of inputs with W^1 the cost of labour, W^2 the price of deposits and $W^3$the cost of capital; the time trend represents the evolution of technical progress over time. Indeed, in this research, the intermediation approach[4] is adopted with three inputs, namely labour, bank deposits and physical capital. The output is represented by total assets. This choice is justified, on the one hand, it allows us to compare the results obtained with those of the existing literature that uses this approximation (Turk Ariss, 2010; Koetter et

[3] Or in a more general framework from a Fourier function, of which the translog function is only a particular case.

[4] The other approach used in banking studies is the production approach. This approach assumes that the bank uses physical capital and labour to produce services. This approach ignores the intermediation function of banks and does not consider deposits as an input in the banking production process.

al., 2011; Kumbhakar C. Subal and Tai-Hsin Huang, 2017) and on the other hand, the main activity of West African banks remains intermediation. Loans and deposits account for nearly 80% of banks' total assets (BCEAO, 2015). $\alpha, \beta, \eta, \gamma, \omega, \varphi, \sigma_{v^1}^2 et \sigma_{u^1}^2$ are unknown parameters to be estimated.

To regress this function, symmetry and homogeneity conditions must be imposed. The imposed symmetry condition is as follows: $(\beta_{kh} = \beta_{hk}, \forall k \neq h)$. The homogeneity conditions[5] that this cost function must meet are:$\sum_{k=1}^{3} \eta_k = 1;\ \sum_{k=1}^{3} \gamma_k = 0;; \sum_{k=1}^{3} \varphi_k = 0\ et \sum_{k=1}^{3} \beta_{kh} = 0\ \forall h.$

Marginal costs are then obtained directly from the estimated parameters of the *translog* cost function in equation (2)by calculating the derivative with respect to$Q$the total assets. The marginal cost is obtained as follows:

$$Cm_{it} = \frac{\partial CT_{it}}{\partial Q_{it}} = \frac{CT_{it} \partial lnCT_{it}}{Q_{it} \partial lnQ_{it}} = \frac{CT_{it}}{Q_{it}} \left[\alpha_1 + \alpha_2 lnQ_{it} + \sum_{k=1}^{3} \gamma_k (lnW_{it}^k) + \omega_3 Trend \right] \quad (3)$$

The estimation of the panel data function of a set of banks can be done in two different ways. We can use *OLS* (ordinary least squares) or a stochastic frontier (SFA) (Koetter et al. 2012). The latter approach has, in our view, a valuable advantage in that it allows us to account for inefficiencies in liabilities. The methodology consists of determining for each level of *output* the minimum expected costs, and in this way establishing an efficiency frontier. Thus, by comparing the estimated observed costs, we obtain the bank's inefficiency or, in other words, the distance to the frontier. Formally, this requires the assumption that the error term can be decomposed into two such that:

$$\varepsilon_{it} = \mu_{it} + v_{it} \quad (3)$$

Where $v_{it}$is the specified error, assumed to be$i.i.d$ and normally distributed and μ_{it} a random variable distributed according to a truncated normal distribution.

Taking into account inefficiencies may be of crucial importance. The distance between price and marginal cost could indeed be altered because banks with market

[5] *These linear homogeneity constraints ensure that the cost minimisation process does not change if all prices are multiplied by the same scalar, and therefore maintain the assumption that only input price ratios affect the allocation of factors of production.*

power would adopt a quiet life (Hicks, 1935, Maudos and de Guevara, 2007), or on the contrary because efficiency would lead to structuring the market around the most efficient banks (Demsetz, 1973, Peltzman, 1977). Koetter et al. 2012 note, however, that liability inefficiencies are relatively limited. Thus, their work proposes to improve Lerner by estimating the price adjusted for asset inefficiencies, similar to the marginal cost. Since it is not possible to estimate this price, the authors do so indirectly, recalling that the average price is nothing other than the sum of average costs and profits.

$$\hat{P}_{it} = \frac{\widehat{CT}_{it}}{Q_{it}} + \frac{\hat{b}_{it}}{Q_{it}} \quad (4)$$

The first term $\frac{\widehat{CT}_{it}}{Q_{it}}$ is obtained from our *translog* cost function, the second $\frac{\hat{b}_{it}}{Q_{it}}$ can be obtained from an alternative *translog* profit function. The *translog* alternative profit function is similar to the cost function. Only one element differs in the initial specification: total costs are replaced by profits in the function specification. Except for this distinction, the estimation method and restrictions are identical, which makes it easy to estimate b according to a stochastic frontier. Thus, the Lerner adjusted for asset and liability inefficiencies is in the form:

$$Lerner_{it}^{adj} = \frac{(\widehat{CT}_{it}/Q_{it} + \hat{b}_{it}/Q_{it}) - Cm_{it}}{\widehat{CT}_{it}/Q_{it} + \hat{b}_{it}/Q_{it}} \quad (5)$$

We determine the latter for the banks in our sample over the selected period.

3.2. Econometric modelling of the relationship between market power and efficiency

In order to analyse the effect of market power on the efficiency of banks in the WAEMU, the empirical model used is as follows:

$$Eff_{it} = \theta + \delta_1 Lerner_{it}^{adj} + \delta_2 lnQ_{it} + \delta_3 Créd_{it} + \delta_4 Guichet_{it} + \delta_5 PCE_{it} + \delta_6 PCP_{it} + \delta_7 ProR_{it} + \varepsilon'_{it} \quad (6)$$

with Eff_{it} cost efficiency scores; $Lerner_{it}^{adj}$ the market power indicator. The variables $lnQ_{it}, Créd_{it}, Guichet_{it}, PCE_{it}, PCP_{it}$ et $ProR_{it}$ are control variables.

Empirical models very often require a trade-off between different parameter estimation procedures: one may be more consistent and yet less efficient than another. We face a similar trade-off when estimating our model. We can indeed resort to OLS. However, the fear of endogeneity means that the estimation procedure would be inconsistent with this problem. This is why we opt for the use of instrumental variables (IV). Having chosen an instrumental variable model, we have two possibilities: the 2SLS or the GMM. Berger et al. (2009) emphasise the interest of the GMM insofar as it does not require assumptions on the distribution of the error term while being robust to heteroscedasticity (Hall, 2005). We therefore use GMMs for the estimation of equation (6).

4. Data

The data used in this article come from the balance sheets, profit and loss accounts and annual report of the Central Bank of West African States (BCEAO) banking commission[6] . These data are time series and cover the period from 2010 to 2015. The sample consists of all banks in 7 WAEMU countries (Guinea-Bissau is excluded[7]). The sample is composed of 96 banks, i.e., 558 observations (non-cylindrical panel). Our main data are: net profit, total assets, total cost, labour input cost approximated by the ratio of personnel expenses to the number of employees, the price of deposits measured using the ratio of interest paid to depositors by the bank to deposits and the cost of capital is constructed by relating operating expenses to the total fixed assets of each bank in the WAEMU countries. In addition, we will have to use the following variables and ratios in the estimation of model 6:

- lnQ_{it} which is total assets in logarithmic form measures the size of the bank. Larger banks can both have market power and be more efficient (Berger and Humphrey, 1997).
- $Créd_{it}$ which is the ratio of credit to total assets measures participation in the credit market.

[6] *All these data are freely available on the BCEAO website: www.bceao.int.*

[7] *Guinea-Bissau is excluded due to missing data.*

- $Guichet_{it}$ which is the geographical extension measured from the ratio of the number of branches to total assets in its logarithmic form. Indeed, Hirtle (2007) has shown the effect of the size of the banking network on banking performance in America. However, it is likely that the density of the banking network has an important role in explaining efficiency in developing countries, in particular the WAEMU countries. Thus, an extensive network may be a sign of an efficient firm that extends its offer. However, a diffuse network can lead to organizational problems that negatively impact efficiency.
- $PCE_{it} et PCP_{it}$ represent respectively the share of foreign capital and the share of capital held by the state. Indeed, the ownership of banks (foreign and state-owned) is often put forward to explain efficiency differences (Berger, 2007). In order to take this possibility into account, the variables $PCE_{it}\ et\ PCP_{it}$ are introduced as control variables.
- $ProR_{it}$ is the ratio of risk provisions to total assets. Thus, one of the specificities of the banking business is risk management. This characteristic makes it difficult to measure banking efficiency and to study its determinants. Greater risk-taking can lead to higher costs and revenues. Because of the difficulty of measuring it, risk is taken into account by this ratio. This ratio makes it possible to capture in part the more or less risky investment choices made by the bank.

5. Results

Table 1 below summarises the descriptive statistics of the relevant variables for each of the eight (8) WAEMU countries. Côte d'Ivoire had the highest number of observations in our sample, and Niger had the lowest number of observations. There is considerable variation across countries for all the variables we use. Specifically, banks in Burkina Faso have the highest average values of total profits and costs followed by banks in Côte d'Ivoire, Benin, Senegal, Mali, Togo and Niger. As for output (total assets), Ivorian banks have the highest average values, followed by banks in Burkina Faso. This implies that the magnitude of Ivorian and Burkinabe banks is the highest among the seven (7) WAEMU countries on average while Nigerian banks are at the other end of the spectrum. In addition, average output and input prices vary across the seven

(7) WAEMU countries, which means that banks in different countries might have different technologies and might also operate under different market conditions for output and inputs. Togolese banks pay the highest average salary to their employees, followed by Nigerian, Ivorian, Beninese, Malian, Senegalese and Burkinabe banks. Togolese banks also have the highest average deposit prices, followed by Beninese, Burkinabe, Senegalese, Ivorian, Malian and Nigerian banks. Senegalese banks pay the highest average price, followed by Nigerian, Ivorian, Burkina Faso, Togolese, Beninese and Malian banks. Thus, in order to adapt to these heterogeneous circumstances, WAEMU banks use their individual market power to set their own output prices. The highest average price is charged by the Togolese bank, followed by the Beninese, Burkinabe, Nigerian, Ivorian, Senegalese and Malian banks.

Table 1 Descriptive statistics for variables used in boundary estimation

	Benin	Burkina Faso	Côte d'Ivoire	Mali	Niger	Senegal	Togo
Profit (b)	815.58	682.93	5142.43	2139.97	936.35	2868.38	16.45
	(4593.96)	(782.77)	(11416.66)	(3147.16)	(2488.99)	(3059.73)	(6916.936)
Total assets (Q)	204393.7	210048.5	270289.1	199167.1	94487.95	232347.2	116250.3
	(201666.9)	(175924.7)	(280594.8)	(152817.8)	(76115.02)	(203131)	(109271.2)
Total cost (TC)	24278.13	28434.56	24914.99	18687.36	9528.915	20729.76	18164.39
	(32051.58)	(66749.58)	(27308.63)	(25331.64)	(7545.333)	(21075.26)	(29374.39)
Price of labour (w_1)	0.0182	0.016	0.0258	0.0183	0.0288	0.018	0.0294
	(0.0113)	(0.0104)	(0.0159)	(0.0062)	(0.025)	(0.0093)	(0.0362)
Deposit price (w_2)	0.0430	0.033	0.027	0.0258	0.0255	0,0313	0.0504
	(0.0129)	(0.0138)	(0.0202)	(0.0127)	(0.0107)	(0.0207)	(0.0739)
Capital price (w_3)	0.1202	0.1446	0.1462	0.1147	0.1715	0.1794	0.1415
	(0.0887)	(0.1652)	(0.141)	(0.1108)	(0.1721)	(0.1317)	(0.0913)
Output price (P)	0.1283	0.1254	0.1099	0.105	0.1208	0.1058	0.1572
	(0.1226)	(0.1217)	(0.0824)	(0.0694)	(0.0566)	(0.078)	(0.234)
Number of banks	12	12	20	13	10	17	12
Number of observations	70	71	115	77	59	99	67

Source: Compiled by the author from STATA 13

The mean values RT, Q and CT are in millions of CFA francs and the numbers in brackets are standard deviations

A very important question can be raised. A higher output price is compatible with a higher market power. In the following, we will analyse to find an answer to this question.

Table 2 below presents the descriptive statistics of the Lerner index and the cost efficiency. It can be seen that the calculated Lerner indices are all positive. This is in line with economic theory which states that no firm can price below marginal cost unless it is subsidised by the government. Mali has the highest Lerner index, followed by Benin, Togo, Burkina Faso, Senegal, Niger and finally Côte d'Ivoire. Thus, the Ivorian banking industry on average prices its customers low, perhaps because this market is the most competitive of the six (6) other banking industries based on estimated Lerner indices. Ivorian banks set the highest average output price than Senegalese and Malian banks, but operate in a more competitive market than the latter because of its low average Lerner index value. This could be due to institutional factors such as interest rate regulation by the authorities. Conversely, Malian banks set the lowest average output price and operate in the least competitive market. Thus, it can be concluded that a small number of Malian banks operate in a contestable market and behave competitively due to the non-existence of barriers to entry and exit.

Table 2 Descriptive statistics on market power as measured by the Lerner index and on the efficiency of WAEMU banks

Lerner Index							
Mean	*0.505*	*0.354*	*0.064*	*0.594*	*0.084*	*0.108*	*0.486*
SD	*0.243*	*0.087*	*0.0434*	*0.072*	*0.015*	*0.053*	*0.204*
Min	*0.006*	*0.237*	*0.001*	*0.417*	*0.05*	*0.017*	*0.03*
Max	*0.903*	*0.656*	*0.316*	*0.688*	*0.14*	*0.425*	*0.874*
Total number obs	*69*	*71*	*115*	*77*	*59*	*99*	*67*
Cost efficiency							
Mean	*0.816*	*0.832*	*0.808*	*0.922*	*0.965*	*0.915*	*0.608*
SD	*0.123*	*0.092*	*0.115*	*0.036*	*0.017*	*0.086*	*0.185*
Min	*0.556*	*0.713*	*0.625*	*0.870*	*0.924*	*0.68*	*0.218*
Max	*0.939*	*0.988*	*0.980*	*0.993*	*0.994*	*0.979*	*0.842*
Total number obs	*72*	*72*	*120*	*78*	*59*	*102*	*72*

Source: Made by the author from Stata 13

Table 3 below presents the descriptive statistics for the variables cr (credit to total assets ratio), gui (geographical extension measured by the number of windows to total assets), pce and pcp (represent respectively the share of foreign capital and the share of capital held by the State) and pror (ratio of provisions for risk to total assets)

Thus, banks in Burkina Faso have the highest average ratio of credit to total assets, followed by banks in Niger, Togo, Senegal, Mali, Benin and Côte d'Ivoire. Malian banks have on average the highest number of branches while Nigerian banks have on average the highest number of branches. As for the share of foreign capital, Benin has the highest average share of capital, Côte d'Ivoire the lowest. Ivorian banks have the highest average share of capital held by the state, while Beninese banks are at the other end of the spectrum. Togolese banks on average manage more risk and Burkinabe banks take enough risk.

Table 3 Descriptive statistics for the other variables in equation 6

	Benin	*B/FASO*	*CI*	*MALI*	*NIGER*	*SENEGAL*	*TOGO*
Cr	*0.54*	*0.68*	*0.51*	*0.56*	*0.62*	*0.56*	*0.58*
	(0.15)	*(0.78)*	*(0.21)*	*(0.11)*	*(0.18)*	*(0.17)*	*(0.54)*
mistletoe	*16*	*17.91*	*27.53*	*30.36*	*11.83*	*20.56*	*18.41*
	(10.91)	*(11.95)*	*(34.5)*	*(27.7)*	*(6.3)*	*(21.64)*	*(11.7)*
Pce	*0.77*	*0.61*	*0.26*	*0.63*	*0.61*	*0.64*	*0.42*
	(0.22)	*(0.31)*	*(0.37)*	*(0.37)*	*(0.4)*	*(0.32)*	*(0.41)*
Pcp	*0.028*	*0.16*	*0.51*	*0.16*	*0.16*	*0.06*	*0.3*
	(0.12)	*(0.19)*	*(0.44)*	*(0.3)*	*(0.29)*	*(0.1)*	*(0.39)*
pror	*0.01*	*0.003*	*0.01*	*0.0091*	*0.02*	*0.007*	*0.07*
	(0.02)	*(0.004)*	*(0.03)*	*(0.02)*	*(0.025)*	*(0.146)*	*(0.26)*

Source: Made by the author from Stata 13

Table 4 below presents the results of the estimation of equation 6 by the generalised method of moments. The statistics obtained show that the model is globally significant. Thus, the market power, expressed by the Lerner index, affects positively and significantly at the 1% threshold the cost efficiency of banks in the WAEMU. In other words, WAEMU banks with higher market power are also more efficient in reducing their costs. An increase in market power therefore improves the cost efficiency of banks in the WAEMU region, thus rejecting the QLH.

Table 4: Estimation results

Variables explanatory notes	*Benin*	*B/Faso*	*CI*	*Mali*	*Niger*	*Senegal*	*Togo*
Lerner	*0.1776**	*0.3497**	*0.2017**	*0.2116**	*0.1976**	*0.3277**	*0.2168**
	(0.0176)	*(0.0499)*	*(0.4426)*	*(0.0169)*	*(0.0629)*	*(0.0594)*	*(0.0340)*
Lnq	*0.0857**	*-0.0567**	*-0.0400**	*0.0057**	*-0.0113*	*-0.0789**	*-0.0407**
	(0.0073)	*(0.011)*	*(0.0037)*	*(0.0025)*	*(0.0015)*	*(0.0049)*	*(0.0049)*
Cr	*0.0858**	*-0.0260**	*-0.0280**	*0.0137**	*-0.0005*	*0.1381**	*0.0130**
	(0.0007)	*(0.0061)*	*(0.0077)*	*(0.0131)*	*(0.0065)*	*(0.0162)*	*(0.0062)*
lngui	*-0.0009*	*0.0079*	*-0.0314**	*-0.0135**	*0.0056**	*0.0529**	*0.0483**
	(0.0332)	*(0.0242)*	*(0.0028)*	*(0.0021)*	*(0.0015)*	*(0.0036)*	*(0.0062)*
Pce	*0.0633**	*0.0101*	*-0.0622**	*0.0178**	*0.0162**	*0.0463**	*0.0342**
	(0.0237)	*(0.1047)*	*(0.0062)*	*(0.0043)*	*(0.0028)*	*(0.0108)*	*(0.0113)*
Pcp	*-0.0596*	*-0.3410**	*-0.0315**	*0.0257**	*0.0149**	*0.0696**	*-0.0222**
	(0.0383)	*(0.0863)*	*(0.0051)*	*(0.0057)*	*(0.0036)*	*(0.0323)*	*(0.0128)*
Pror	*1.4351*	*-5.2828**	*-0.3407**	*0.4591**	*0.1864**	*-1.4034**	*0.0632**
	(0.2155)	*(0.9752)*	*(0.0678)*	*(0.0511)*	*(0.0563)*	*(0.1920)*	*(0.0147)*
Cons	*0.2211**	*0.7367**	*1.1243**	*0.7835**	*0.9676**	*1.0442**	*0.5844**
	(0.0449)	*(0.0179)*	*(0.0123)*	*(0.0186)*	*(0.0087)*	*(0.0218)*	*0.0312*
No. of obs	*67*	*54*	*110*	*71*	*59*	*82*	*51*
Prob	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*

Source: Compiled by the author from the results of the Stata estimates

Table 4 presents estimation results for each country. Thus, instead of grouping all countries together, we estimate the stochastic regression equations (2) and equation 6 for each country. We find that the country-specific cost frontiers are well fitted, as most of the coefficient estimates reach statistical significance. Similarly, the results of the GMM estimation of equation 6 show that the model is globally significant

Thus, an increase in the Lerner of 1% would lead to an increase in cost efficiency of 0.1776% in Benin, 0.3497% in Burkina Faso, 0.2017% in Côte d'Ivoire, 0.2116% in Mali, 0.1976% in Niger, 0.3277% in Senegal and 0.2168% in Togo. The results presented in Table 4 show that in the WAEMU banking market, the *Lerner* The results presented in Table 4 show that in the WAEMU banking market, the cost-efficiency ratio is significantly positive, implying that the WAEMU banking industries with

higher market power are able to set favourable prices in response to higher costs due to cost inefficiency. This can be explained by the value of the Lerner index which is strictly greater than 0.

Table 3 shows the descriptive statistics of the Lerner index and the cost efficiency. It can be seen that the calculated Lerner indices are all positive. This is in line with economic theory, which states that no firm can price below marginal cost unless it is subsidised by the government. Mali has the highest Lerner index, followed by Benin, Togo, Burkina Faso, Senegal, Niger and finally Côte d'Ivoire. Thus, the Ivorian banking industry on average charges its customers low prices, perhaps because this market is the most competitive of the six (6) other banking industries based on estimated Lerner indices. Ivorian banks set the highest average output price than Senegalese and Malian banks, but operate in a more competitive market than the latter because of its low average Lerner index value. This could be explained by institutional factors such as interest rate regulation by the authorities. Conversely, Malian banks set the lowest average output price and operate in the least competitive market. Thus, it can be concluded that a small number of Malian banks operate in a contestable market and behave competitively due to the non-existence of barriers to entry and exit.

From the results and analysis, we conclude that market power contributes to the improvement of banks' efficiency in the WAEMU. Indeed, our results reject the idea that the origin of banking crises lies in the lack of competition. Moreover, it is banks with greater market power that are more efficient. Thus, we suggest that regulatory authorities should be able to allow banking institutions to manage information asymmetry by having the market power to invest in information search. In terms of economic policy, this research highlights the potentially harmful effects of bank competition. Therefore, increased competition may induce additional costs by reducing access to and investment in information search. Thus, competition policies need to be coupled with actions that promote the dissemination and distribution of information.

6. Discussion

Theoretically, the results of our estimations present several perspectives. In particular, the confirmation of the results obtained by other authors on other countries. These results are consistent with Maudos and Fernandez de Guevara (2007) for European banks. Koetter et al (2012) with adjusted Lerner indices for US banks find a positive relationship between market power and efficiency. On the contrary, Berger and Hannan (1998), Delis and Tsionas (2009) and Turk-Ariss (2010) find a negative relationship between market power and cost efficiency in the US, European and developing countries respectively.

However, some limitations could be noted, which will allow for further studies on the subject by changing the focus or the method. The limitations of this research include the presence of missing data that may influence the results. In addition, the calculation of certain variables (ratios) may be biased,

for example, the lack of information on certain variables of the WAEMU banks... Also, the data from the database we used may not be of the best quality, and therefore may bias the data and our analyses.

Moreover, two types of loans can be distinguished in the WAEMU area. Most of the loans are allocated to sectors and actors with low profitability and low risk. These are loans to the public sector, to large companies (especially foreign ones), to companies linked to trade or tourism. These are loans with short maturities. The interest rates charged are low because of limited risk but also because of low marginal productivity of capital. On the other hand, the majority of economic actors have limited access to bank credits. These are small and medium-sized enterprises, sectors of activity such as agriculture or industrial (non-extractive) activities. These actors face high interest rates due to higher default risk and higher marginal productivity. Even controlling for risk, the interest rate for safe loans is lower than for risky loans due to differences in marginal productivity. Proxies for risk-taking were introduced into the empirical specification to purge this effect.

Banks are free to choose the allocation between these two sectors. However, banks with some market power may not have an incentive to reach the risky end of the customer base. Because of the limited size and cost of entry into this market, it may be more rational to concentrate lending only to the safest agents. However, this portfolio allocation choice does not maximise income if the expected income from risky agents is higher than the certain income from lending to non-risky agents. On the other hand, banks that do not have easy room for manoeuvre are obliged to diversify their choice of customers. This strategy, while it leads to higher costs, also leads to higher total revenues. Further research in this direction is needed to better understand the ins and outs of these various strategies.

7. Conclusion

In this paper, we attempt to empirically analyse the effect of market power on bank efficiency in the WAEMU region over the period 2010 to 2015. Our first model consists of a cost frontier and a profit frontier. These frontiers allowed us to estimate the efficiency scores and the Lerner index of the bank. This approach lies in the determination of the Lerner index, using the marginal cost function (Cm) implied by the cost frontier. In addition, the measure of the Lerner index found guarantees non-negativity and is strictly positive. The method of calculating the adjusted Lerner index of Koetter et al. (2012) is used in this paper.

The estimated Lerner index is strictly positive for all WAEMU banks. Similarly, this index has a positive and strictly statistically significant effect for each country, which implies the existence of a dependence between costs and output price. A bank with higher costs due to operational inefficiency may pass on part of the cost to consumers, depending on the competitiveness of the market. Furthermore, the calculated Lerner indices allow us to say that in the WAEMU, banks are in a situation of imperfect competition.

The results highlight a positive effect of market power on banking efficiency in the WAEMU. Thus, economic theory explains this effect on efficiency by an ability to generate information for banks with market power. However, the dissipation of this beneficial effect is not explained in the literature. But our intuition is that banks with some market power are reluctant to extend their service offering to new and more profitable customers for reasons such as: cost of entry, limited size.

As a research perspective we wish to refine the research by using a panel model in order to capture the individual contribution of each bank in the overall value of market power. This will make it possible to offer a reduction in the cost of banking services.

Bibliographie

[1] **Aigner D, Lovell CAK, Schmidt P (1977)**, Formulation and estimation of stochastic frontier production function models. J Econom 6:21-37

[2] **Alegria C, Shaeck K. (2008)**, On measuring concentration in banking systems.

[3] **Amsler C, Prokhorov A, Schmidt P (2004)**, Using copulas to model time dependence in stochastic frontier models. Econom Rev 33:497-522

[4] **Angelini P, Cetorelli N (2003)**, The effects of regulators reform on competition in the banking industry.J, Money Credit Bank 35: 663-684

[5] **Beck T, Demirgüç-Kunt A., Levine R (2006)**, Bank concentration, competition, and crisis: first results. J Bank Financ 30: 1581-1603

[6] **Berger AN, Hannan TH (1998)**, The efficiency cost of market in the banking industry. Rev Econ Stat 8: 454-465

[7] **Berger AN, Demirgüç-Kunt A, Levine R, Haubrich JG (2004)**, Bank concentration and competition: an evolution in the making J. Money Credit Bank 36: 433-451

[8] **Carta A, Steel MFJ (2012)**, Modelling multi-output stochastic frontiers using copulas. Comput Stat Data Anal 56:3537–3773

[9] **Claessens S, Laeven L (2004)**, What drives bank competition? Some international evidence. J Money Credit Bank 36:563–583

[10] **Delis MD, Tsionas EG (2009)**, The joint estimation of bank-level market power and efficiency. J Bank Financ 33:1842–1850

[11] **Fernández de Guevara J, Maudos J, Pérez F (2005)**, Market power in European banking sectors. J FinancServ Res 27:109–137

[12] **Fernández de Guevara J, Maudos J, Pérez F (2007)**, Integration and competition in the European financial markets. J Int Money Financ 26:26–45

[13] **Florian Léon (2012)**, Effet de la concurrence sur l'efficience bancaire en Afrique : Le cas de l'UEMOA, Etudes et Documents, E 2012.2

[14] **Green WH (2003)**, Simulated likelihood estimation of the normal-gamma stochastic frontier function. J Prod Anal 19:179–190

[15] **Jondrow J, Lovell CAK, Materov IS, Schmidt P (1982)**, On the estimation of technical inefficiency in the stochastic frontier production function model. J Econom 19:233–238

[16] **Koetter M, Kolari J, Spierdijk L (2012)**, Enjoying the quiet life under deregulation? Evidence from adjusted Lerner indices for U.S. banks. Rev Econ Stat 94:462–480

[17] **Kumbhakar SC, Tai-Hsin Huang (2017),** Joint estimation of the Lerner index and cost efficiency using copula methods, empirical Economics-January 2017

[18] **Lai HP, Huang CJ (2013)**, Maximum likelihood estimation of seemingly unrelated stochastic frontier regressions. J Prod Anal 40:1–14

[19] **Lerner AP (1934)**, The concept of monopoly and the measurement of monopoly power. Rev Econ Stud 1:157–175

[20] **Maudos J, Fernández de Guevara J (2007)**, The cost of market power in banking: social welfare loss versus cost inefficiency. J Bank Financ 31:2103–2125

[21] **Meeusen W, Van den Broeck J (1977)**, Efficiency estimation from Cobb–Douglas production functions with composed error. Int Econ Rev 18:435–444

[22] **Panzar JC, Rosse JN (1987)**,Testing for monopoly equilibrium. J Ind Econ 35:443–456

[23] **Shi P, Zhang W (2011)**, A copula regression model for estimating firm efficiency in the insurance industry.JAppl Stat 38:2271–2287

[24] **Sklar A (1959)**, Fonctions de répartition dimensions et leurs marges. Publications de l'Institut de Statistique de L'Université de Paris 8 :229–231

[25] **Smith MD (2008)**, Stochasticfrontiermodelswithdependenterror components. Econom J 11:172–192

[26] **Tsay WJ, Huang CJ, Fu TT, Ho IL (2013)**, A simple closed-form approximation for the cumulative distribution function of the composite error of stochastic frontier models. J Prod Anal 39:259–269

[27] **Turk-Ariss R (2010)**, On the implications of market power in banking: evidence from developing countries. J Bank Financ 34:765–775