Structure and efficiency of WAEMU banking market

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The economic growth of a nation depends on its capacity to create wealth. Thus, the financing of investment becomes essential for developing countries. Studies as those of Nasser Ary T., (2008) and S. Kablan, (2008), have examined the eventual determinants of the banking performances of the WAEMU, but none by now have focused precisely on the effect that the market environment may have on the efficiency of the banks. Yet, the level of competition and concentration in the sector as shown in recent studies (Allen and Liu, 2006) appears to be a fundamental element to consider. Therefore, it is right to suppose that a clear representation of the banking market structure of the Sub-region could be a major contribution in the determination of its performance. The question then is to try to know how the banking market environment can influence this efficiency.

Two approaches attempt to explain the link between market structure and performance: **The structural measures** based on structure-conduct-performance paradigm (SCP) which establishes a one-way-causality between market environment, conduct and performance, and the **non-structural measures** resulting from the new industrial technologies (NIO) which consider the concept of contestable market. The aim of this study will be to determine first the structure of WAEMU banking market and then, to analyse the impact of its components on the efficiency of this market.

1-Assessment method of market structure: the Panzar and Rosse model (P-R model)

In 1987, Panzar and Rosse developed a method to estimate the level of competition based on the computation of the "H-statistic". It measures the sum of the elasticities of the reduced form revenues with respect to factor prices, in other words, it assesses the effect of prices variation of inputs on the revenues of the enterprise (J. Allen et W. Engert, 2007).

Panzar and Rosse showed that for:

$H < 0 \Rightarrow$ the underlying market is monopoly;

$H \in [0, 1[\Rightarrow$ Chamberlin monopolistic competition;

$H = 1 \Rightarrow$ perfect competition.

If we consider TR the total revenue, w_i the input i and CF control variables specific to each bank (scales and structures variables), ε disturbance, α individual effects, n number of inputs needed to produce banking services and m the number of variables expressing specificity of each bank. The P-R model equation that will be used is:

$$\text{Ln}\left(\frac{\text{TR}}{\text{TA}}\right) = \alpha + \sum_{i=1}^{n} \beta_i \ln w_i + \sum_{j}^{m} \gamma_j \ln CF_j + \sigma \ln \text{TA} + \varepsilon \quad (3)$$

It is a price equation that considers TA as control variable and according to Claessens and Laeven (2004) or Schaeck et al. (2009) it is the more recent one. The H-statistic is then:

$$H = \sum_{i=1}^{n} \beta_i \quad (2)$$

2- Efficiency determinants

The determinant of efficiency can be gathered in three groups as shown on this table:

Table 1: of efficiency determinant

1- MANAGERIAL AND ORGANIZATION DETERMINANTS	
General or functioning charges : **CGF**= *general charges/ total assets*	**Bank size :** **AT**= *total assets*
Commercial Policy variables : **CT**= *credits/total deposits*	**Banks stockholder's equity :** **CP=** stockholder's equity / total assets
Prudential measures in front of generals banking risks : **MPR=** *(funds for* **generals banking risks** *+ Provisions on loans or non performing credits) /total assets*	**The engagements :** **EHB=***engagements out of balance sheet/ (out of balance sheet engagements + Total assets)*
2-MACRO-FINANCIAL DETERMINANTS	
Banking sector size : **ATP=***Total assets of the banking sector over GDP*	**banking concentration indicator** **ICB1=** *deposits of the bank over total deposits of the banking sector*
banking competitive indicator **ICB2=***assets of the bank over total assets*	
3-MACROECONOMICS DETERMINANTS	
The economic growth : cyclical output **PIBR**= *incomes per capita*	**The inflation :** **TXI**= *inflation rate*

- ***Stochastic Frontier analysis*** *(SFA)*

According to Bourke (1989) we have:

$$\text{Log } \pi_{it} = \alpha_i + \sum_{j=1}^{N} \delta_j \log x_{it}^{j} + \varepsilon_{it} \qquad (4)$$

Where π_{it} represents the bank i profit at time t, x_{it}^{j} the j-th explicative variable of the bank i profit at time t, δ_j the coefficient affected to the j-th variable, constant through banks, α_i individual effect specific to the bank i, ε_{it} disturbance of the bank i at time t, which can be deterministic or stochastic.

In case the econometrics tests (Hausman et Taylor test, 1981) reveal a deterministic term of error, it will be a fixed effect model. The efficiency will be:

$$(\text{eff})_i = \exp(\hat{\alpha}_i - \hat{\alpha}) \qquad (5) \qquad \text{were} \qquad \hat{\alpha} = \max_i(\hat{\alpha}_i) \qquad (6)$$

If the disturbance is stochastic, then it will rather be an error component model. And the disturbance will be split up as $\varepsilon_{it} = u_i + v_{it}$ and the new equation of the efficiency will be:

$$\text{Log } \pi_{it} = \alpha + \sum_{j=1}^{N} \delta_j \log x_{it}^{j} + u_i + v_{it} \qquad (7)$$

Then the average efficiency will be:

$$\alpha_i = \frac{1}{T} \sum_{t=1}^{T} \hat{\varepsilon}_{it} \qquad (8)$$

with $\hat{\varepsilon}_{it}$ the residual estimated by GLS.

Setting $\hat{\alpha} = \max_i(\alpha_i)$ (g), we obtain: $(\text{eff})_i = \exp(\alpha_i - \hat{\alpha})$ (9)

3- Empirical study

- ***Hypothesis***

Outputs are elements that generate an added value like credits or loans and the WAEMU banks function under banking intermediation system. The Panzar and Rosse model assumes a price elasticity of demand, greater than unity, long run equilibrium and a homogeneous cost structure. Bank i maximizes its profits where marginal revenue equals marginal cost.

- ***Sample***

Our sample is constituted of cross-section data in a total of eighty (80) banks in a period from 2002 to 2007. The sources of data are Balance-sheets and Final accounts that have been given by the Central Bank of West African States (CBWAS).

3.1-Structure

In the year 2009, 119 banks and financial establishments are counted. These credits establishments are divided into three categories according to their statement size. The greatest ones (G-Bq) have a statement more than 100 Mds FCFA, the medium size ones (M-Bq) a statement between 100 Mds FCFA and 50 Mds FCFA and the small ones (P-Bq) a statement lower than 50 Mds FCFA. Their credits per deposits evolution is shown on graph 1.

Table 2 variables

Dependent variable : net incomes **PNB=** *total incomes – banking charges*	
Output factor indicator costs	
Personal expenses **DP**= *personal expenses /total assets*	**Other general expenses** **AFG=** *overhead expenses –personal expenses / total asset*
Financial price **PF=** *average weight cost of financial resources / total assets*	**Banking or financial service prices** **CV** = *commissions and financing engagement / total assets*
Scale variable **AT=** *bank total assets*	
Structural variables	
Bank's net credits **CN=** *banks net credits /total assets*	**Clients deposits** **DPO=** *clients deposits / total assets*
Risk on bank's activities **RISK1** = *loan-loss and charges provisions + general banks fund risks / total assets*	**Risk while transforming deposits in to credits** **RISK2=** *crédits / deposits*

- ***Model***

According to the Hausman specification test (refer to table 1) of individual effects, the panel fixed effect regression is retained (panel least squares: LSDV). Since the analysis time period is relatively short, stationnarity and cointegration test are not necessary. The estimate P-R model is then:

$$LRT_{it} = \delta_i + \alpha_1 LDP_{it} + \alpha_2 LAFG_{it} + \alpha_3 LPF_{it} + \alpha_4 LCV_{it} + \beta_1 LAT_{it} + \beta_2 LCN_{it} + \beta_3 LDPO_{it} + \gamma_1 LRISK1_{it} + \gamma_2 LRISK2_{it}$$

Where LX= ln(x).

3.2- *WAEMU structure effect on efficiency: Stochastic Frontier Analysis method*

The reference will be the profitability function developed by Molyneux and Forbes (1995) which is the ratio between current bank profits and the maximum profits that could be achieved if this bank was as efficient as the most efficient bank of the sample.

- ***Model***

The Hausman specification test of individual effects reveals that the most appropriate regression is the Random Effect model. Therefore our model is:

$$LROE_{it} = \delta_i + \delta_1 LCGF_{it} + \delta_2 LCT_{it} + \delta_3 LCP_{it} + \delta_4 LMPR_{it} + \delta_6 LATP_{it} + \delta_7 LICB1_{it} + \delta_8 LICB2_{it} + \delta_9 PIBR_{it} + \delta_{10} TXI_{it} + v_{it}$$

- ***Interpretation of results***

Table 1: P-R regression model

Variables	Coefficients	Prob.
LDP	**0.225385**	**0.0000**
LAFG	**0.132798**	**0.0006**
LPF	**-0.215614**	**0.0000**
LCV	**0.026447**	**0.0282**
LAT	**0.098194**	**0.0035**
LCN	**0.418942**	**0.0092**
LDPO	**0.402461**	**0.0000**
LRISK1	**-0.035618**	**0.0341**
LRISK2	**0.291715**	**0.0038**
C	**-2.224628**	**0.0000**

Source: CBWAS, our estimations

The price elasticity that allows the H-statistic to be positive is the one of personnel expenditures, other general expenditures and commissions which increases the revenue. Then we obtain:

H= 0,169016

This value of H-statistic permit to assert that the WAEMU banking market formerly an oligopolistic structure (Dem I., 2003) has undergone some modifications and becomes this last decade a low monopolistic competitive environment.

Yet, competition brings changing in market actor behaviour. So we are about to ask ourselves what are the consequences of this new competitive situation of the banking market on the bank efficiency of the Union?

The regression of the return on equity on some explicative variables of the table 1 permits us to obtain the following average efficiency scores:

- ***Average efficiency scores***

They are calculated as given in the equation (8) and (9). The results show that the most efficient bank of the WAEMU in the last decade was in Ivory Coast and the least in Mali. The WAEMU banking market is efficient with a score average around 63, 29% of the most efficient bank. You can see on the table above the average efficiency of the 08 countries of the Union.

Tableau 4: return on equity (ROE) assessments.

LROE	Coefficients.		Adjusted R-squared
LCGF	0,464	0,000	*0,826*
LCT	0,319	0,005	
LCP	-1,096	0,000	
LATP	0,008	0,877	*Prob (F-statistic)*
LMPR	0,018	0,243	
LICB1	0,549	0,000	
LICB2	-0,536	0,001	*0,0000*
LPIBR	0,029	0,679	
TXI	-0,001	0,806	
C	-1,284	0,002	

Conclusion

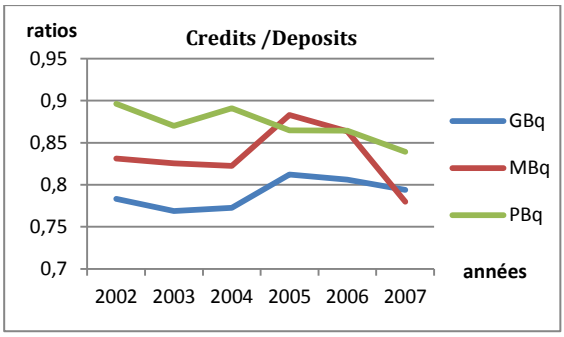
The bank market structure analysis of the Union revealed that economic environment of the WAEMU banking market is currently a monopolistic competition. That was not the case in the last few years. This shows a changing in behaviour of banks concerning the differentiation of products offered to their clients, though the sector is still being concentrated around foreign groups. The estimation by the stochastic frontier analysis confirms the significant impact of the competition and concentration on the efficiency of the bank. That is to say that changing in WAEMU bank attitude can lead to modifications of the level of efficiency of these banks for the Sub-region economy. This study allowed us to understand that the banks efficiency do not always satisfy general welfare. Thus, the global efficiency of the market must consider social factors as restriction to take into account social well-being aspect..

Tableau 5: average efficiency

Country	Average efficiency
Benin	0,516
Burkina faso	0,641
Ivory Coast	0,631
Guinea Bissau	0,602
Mali	0,632
Niger	0,709
Senegal	0,595
Togo	0,709

Graphics and tables

Graph1: Evolution of ratio credit per deposit



Source: « CBWAS annual report »

Table 6: Hausman specification test

Hausman specification test 1			
Test Summary	Chi-Sq. Statistic	Chi Sq. d.f.	Prob.
Cross-section random	30.81	9	0.0003

Source : estimation

Table7: Hausman specification test

Hausman specification test 2			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.0000	9	1.0

Source: estimation

Table 8: WAEMU Banks efficiency scores

BK	effi_i	BK	effi_i	BK	effi_i	BK	effi_i
1	0,50	21	0,75	41	0,89	61	0,61
2	0,21	22	0,68	42	0,46	62	0,55
3	0,53	23	0,58	43	0,17	63	0,67
4	0,70	24	0,58	44	0,58	64	0,60
5	0,63	25	0,42	45	0,69	65	0,67
6	0,38	26	0,74	46	0,61	66	0,65
7	0,54	27	0,61	47	0,85	67	0,48
8	0,55	28	0,56	48	0,87	68	0,46
9	0,54	29	0,54	49	0,87	69	0,64
10	0,58	30	0,74	50	0,37	70	0,65
11	0,60	31	0,62	51	0,61	71	0,44
12	0,69	32	0,67	52	0,67	72	0,75
13	0,64	33	0,60	53	0,63	73	0,59
14	0,72	34	0,78	54	1,00	74	0,59
15	0,50	35	0,67	55	0,61	75	0,88
16	0,67	36	0,74	56	0,63	76	0,61
17	0,78	37	0,53	57	0,81	77	0,26
18	0,61	38	0,98	58	0,61	78	0,75
19	0,57	39	0,61	59	0,72	79	0,84
20	0,57	40	0,22	60	0,82	80	0,41

Source: estimation

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ABSTRACT

This paper studies the structure of the WAEMU bank market and examines the impact of this structure on banks efficiency. We estimate competitive behavior in the WAEMU banking system by applying the Non-structural measures of competition developed by Panzar and Rosse (1987) using panel data from 2002 to 2007. The results of this non-structural model have shown that the WAEMU banking sector faces a low level of monopolistic competition. The effect due to the concentration and competition on the efficiency is determined by using the stochastic frontier analysis approach. The research results show that there is a significant connection between competition, concentration and efficiency in WAEMU.