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On the Sensitivity of Banking Activity Shocks: Evidence from the CEMAC Sub-region

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Abstract

This paper qualitatively and quantitatively assesses the degree of resilience in the financial intermediary sector of the Economic and Monetary Community of Central African States (CEMAC) to macroeconomic shocks and discusses the relevant policy implications. Using GMM and a battery of estimations techniques, the panel-based investigations broadly show that the sub-region is vulnerable to macroeconomic shocks. Lower bank provisions result on the one hand from shortages or decreases in long-term financing, real exchange and GDP per capita growth rate on the other hand from increases of interest rates. Whereas the change in interest rate increases net income commission, the effect is negative from lower levels of short-term financing. The incidence of changes in interest rates on the interest rate margin of banks is ambiguous. The findings broadly confirm the need to incorporate macroeconomic shocks in financial policy decision making. The paper contributes at the same to the knowledge on stock management in monetary zones and the need to: (1) timely intervene to mitigate potential shocks and; (2) increase control to sustain the credibility of the banking system.

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1. Introduction

Recent literature has substantially documented the need for effective financial intermediary policies in the CEMAC sub-regions (Tsafack Nanfosso and Nguena, 2014; Nguena, 2013 ab; Asongu, 2013a). Indeed the role of financial deepening has been critical in the consensus on the positive nexuses among finance, economic productivity and growth (Asongu, 2013b; Davies, 2012; Lozano-Vivas and Pastor, 2006; Levine, 1997; Guillaumont et al, 2006; Beck *et al.* 2000). Arestis (2006) has emphasized that the literature has rarely attempted to identify the specific mechanisms by which this nexuses come into effect. In light of the transmission mechanisms, it is logical to infer that financial deepening cannot substantially influence the real economic sector without the crucial roles of the banking sector. A two-way causality from financial deepening to banking productivity has been established by Chortareas (2011) in Latin America. Owing to the relative similarity between Latin American countries and the CEMAC region, investigating the nexus within the latter framework is hypothetically justifiable. Hence, the object of this note is to assess the management of macroeconomic shocks by authorities and the sensitivity of the banking sector to these shocks. Based on the nexuses established, we provide the much needed policy measures needed by financial authorities.

Over the past fifteen years, there has been a renewed interest in studies investigating the nexus between bank performance and the macroeconomic environment. More generally, empirical approaches have been devoted to assessing the role of interest rate margins, importance of bank provisions and/or bank profitability.

Theoretical models constructed to understand changes in bank interest margin often entail the derivation of optimal interest margin by incorporating the market structure, the degree of uncertainty, and risk aversion of bank leaders. The basic assumption underpinning these models is to consider the banking firm as an indivisible entity pursuing an objective of maximizing interest margin. Note should be taken of the fact that the first model of bank interest margin was developed by Ho and Saunders (1981). In this seminal approach entitled the Dealer model, uncertainty is attributed to the asynchronous nature of the random supply and demand of deposits and loans. In a more recent paper, Saunders and Schumacher (2000) have applied the "broker" model to an international panel of 614 banks observed over the period 1988-1995. The findings suggest that regulatory constraints and interest rates volatility would be the determinants of bank interest margins. Other single-stage studies have focused on the empirical determinants of bank interest margin. Angbazo (1997) studied the nexus

between the interest rate risk and banks interest margins. Demirgüç-Kunt and Huizinga (2000) have paid particular attention to the financial structure effects on bank performance. They have concluded that the levels of profitability and interest margins are subject to the quality of the financial structure of the country in which the financial institutions are operating.

The cyclical nature of provisioning has been interestingly documented by Laeven and Majnoni (2003) and Bikker and Hu (2002). Results from these studies are consistent with the previous assumption. Hence, increase (decrease) in provisions during periods of low (high) economic growth would lead to strengthening the cycle. However, an alternative argument to these claims is postulated by Lowe (2002) and Borio *et al.* (2001) From their study it is clear that borrowers default risks emerge and grow during periods of economic expansion, whereas their realization is closely linked to periods of cycle downturn. According to this last strand of authors, the provision of credit is facilitated by banks during periods of sustained growth and solvency tests required by banks become less relevant. This thesis thus combines banks endogenous behavior to increase risk and the development of financial imbalances that would cause the contraction of the economy. So it appears that these analyzes advocate the adoption of a provisioning process that is positively correlated and countercyclical with the business cycle. Therefore, in times of favorable economic conditions, financial institutions should increase their provisions to deal with the realization of defaults during periods of downturn in the cycle.

Concerning bank profitability, Akhavein *et al.* (1997) have found a positive and statistically significant nexus between bank size and profitability. By performing panel data regressions and expressing profits and / or profitability ratios function of a set of banks internal and external variables, Goddard *et al.* (2004), Bikker and Hu (2002), Molyneux and Thornton (1992) and Bourke (1989) corroborate the assumption that profitability is positively correlated with size. However, this conclusion does not coincide exactly with those of Rouabah (2002) and Berger *et al.* (1987) for which the size is by no means a source of cost savings. This is even truer in the sense that the largest banks are prone to inefficiencies of scale (scale inefficiency). The analysis of Molyneux and Thornton (1992) found a negative and statistically significant nexus between the level of assets liquidity and bank profitability. In contrast, Bourke (1989) leads to a result that the relationship between liquidity and profitability is positive. As for the impact of credit risk on bank profitability, it appears in the work of Miller and Noulas (1997) that it is clearly negative. The work of Molyneux and Thornton (1992) clarified the relationship that may exist between the profitability of banks on

the one hand and inflation and interest rates of long-term on the other hand. Their empirical results show a positive relationship, suggesting that the increase in inflation and long term interest rates would be in favor of increasing the profitability of banks. More recently, Bikker and Hu (2002) and Demirgüç-Kunt and Huizinga (2000) addressed the issue of cyclical profitability. Although the variables adopted are only indirect and imperfect indications of the economic cycle (unemployment, GDP per capita, growth rate of GDP), the results tend to confirm the existence of a positive correlation between bank profitability levels and economic cycle.

As a summary, the empirical literature on the problem of sensitivity of the banking sector to macroeconomic shocks using the vector autoregressive (VAR) method applied to the time series is quite abundant. However, using a panel data methodology, particularly the Generalized Methods of Moments (GMM) that implicitly solves the problem of endogenous variables is quite rare. In addition, there is no study using this method applied to Sub Saharan African countries in general and CEMAC in particular. The contribution of such an investigation to the current state of the literature is thus legitimized.

This brief literature review illustrates that the problem tackled by this paper has been at the base of several studies and therefore can legitimize this one applied to the CEMAC sub-region. Indeed, the diligence of the sensitivity level of financial sector shocks is an essential element that can both assess existing financial policies and guide the choices in the implementation of these policies. Due to the undeveloped nature of the financial market, the study will focus on the financial intermediary development or more precisely on the deepening of financial institutions and the banking sector. We will therefore be interested in the question of the level of sensitivity to potential macroeconomic shocks of the banking sector in the CEMAC region. Moreover, even if the relative disconnection of global financial markets has reduced the potential problems of financial instability and international monetary and financial shocks that the countries of the CEMAC sub-region may be subject to as noted by Beck (2011), the presence of sub regional banks and foreign subsidiaries as well as monetary policy and financial liberalization applied by the sub-region monetary authority has put forward the importance of checking the capacity problem in the banking sector in the sub-region to support the potential macroeconomic shocks that may occur. Within the framework of this verification and considering our brief literature review, we rely on the assumption that macroeconomic shocks usually negatively affect the performance of the banking sector in the sub-region.

Such an investigation has a fourfold interest. First, we use primary and hitherto unexploited data from COBAC. Along this line, compared with data from other sources (IMF, World Bank) the recent dataset from the said source should provide findings with updated and more focused policy implications. Second, as far as we have reviewed, no study has employed the empirical approach we are about to use in tackling the problem statement in the monetary zone. Hence, the paper also contributes to the existing literature from a methodological standpoint. Third, given the destabilization challenges of globalization, especially in terms of macroeconomic shocks, the analysis could serve as a basis for the implementation and/or revision of policies towards banking and financial system development by authorities in the sub-region. Finally from a logical point of view, the fact that the CEMAC sub-region environment is characterized by relatively stable economic growth cohabiting with an undeveloped financial system increases the interest of the study.

The rest of the paper is organized as follows: In Section 2, we specify the model, discuss the data as well as sensitivity analyses for robustness checks. Empirical analysis is presented in Section 3. Section 4 concludes with policy recommendations.

2. Sensitivity of banking in the CEMAC zone to macroeconomic shocks: An empirical assessment

2.1 Choice, specification, testing and estimation procedure

2.1.1 Source and description of the sample and data

Individual quarterly and annual bank data used are obtained from the database of COBAC (Central African Banking Commission) and BEAC (Central Bank of Central African States). Other macro financial and macroeconomic data originate from three sources: the database of the International Monetary Fund (IMF's International Financial Statistics Database), the World Bank (World Development Indicators) and the new database on financial development. The observation period covers the years 1981-2011 and the available initial sample is unbalanced. It takes into account the 44 commercial banks in the 06 member countries of the CEMAC sub-region.

It should be noted that for reasons of lack of data for individual commercial banks, we have considered all commercial banks in the same country as one. Similarly, some banking sectors are not observed over the entire period due to data availability issues. This is the

reason why there is discrepancy between the number of observations on the one hand and the product between the number of banks and the number of years on the other hand.

2.1.2 Discussion of model and estimation method

After specifying the model, we will present the estimation method that we use.

The dynamic model is in the following theoretical shape:

$$y_{i,t} = \sum_m \nu_m y_{i,t-m} + \beta X_t^k + \delta Z_{i,t}^p + \omega_i + \varepsilon_{i,t} \quad (1)$$

Where $y_{i,t-m}$ is the lagged endogenous variable with m periods.

In this specification, the variable $y_{i,t}$ represents the performance indicator of bank (i) at time (t), such that the profit margin on interest provisions ... etc., X_t^k is a vector composed of (k) common to all banks macroeconomic variables. $Z_{i,t}^p$ is a vector (p) variables internal to the bank, ω_i the specific effect which is unique to each bank, and remains unchanged over time, while $\varepsilon_{i,t}$ a random disturbance is a form to be processed by a first order autoregressive process.

The three performance indicators of banks interest are in fact the ratio of net interest income and provisions for receivables (reflected by the ratio of their respective values shown in the profit and loss account for advances to customers), provisions for doubtful debts and commissions (the posted rate expresses the percentage ratio of fee income to asset balance). Indeed it is assumed that if banks of the CEMAC sub-region are vulnerable to shocks, they tend for example to increase their doubtful debt provisions and to have a low interest margin and a low commission.

In addition to the dependent variables of banks performance in the CEMAC sub-region, we consider our estimates in two categories of explanatory variables in the light of the explanatory variables used by Rouabah (2006) in his empirical investigation applied to the Luxembourg banking sector. The first includes internal variables to banks, while the second corresponds to external factors to them. The explanatory variables are chosen based on the theoretical and empirical link (endorsed by the empirical work carried out by other authors on the same issues and presented in the previous literature review) with the performance variables. This link implies a potential impact on performance of the banking sector in the sub-region. The three models are as follows:

✓ The model of bank interest margins:

This model will be used to test the sensitivity of the bank's interest margin to macroeconomic shocks. The dependent variable is the logarithm of bank interest margin (LN**MARGEINT**). The explanatory variables are: the logarithm of the change in interest rates, provisions for doubtful debts, net commission income, the average rate of return on assets (ROA) (which is reflected by the ratio of profits before taxation to total assets), the short-term financing (approximated by the ratio of deposits to total assets) and long-term financing (approximated by the ratio of savings deposits to total assets).

In order to verify the assumption of interdependence, we analyzed correlations. Observing the table of correlation between these variables shows a highest correlation between the provision for doubtful debts and bank interest margin (0.97), which leads to anticipate a significant impact of the variation of this variable on the dependent variable. The other correlations are lower.

The model is presented in the following static form (we will include the lagged value of dependant variable for the dynamic form):

$$\ln(\text{MARGEINT})_{i,t} = \beta_0 + \beta_1 \ln(\text{VARINT})_{i,t} + \beta_2 \ln(\text{PROV})_{i,t} + \beta_3 \ln(\text{COM})_{i,t} + \beta_4 \ln(\text{ROA})_{i,t} + \beta_5 \ln(\text{FINCT})_{i,t} + \beta_6 \ln(\text{FINLT})_{i,t} + \alpha_i + \varepsilon_{i,t} \quad (2)$$

✓ The model of provisions for doubtful debts:

This model will test the sensitivity of provisions for doubtful debts to macroeconomic shocks. The dependent variable is the logarithm of provisions for doubtful debts (LN**PROV**). The explanatory variables are: the logarithm of the GDP per capita growth rate, exchange rate, interest rate, the bank interest margin and long-term financing (proxied by the deposits/savings ratio to total assets).

The peculiarity of these macroeconomic variables is that they can capture the impact of the economy cyclical nature on the level of banking system reserves. For example, the decline in GDP, exchange rate and increase in interest rates are likely to exert a stimulating effect on the increase in provisions. Also, it is expected that provisions increase with the interest margin and long-term financing.

The model is presented in the following static form (we will include the lagged value of dependant variable for the dynamic form):

$$\ln(PROV)_{i,t} = \tau_0 + \tau_1 \ln(TXPBPT)_{i,t} + \tau_2 \ln(TXCHANGE)_{i,t} + \tau_3 \ln(TXINT)_{i,t} + \tau_5 \ln(MARGEINT)_{i,t} + \tau_6 \ln(FINLT)_{i,t} + \vartheta_i + \pi_{i,t} \quad (3)$$

✓ The model of net commission income:

This model is used to test the sensitivity of net commission income to monetary and financial shocks. The dependent variable is the logarithm of net commission income (LNCOM). The explanatory variables are: the log of short-term financing, long-term financing, exchange rate and interest rates variation.

The previous literature review predicts that the variation particularly with rising of interest rates is likely to have a negative influence on the amount of net commission income generated by the banking intermediation. Also it is expected that the upward movement of short-term financing and long-term financing positively influences the level of net commission income and that the appreciation of the real exchange rate has a negative impact on it.

The model is presented in the following static form (we will include the lagged value of dependant variable for the dynamic form):

$$\ln(COM)_{i,t} = \gamma_0 + \gamma_1 \ln(FINCT)_{i,t} + \gamma_2 \ln(FINLT)_{i,t} + \gamma_3 \ln(TXCHANGE)_{i,t} + \gamma_5 \ln(VARTXINT)_{i,t} + \theta_i + \mu_{i,t} \quad (4)$$

2.1.3 Justification of the choice of the model and econometric method

The methodology is based on Lehman and Manz (2005) studies in their analysis on the macroeconomic determinants of the performance of Swiss banks. This choice is mainly due to the similarities of the two economies in terms of openness and dominance of banking sector in the domestic financial system. Indeed, the model of Lehman and Manz (2005) takes into account only banks operation and neglects that of other financial institutions, which is a more fitting situation and directly applicable to the context of the CEMAC sub-region which has an embryonic financial system and high degree of openness under the dictation of Breton-Wood institutions.

We will estimate a dynamic panel by introducing lagged endogenous variable among the regressors. The GMM estimation can provide solutions to the problems of simultaneity bias, reverse causality and omitted variables. It allows treating the problem of endogenous variables, which necessarily arises when studying the relationship between banking

development and economic development. There are two variants of the GMM estimator in dynamic panel: the first difference GMM estimator and the system GMM estimator. The first difference GMM estimator of Arellano and Bond (1991) is taken for each period the first difference equation to estimate to eliminate the effects of specific countries, and then instrument the explanatory variables in the equation in first difference with their lagged level values of one period or more. As for the GMM system estimator of Blundell and Bond (1998), it combines the equations in first difference with the level equations in which the variables are instrumented by their first differences. Blundell and Bond (1998) showed, using Monte Carlo simulations that the system GMM estimator is more powerful than the difference estimator. This last one gives biased results in small samples when the instruments are weak.

2.1.4 Testing and estimation procedure

As part of the econometric analysis, various preliminary tests were performed to ensure the validity of results in two stages. The Fisher specification test which is used to validate or not the existence of individual effects was successful for all models. The endogeneity tests are not generally conclusive for all variables of the three models; However estimating a dynamic panel can help avoid this problem. Concerning the heteroskedasticity tests apart from model 2, models 1 and 3 suffer from a problem of heteroscedasticity. The result of residuals normality test leads to reject the null hypothesis at 5% and confirms that residuals of fixed and random effects estimates do not follow a normal distribution. Concerning the autocorrelation of errors and validity of instruments tests associated with the dynamic panel we observe that for all the three models, the test results in first difference or system reveals the absence of autocorrelation in the residuals; Similarly, the over-identification test results (or the validity of instruments) for all of the estimated equations, attest that we can accept the hypothesis of validity of instruments, since the p-values exceed 10% in all cases.

2.2 Presentations of the results and interpretations

2.2.1 Model checking the sensitivity to the bank's interest margin shock

The presentation of the first estimation model results respectively with first difference and system GMM method is available in the table below.

Table I : Presentation of model 1 results estimation.

Var. (LN)	MMG Différence			MMG Système		
	Coefficient	Std. Err.	T Value	Coefficient	Std. Err.	T Value
MARGEINT-1	0.125468	2.023	-0.79	0.251346	0.422	1.56
VARTXINT	0.5918986	0.495	1.20	0.2736561	0.122	2.24
PROV	1.01188**	0.267	3.79	0.99154***	0.072	13.68
COM	-1.451919	1.921	-0.76	-0.5210244	0.354	-1.47
ROA	-2.788606	3.389	-0.82	-0.1433199	0.080	-1.79
FINCT	-0.909148	0.717	-1.27	-0.237484	0.237	-1.00
FINLT	0.9718018	1.487	0.65	-0.4410125	0.411	-1.07
Constant				2.234568	0.056	1.79
Wald test (Prob > F^a)	0.000			0.000		
Sargan test (Prob > chi2^b)	0.216			0.258		
Autocorel. test (Pr > z^c)	0.044			0.073		

Notes: *, **, *** represent respectively the signification level at 10%, 5% et 1%. The explanatory variable are in order: the lagged value of Bank interest margin; The Interest rate variation; The Bank provision; The Bank commission; The Asset return; The Short term financing; The Long term financing. a: Fisher statistic; b: Chi deux statistic; c: Normal statistic.

Source: Result observation on STATA by the authors.

Observing the first difference dynamic panel estimation results presented above, we can see that only the variable provision for doubtful debts has a significant and positive impact on the interest margin. The dynamic panel estimation by the system GMM method shows that changes in interest rates also has a significant and positive impact on bank interest margin.

In summary, regarding the impact of changes in interest rates on net interest income, we can see that it is negative. In addition, the estimation with the GMM in first differences impact is not significant. The interpretation of this result should be the following. From the first results with static panel estimation we suggest that banks in the CEMAC sub-region are not immune to interest rates variation, which negatively affects their bank interest margin. Therefore in this context, the control of interest rates variation should be a goal for "policy makers". Second, the results of the dynamic panel estimation suggest that banks exposure to shocks of interest rates variation is not a problem since it has a positive impact on bank interest margins. Third, the results of the estimation by GMM in first differences suggest that interest rates variation have no impact on bank interest margins. Given this result, CEMAC

zone banks have avoided exposure to market rate over the period considered for our empirical investigation.

However, for reasons of results robustness, we are going to consider the results of the dynamic estimation because this estimation method eliminates the potential problem of explanatory variables endogeneity and enables the consideration that banks interest exposure to foreign exchange rate shocks does is not a problem for them.

2.2.2 Model checking the sensitivity to provisions shock

To determine the impact of the variability of macroeconomic variables such as exchange rate, interest rate and GDP per capita growth rate on bank provisions in the CEMAC sub-region, we have estimated previous static and dynamic specifications where the endogenous variable is the set of banks provisions in each country.

Table II : Presentation of model 2 results estimation.

Model 2: Bank provision						
Var. (LN)	MMG Différence			MMG Système		
	Coefficient	Std. Err.	T Value	Coefficient	Std. Err.	T Value
PROV-1	0.316235	0.339	0.598	0.112456	0.742	1.53
TXPIBPT	-0.265753	0.3036	-0.88	1.312768*	0.5173	2.54
TXCHANGE	0.120535	0.043	1.296	0.889382**	0.13675	6.50
TXINT	-0.7601131	0.78068	-0.97	-1.638887*	0.52993	-3.09
MARGEINT	1.08116***	0.03809	28.38	0.0121154	0.216	2.88
FINLT	-0.249411	0.1914	-1.30	0.855619**	0.25462	3.36
Constant				1.204568	0.759	1.99
Wald test (Prob > F^a)	0.000			0.000		
Sargan test (Prob > chi2^b)	0.374			0.112		
Autocorel. test (Pr > z^c)	0.092			0.069		

Notes: *, **, *** represent respectively the signification level at 10%, 5% et 1%. The explanatory variable are in order: the lagged value of The Bank provision ; The GDP per capita rate ; The exchange rate ; The Interest rate ; The Bank interest margin and the Long term financing. a: Fisher statistic; b: Chi deux statistic; c: Normal statistic.

Source: Result observation on STATA by the authors.

Observing the results of the dynamic panel data estimation with the first difference GMM method available above shows that only the interest margin variable has a positive and significant impact (1%) on bank reserves in the sub-region. Moreover, this variable has the

expected sign which implies that the interest margin increases with the provisions for doubtful accounts. This result implies that some provisions for doubtful debts are prices to pay for the research of interest margin by banks in the CEMAC sub-region.

Other variables were not significant and did not have the expected sign except the GDP per capita growth rate. On the other hand, the observation of dynamic panel estimation results using the system GMM method shows that non-significant variables in the previous estimation with first difference GMM are now significant respectively at 10%, 5%, 10% and 5%. Also they are contrary to those shown by the previous estimate with the exception of the signs of interest rate variable.

The GDP per capita growth rate coefficient does not show the expected sign because it is preceded by a positive sign. This unexpected result indicates that this variable has a positive impact on the level of reserves in the CEMAC zone. This suggests that GDP per capita growth rate in the CEMAC zone would be a factor of increase of bank reserves and hence would be detrimental to the proper functioning of the banking sector. One explanation for this paradoxical result is that the GDP per capita growth rate over the period is very low in the CEMAC sub-region. The CEMAC zone authorities would gain control of the macroeconomic variability and size to ensure that GDP per capita grows at a decreasing rate and for the best case at a constant rate.

Similarly, the exchange rate has a positive sign which is contrary of the expected sign and which means that the variation of exchange rate leads to a positive impact on the level of reserves in the CEMAC zone. The fact that the CEMAC sub-region monetary and banking authorities want to control the variability of the real exchange rate is legitimized since it can be detrimental to the functioning and stability of the banking sector.

Contrary to the theoretical prediction, the increase of interest rate has a significant and negative impact on the level of reserves. The lower interest rate is susceptible to exercise a stimulating effect on the growth of doubtful accounts provision in the CEMAC sub-region. The negativity of this coefficient is problematic insofar as the increase in provisions is often associated with rising of interest rates. A potential explanation for this result is that the provisioning is countercyclical with the evolution of interest rates. Monetary and banking authorities in the sub-region should therefore ensure an increase of interest rate to reduce the level of provisions for doubtful debts and thus improve the functioning of the banking sector in the CEMAC zone.

The long-term financing variable shows the expected sign and has a positive and significant impact on the level of provisions for doubtful debts in the CEMAC sub-region i.e. the increase of this variable positively affects the level of provisions of credit granted by CEMAC sub-regional banks. This econometric result is somehow legitimizing the fact that banks are reluctant to grant long-term credits in the area (Asongu, 2014ab; Asongu, 2013cd; Fouda, 2009; Saxegaard 2006). This also confirms the recent documented issues of bank inefficiency in the African continent (Tsafack Nanfosso and Nguena, 2014; Mlambo and Ncube, 2012; Zhao and Murinde, 2012). Authorities in the zone must control variability in the evolution of banking system provisions at the macroeconomic level in order to mitigate potential adverse effects. However, this recommendation should be put into perspective in that it can interfere with the objective of boosting growth by financing long-term investments in the region.

2.2.3 Model checking the sensitivity to the net commission income shock

In order to determine the impact of macroeconomic variables variability on net banks commission income in the sub-region, we estimated the dynamic and static specifications presented above where the endogenous variable to be explained is a ratio as a percentage of revenue commissions to asset balance sheet of banks in each country.

Table III : Presentation of model 3 results estimation.

Var. (LN)	MMG Différence			MMG Système		
	Coefficient	Std. Err.	T Value	Coefficient	Std. Err.	T Value
COM-1	1.023566	3.389	-0.82	0.415632	2.419	0.15
VARTXINT	0.409764**	2.023	-0.79	0.1185515	0.106	1.12
FINCT	-1.04403**	0.495	1.20	10.02164	9.686	1.03
FINLT	-1.065549*	0.267	3.79	-9.543023	8.275	-1.15
TXCHANGE	-10.7733	1.921	-0.76	-3.937724	3.617	-1.09
Constant				-0.2355625	3.094	-0.44
Wald test (Prob > F ^a)	0.000			0.000		
Sargan test (Prob > chi2 ^b)	0.813			0.130		
Autocorel. test (Pr > z ^c)	0.085			0.083		

Notes: *, **, *** represent respectively the signification level at 10%, 5% et 1%. The explanatory variable are in order: The lagged value of Bank commission; The Interest rate variation ; The Short term financing and the Long term financing; The exchange rate; a: Fisher statistic; b: Chi deux statistic; c: Normal statistic.

Source: Result observation on STATA by the authors.

The dynamic panel estimation in first difference results shows that all variables are significant with the exception of the exchange rate. However the estimated results using the system GMM method show no significant variables.

In summary regarding the short-term financing impact on the level of commission income, we observe a contrast with respect to the theoretical predictions since we have a negative and significant impact between both variables. This means that an increase in the level of short-term financing has a negative impact on commission income in the sub-region. The credit rationing behavior of the sub-region banking system is thus relatively legitimized.

Regarding long-term financing, regardless of estimation method, we find that it has a negative and significant impact on the level of bank system income commission in the sub-region.

Regardless the method used the impact of real exchange rate is not significant. One potential explanation for this result is that the link is not direct between the two macroeconomic variables when the activities in the area are domestic and generally denominated by domestic currency. Contrary to theoretical predictions, the change in interest rates has a positive and significant impact on the level of commission income of the banking system in the CEMAC region. The more interest rates vary, the more commission income is high. Monetary authorities in the sub-region would gain by allowing changes in interest rates to improve the level of income commission and hence the functioning and stability of the banking system in the CEMAC region.

3. Conclusion and recommendation of economic policy

This article's objective was to verify the soundness of the banking system of the sub-region in order to decide on the necessity of taking into account the management of macroeconomic shocks by authorities in the conception of their financial policy.

After a presentation of the financial and banking landscape in the region and a review of empirical literature, the econometric investigation purpose of this paper was devoted to analyzing the impact of macroeconomic shocks on banks performance in CEMAC sub-region. In fact we tried to quantify the sensitivity of the performance of banks operating in the CEMAC sub-region with different types of macroeconomic shocks such as real, financial and monetary. The analysis was therefore to examine the impact of these different types' of

shocks on the bank interest margin, level of reserves and net income of bank transactions. It has been highlighted that this is the first study of its kind in the banking system and especially in the CEMAC region. In this perspective, we have adopted the same approach as Lehmann and Manz (2005) in their analysis on the macroeconomic determinants of the performance of Swiss banks with some specificity related to the context of the study. This choice is mainly due to the similarity between these economies and CEMAC sub-region economies in terms of openness and economic dominance of the banking sector.

In general, empirical approaches to analyze the impact of macroeconomic environment on bank performance has paid particular attention firstly to the explanation of interest margin, secondly to the importance of provisions and thirdly to banks commissions net income. Bank individual data used were obtained from the COBAC database, the IMF and World Bank new databases. We have estimated equations with lagged endogenous variables by using system and first difference Generalized Method of Moments (GMM) suggested by Arellano and Bond (1991).

In conclusion, the main results of the estimates revealed that:

- The effect of interest rates variation on the bank's interest margin remains ambiguous; this fact probably reflects the banks' efforts in the sub-region to limit the exposure of their net interest margins to interest rates risk;

- The decline in the GDP per capita growth rate leads to lower provisions; according to this result, the reactivity of the provision level to the GDP rate variability tend to reject the common idea on the synchronized nature of the provisioning with business cycle. Thus, it appears that during periods of weaker economic activity in the sub-region, the provision for doubtful debts of banks were marked by a downward trend. However, their level was augmented as a result of economy recovery.

- The decline in the real exchange rate explains lower provisions. However, this result should be interpreted with caution. Indeed, one could consider that exchange rate decline is a source of yield growth of loans granted abroad and by then a factor of lower provisions. However, the interpretation of the positive direct impact is difficult because it is obscured by the indirect effects that can be attributed to monetary policy, inflation and productivity differentials between countries;

- The increase in interest rate is a factor of lower provisions;

- The decrease in the level of long-term financing leads to lower level of provisions on the one hand and the increase in net commission income;
- The decrease in the level of short-term financing lowers the level of net commission income;
- The change in interest rates is a factor in the rising level of net commission income.

Ultimately, the evaluation of banks sensitivity to both interest rate risk of short-term negative impact on banking and a decline in economic activity in the CEMAC sub-region has ambiguous results. Indeed, empirical results support the weaknesses of banking sector to manage changes in the macroeconomic environment, such that the risks of financial instability related to monetary, financial or real economy macroeconomic shocks are probable.

It is therefore legitimate and even necessary to consider the management of macroeconomic shocks in the design of financial policies of the CEMAC sub-region. Assessing financial policy impact on financial deepening should therefore take into account the constraints posed by the macroeconomic shocks on the banks of the subregion.

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