

Prudential Regulation and Bank Profitability in the Central African Economic and Monetary Community (CEMAC)

Ndongo Jean Stanislas¹, Iroume A Bouebe Alexandre Turpin²

¹Ph. D, Dschang School of Economics and Management, University of Dschang-Cameroon, Fundamental and Applied Economics Research Laboratory.

²Senior lecturer, Faculty of Applied Economics and Management University of Douala-Cameroon.

ABSTRACT: The situation of banking activity prior to the major financial reforms of 1993 highlighted the appropriateness of prudential regulation (Avom and Eyeffa. 2007). This study aims to measure the impact of banking regulations on the profitability of commercial banks in the CEMAC zone. More specifically, the aim is to assess the extent to which prudential regulations improve the profitability of banks in the sub-region. To this end, we adopt a multiple regression model based on the method of generalized moments in system following the economic and financial data extracted from the entire banking system during the period 2003-2015 in accordance with the work conducted by Kahane (1977). Our results indicate that compliance with the minimum capital requirement has a positive relationship with bank profitability over the period studied. However, if the banking sector has now regained its solvency, it is important to strengthen the supervisory system by means of independent regulation.

KEYWORDS: Prudential regulation; Profitability; Independent regulation; CEMAC.

INTRODUCTION

Since the early 1980s, there has been a fairly broad international consensus on the need to supervise banking institutions. This consensus is the result of a number of major events that have had a significant impact on the functioning of national and international banking and financial systems, two of which are of major importance and relevant to the analysis of this work. On the one hand, according to Fouda S. and Touna Mama (1996), the consequences of a crisis in the financial and banking system usually go beyond the financial sphere and rapidly spread to the real economy. From this point of view, the United States provided a dramatic example of the cost to the economy as a whole (and to taxpayers in particular) of the bankruptcy and collapse of part of the financial and banking system (Dawatripont and Tirole, 1993). In addition, the events of 1989 in the CEMAC countries, which led to the uncontrollable and massive collapse of banks in the sub-region, gave reason to the emergence of regulation.

The CEMAC countries in general have not escaped the effects of the financial turmoil that began in 1989. According to Avom and Eyeffa (2007), following the banking crisis that shook credit activity, reforms aimed at better regulating the banking system were implemented. These countries' interest in regulation became clear in the 1990s, with the creation of the Central African Banking Commission (COBAC) in 1992, which replaced the national regulatory bodies. The establishment of this sub-regional commission was complemented a few months later by the Harmonisation of Banking Regulations in Central Africa. The role assigned to this supranational structure is to ensure banking supervision and control for all six countries that make up the new community. Its establishment, despite the difficulties, has undoubtedly contributed to the current relative stability of the banking system.

Today, according to Fouda O. (2005), after observing numerous bankruptcies between 1986 and 1990, banks have become considerably more universal, reorganised, computerised, diversified and are currently in the process of internationalising, giving rise to firms that certainly need to be examined with fresh eyes. The far-reaching reforms that the various banking business lines have undergone have given rise to numerous debates about the industry's activities. The importance of the regulatory framework and the external effects on the rest of the economy are the result of the liberalisation of the financial sector, particularly the banking sector, the increase in supply through new forms of financing, the introduction of information and communication technologies (ICTs) and the recent trend towards new foreign competitors entering the EU financial market.

The major characteristic of the banking system in the CEMAC countries at the end of the 1980s was undoubtedly the very strong presence of the State in many aspects of its organisation and, above all, its operation. Directly inspired by the European model,

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and in particular the French model, the banks remained subject to the influence of the State, which wanted to turn them into a powerful instrument of economic development, in order to compensate for the loss of control over monetary policy, and in particular exchange rate policy. On the monetary front, this presence was specifically reflected in the administration of interest rates and the sectoral allocation of credit to sectors deemed to have priority, based essentially on the mechanism of unsecured advances. These advances were themselves defined in the form of global credit ratings, which were allocated to the various banks by each national monetary committee. Similarly, as part of the financing of the economy, an additional obligation was imposed on banks, particularly in Cameroon, to reserve 20% of their outstanding loans for small and medium-sized enterprises, considered to be the basis for the establishment of a significant national industrial fabric (Eyeffa Ekomo, 2002).

The theoretical justification for this monetary policy lay in the triumphalism of Keynes's work, which was dominant at the time. In the economic literature of the early 1970s, it was described as "financial repression", simultaneously by McKinnon (2010) and Shaw (1973). Financial repression refers to the set of government interventions aimed at limiting the financial sector's freedom of movement (through various channels such as interest rate ceilings, high reserve requirements, selective credit allocation, etc.). The main consequence of financial repression has been the introduction of numerous distortions in domestic capital markets. The most visible manifestation of this state presence has been the size of the public banking sector. Indeed, most national banking legislation required banks to reserve for the State, or certain public bodies, a greater or lesser proportion of their capital¹.

The omnipresence of the State in banking has had at least two perverse effects. On the one hand, the presence of the State in the shareholding of banks has encouraged the development of conflicts of objectives and laxity in management, by developing opportunistic behaviour in the form of moral hazard of the type described by Stiglitz and Weiss (1981). This, combined with myopia for disaster², to quote Guttentag and Herring (1986), materialised in the form of numerous public and private bank debts which benefited from an implicit state guarantee and/or that of debtors who occupied important positions in the spheres of power. On the other hand, the banks interpreted the presence of the State in their share capital as all-risk insurance, by underestimating debtors' default on repayment. The idea was that the State would not go bankrupt and therefore, in the event of difficulties, it would intervene as a last resort via the central bank to ensure the stability of the financial system. The State also acted directly in the mechanisms for appointing managers, whose articles of association also required them to be nationals. In return, they steered the distribution of credit by granting bank loans considered to be "political", i.e. loans with almost zero probability of repayment, to important figures in the regime. According to Sandretto and Tiani Kéou (1993), these loans were granted without consideration and usually without any prior study of the project's profitability.

This omnipresence was also reflected in the fact that the public sector held a significant proportion of deposits in banks and an increasing proportion of loans went to them. However, their role was largely ineffective in ensuring compliance with regulations. Moreover, the financial markets remained non-existent. Finally, in the 1980s, the majority of banks proved to be illiquid and insolvent, as a result of a rapid deterioration in their portfolios. Reforms became urgently necessary to halt the deterioration of the region's banking system. Restoring the solvency and profitability of banks will be the main objective of banking restructuring. The reform has gradually focused, on the one hand, on overhauling monetary policy instruments and, on the other, on changing the institutional framework, particularly in terms of the regulation and supervision of banks and financial institutions. The most important change seems to be the transfer of the power to supervise credit institutions to a Community institution: The Central African Banking Commission (COBAC). The COBAC is the only body empowered to grant authorisations for the opening and closing of banks. It also gives an opinion on the recruitment of managers, although formally it is the minister in charge of finance in each country who makes the final decision. It also monitors and supervises banks and credit institutions through five new prudential ratios: the net equity ratio, which must be positive; the solvency ratio (minimum 5%); the fixed asset coverage ratio (minimum 100%); the liquidity ratio (minimum 100%); and the long-term transformation ratio (minimum 50%).

In addition to these ratios, COBAC has set up an automated system for rating credit institutions known as "SYSCO". It is based on an assessment of the individual health of banks, using scores and ratings to periodically assess the situation of each credit institution in terms of compliance with regulatory standards and internal management systems. Prudential ratios and the "SYSCO" system are designed to preserve the liquidity and solvency of banks, as well as the balance between their resources and uses of funds and the quality of the commitments they can underwrite, so as to guarantee the credibility and stability of the entire banking system.

¹ For example, in Cameroon, Article 5 of the Order of 30 August 1973, supplemented by Order 85/002 of 31 August 1985 on banking activities, clearly states that "the structure of the share capital of banks must reflect the presence of public interests, which may not be less than one-third.

² Bank liquidity crisis

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Furthermore, implementing an effective prudential policy is inherently difficult insofar as macro-prudential policy measures can be politically sensitive, which can lead to inaction. More specifically, the stranglehold of regulation has tightened on the community's banking system, with at least 84% of banks complying with the capital adequacy ratio, combined with a drastic fall in deposits and loans (COBAC, 2009), as well as other ratios. Since 2014, the trend has tended to deteriorate in the sub-region. Between the end of December 2014 and 2015, there were 32 to 36 banks in the region that complied with the minimum capital requirements, representing 69% of all banks. In 2012 and 2013, according to the BEAC report 2013, there were 43 compliant banks (86%). In terms of capital adequacy, the regulations do not seem to have had any effect over the last two years. The proportion of banks in compliance is only 48% (24 out of 50 banks), 44% (23 out of 52 banks) and 48% (25 out of 52 banks) respectively from 2014 to 2016, whereas it was 78% (39 banks in compliance out of 50) in 2013 and 2012.

In the light of the above, this research is based on the theoretical debate which has been taking place since the early 1980s and which led the Basel Committee to adopt the Cooke ratio and subsequently the Basel II and Basel III agreements. This theoretical literature, which focuses on the behaviour of banks in terms of banking management under the constraint of prudential regulation, is the basis on which numerous empirical studies have been initiated, the study of which enables us to propose a model for the research problem. This is why we are dealing with this subject in an article entitled "**Prudential regulation and bank profitability in the Central African Economic and Monetary Community (CEMAC)**". The main question we would like to answer is: What is the effect of prudential regulation on the profitability of the banking system in the CEMAC region? In other words, this study aims to measure the impact of compliance with prudential regulations in CEMAC banks on their ability to generate profits. To achieve this objective, this article is based on a rigorous hypothesis: the effectiveness of compliance with prudential standards as a factor in the profitability of banks in the CEMAC zone. To this end, it will first present the literature on the link between prudential standards and bank profitability, secondly describe the estimation methodology, thirdly discuss the results obtained and finally reach a conclusion and recommendations.

1. REVIEW OF LITERATURE.

This section highlights the existing literature on the normalisation of banking firm behaviour and its effects on bank profitability. This analytical development, involving both theoretical and empirical explanations, makes it easy to grasp the key concepts and scientific orientations that are being created on the issue of setting up a system of rules to govern the banking profession in the specific field of prudential regulation.

1.1. Theoretical review.

The new literature, reading Avom and Kuindja (2021), Mishkin (2010) and Rochet (2003), positions a broader consensus in favour of the justification of prudential regulation. Like Nebel (2004), prudential regulation must be applied in a broader field in order to naturally contain systemic risk (macro prudential regulation) and guarantee symmetry of information (micro prudential) in a State-Banks-Publics and Banks-Banks scheme (restriction of competition). To justify banking regulation, Tartari (2002)³ has classified the theories of banking regulation into two categories: normative and positive theories to answer the question of why banking regulation is necessary. In our case, we will confine ourselves to theories of banking regulation based on capital. These theories make it possible to establish the link between banks' capital and their risks and to highlight the evolution of capital as a function of banks' risky assets. This link is essential for prudential authorities in their decisions to strengthen capital, improve bank solvency and make possible future changes to prudential standards. In fact, these theories can help us to explain the relationship between bank capital standards and the profitability of the Cameroonian banking system.

Regulating the composition of capital: the contribution of Kim and Santomero (1988).

The first works on banking regulation and the capital base were those of Pyle (1971) and Kahane (1977). They adopted portfolio theory and the probability of bankruptcy theory to analyse the composition of banks' asset and liability portfolios and to impose a minimum capital requirement based on the probability of bankruptcy. This work was subsequently enriched by the contributions of Kim and Santomero (1988) and J.-C. Rochet (1992). Their studies are based on the behaviour of banks in terms of risk-taking when prudential authorities require them to hold a minimum amount of funds. The most significant hypotheses of this approach are: banks are risk averse while seeking to maximise a quasi-concave utility function depending on the expectation and return on equity; the regulator seeks to limit the probability of bank insolvency to a predetermined level. In this approach, banks are seen as managers whose decisions are constrained by prudential regulations.

³ In his thesis "De la régulation en matière des capitaux propres du système bancaire" he devotes an entire chapter entitled Les théories de la régulation to justifying the implementation of banking regulation on the grounds of social welfare.

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Portfolio theory has highlighted two essential values: a level of capital and a level of risk acceptable to the regulator. The level of capital is an increasing function of bank portfolio risk. To reduce banking risk, the regulator must set a high level of capital provided that the bank does not change the composition of its portfolio. Therefore, if the regulator requires more capital, the bank's leverage decreases, which will have a negative impact on its profitability. To make up for this shortfall, the bank may be tempted to change the structure of its portfolio by adding riskier assets and increasing its profitability.

Kim and Santomero (1988) proposed a model in a book entitled "*Risk in Banking and Capital Regulation*" aimed at analysing the role of bank capital in risk management. They use the portfolio approach and, more specifically, portfolio theory. They summarise the regulatory developments and end by exposing their limits in terms of guaranteeing the stability of banks. They demonstrate the harmful consequences of requiring a minimum capital common to all banking institutions without taking into account the differentiation of assets in the balance sheet portfolio. They concluded that the optimal portfolio for banks should be constituted in such a way that equity capital is proportional to the risks incurred. In fact, there is a positive relationship between bank capital and excessive risk-taking.

To counter this strategy, the regulator can use any means to prevent the bank from reconstituting its portfolio with risky assets. To harmonise the work of Koehn and Santomero (1980) and Kim and Santomero (1988), Rochet (1992) insisted on the need to distinguish between the different assets of banks. He suggests the weighted risk model, based on the market, to measure the risks of banks' assets and concludes that the capitalisation of banks does not reduce their speculative behaviour, so it is necessary to impose an additional level of capital for banks with portfolios of risky assets. Kim and Santomero (1988) point out that a uniform ratio does not make it possible to limit the risk of insolvency; the objective of a regulation is to impose on banks a holding of capital as soon as their investment policy is riskier. According to portfolio theory, a more profitable (and therefore riskier) asset will have to be financed with a larger amount of equity, which will reduce leverage and return on equity (Rochet, 1992). Under these conditions, the bank will no longer have an incentive to recompose its portfolio.

Regulatory incentives: Giammarino et al. (1993).

The incentive approach attempts to link the capital ratio and risk-taking through information asymmetry. According to this approach, the regulator does not have the necessary information on the quality of the assets initially held by the bank (adverse selection) and on the bank's choices to change its risk profile (asset substitution). To maximise social welfare, the regulator must take account of the fact that the existence of regulation will encourage banks to take on risky assets. The regulator is caught in a dilemma: either bear the social losses due to bank failures or incur the costs associated with regulation by using various levers (deposit insurance, capital amounts, minimum reserves, etc.).

The Giammarino et al. (1993) model involves depositors, firms, banks and a regulator, all of whom are initially risk averse. In these agency relationships, equity capital is used to model the probability of default. This model makes it possible to assess the overall structure of the prudential system based on deposit insurance and bank capital (Vilanova, 2006). To resolve the problem of asymmetric information, the regulator has several means at its disposal (deposit insurance premium, level of capital required, level of risk-free reserves). It will link these means to the final quality of the bank's loan portfolio. In conclusion, the regulatory capital ratio decreases with the quality and size of the loan portfolio.

The theory of incomplete contracts by Dewatripont and Tirole (1994).

The model of Dewatripont and Tirole (1994) is the most significant of the incomplete contract approaches because it takes into account the essential characteristics of banks and their environment. In this model, banks are run by shareholders who do not own all the capital, and contracts are incomplete in that certain decisions cannot be specified a priori. In these conditions, we try to find ways of encouraging managers to make optimal decisions, and the introduction of prudential regulation becomes essential. Bank failure is conceived as a transfer of control rights to the beneficiaries (Aghion and Bolton 1992).

More specifically, the bank's situation goes through three stages: During the first stage, the bank's balance sheet shows deposits and equity on the liabilities side, which finance loans to assets. The quality of these loans depends on the manager's level of effort. The maximum level of effort represents a cost for the manager and this level corresponds to the efficient resource allocation plan. The dilemma consists in creating an incentive climate so that the manager exerts this effort corresponding to the control rights. During the second phase: the bank's performance is measured by the flow of loans generated and the net asset value of the loans. Depending on the flows generated and the liquidation value of the loans, the bank controller decides whether to continue operations or to interrupt them and reorganise the bank. Finally, in the third phase, the net asset value is observable. The objective is to determine who controls the bank during the second phase and under what conditions. The transfer of control to the regulator representing the depositors poses a threat to the manager, who risks dismissal and loss of salary. The regulator's intervention is most often linked to poor management of the bank. Setting a threshold capital ratio depends on the bank's performance. Banks

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are required to comply with a more restrictive capital ratio when the bank's performance is mediocre in second stage, hence the need to relax prudential constraints in periods of recession (Dewatripont and Tirole, 1994).

1.2. Empirical review

Through a review of the literature on regulation, we have shown that there is a positive approach and a normative approach. From these theoretical developments on the issue of regulation we have also shown that the nature of the economic good, depending on whether it is public or private, determines the approach to regulation and the form of regulation to be adopted. Several researchers have examined the question of the link to be established between the standardisation of bank capital and bank performance.

Karemera (2013) conducted a study in Rwanda to obtain a relationship between regulation and the financial performance of commercial banks in Rwanda. He incorporated a descriptive research design. The sample size was 10 banks. The study established that regulation is not a significant determinant of the financial performance of commercial banks in Rwanda. The study recommended that the Rwandan government should develop a policy that will help banks operate in an environment conducive to the financial stability of the country's financial institutions. This study therefore finds that regulation has no impact on the financial performance of financial institutions.

The work of Kahuthu (2016) further investigated the impact of prudential regulation on the financial performance of deposit-taking institutions in Kenya. The data collection methodology was to extract secondary data from the Kenyza Banking Activity Database and the analytical tool was the Statistical Package for the Social Sciences (SPSS). The study used a comparative sample design and a linear regression model to establish the impact of prudential requirements. The data was able to show a low return before the legislation was passed and a higher return after the legislation was passed. Further analysis compared the beta⁴ of various independent and dependent variables before and after the regulatory reforms. In comparison, all betas showed that the independent variables, core capital, credit management, headcount growth and liquidity were not good predictors of financial performance, but after prudential regulation they all became good predictors. The study recommends that financial institutions comply with prudential regulation to enable them to benefit from increased business volumes.

In the context of banking procyclicality, the work of Repullo et al (2010) shows that specific regulation of the various activities of banks constrains the procyclicality of capital. Nevertheless, in a comparative analysis of the implications of adjustments to the Basel I and II standards, Repullo and Suarez (2013) conclude that the probability of banks defaulting under Basel II is low due to the sophistication of the methods for managing inherent risks (internal rating or rating method). The results obtained from the calibration method based on a parameter of the internal rating approach (IRB), show the existence of strong cyclicity in the minimum capital required. Given their effectiveness, internal rating methods explain most of this problem of access to credit. The reactions and criticisms levelled at the agreement were based on the fact that the weighting methods unbalanced bank capital and, as a result, affected the financing of economies and businesses.

By empirically analysing the implications in terms of adoption of the Cooke ratio by banks in Basel Committee member countries, Saadaoui (2011) concludes that there is a relationship specific to the type of bank. In fact, by dividing banks into "strongly capitalised and weakly capitalised banks", he asserts that banks with high levels of capital have a clear management and low risk-taking capacity, unlike their peers. He deduces this result using triple least squares (3LS) estimators of the simultaneous equations between changes in regulatory capital and risk over the period 1995-2005. In addition, he concludes that the constraint to increase capital leads to an increase in risk-taking and therefore in bad debts.

2. METHODOLOGY.

This section is organised around three points. The first deals with the presentation of the data, the second presents the variables in the study and the third sets out the methodological approach used in this study.

2.1. Data from the study

We use data from the banking activity of the six countries in the CEMAC zone over the period 2003-2015. All bank balance sheet and income statement data are taken from the COBAC annual activity report database. Given our focus on banking intermediation, we use unconsolidated statements where available and consolidated statements where unconsolidated statements are not provided, ensuring that each bank is included only once in the dataset. In addition, as our sample only includes commercial banks, there is homogeneity in the comparison between country groups. All bank-specific variables are calculated using the standardised global accounting format provided by the financial literature. Data on inflation, economic growth and GDP are taken from the World Development Indicators (WDI).

⁴ Regression model parameters.

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2.2. Description of model variables.

The selection of model variables is based on the choice of variables adopted in empirical and theoretical studies in the banking literature. The idea of this study is to make a comparison with the results of empirical studies carried out on Western and Asian banks in order to find out whether commercial banks in the CEMAC zone have prudential policies that meet performance requirements and whether the hypotheses relating to capital regulation, moral hazard, the structure-behaviour-performance paradigm and the persistence of profits or the competitive environment are verified.

The measure of prudential regulation used in this study is the bank capitalisation ratio (BCR). The bank capitalisation ratio is the ratio of banks' capital to their assets. It expresses the ratio of banks' capital and reserves to their total assets. This ratio represents the prudential policy of banks and is made up of capital and reserves. Empirical work implementing prudential policy, prudential regulation or capital requirements has adopted the ratio of capital to total assets as a measure of bank capitalisation (Lee and Hsieh 2014; Iannotta et al., 2007; Altunbas et al. 2007; Goddard et al., 2004;). Capital and reserves include shareholders' equity, retained earnings in the form of dividends, general and special reserves, and provisions. Capital comprises the banks' own funds, in other words the core capital. This ratio is used to work out the financing structure of banks' assets and, above all, to assess their ability to have sufficient capital to absorb expected and unexpected losses. Since this characteristic applies to all the world's banking systems, our analysis consists of considering the ratio of equity to total assets (Equity On Assets).

We opt for the simple capital ratio (capital/assets) because it is easy to calculate and implement and also to interpret. The lack of data on asset characteristics and the unrealistic assumptions of the model make the ratios of capital to risk-weighted assets and economic capital difficult to calculate. Furthermore, the ratio of capital to total assets appears to be a common measure for all CEMAC banks.

Several accounting instruments and ratios are used to measure bank profitability (Short 1979; Bourke 1989; Molyneux and Thornton 1992; Demircuc-Kunt and Huizinga 2000). The profitability of banks can be assessed through the intermediate management balances, costs and operating ratios of their main activities. The empirical literature on the determinants of banks' profitability, performance or efficiency offers a wide range of variables measuring their profitability. In the case of our model, we limit our profitability variables to ROA (Return On Assets). Return On Assets (ROA) is a financial ratio used to measure the profitability of banks' assets, it is considered to be the best indicator reflecting the profitability of assets and taking into account the different balance sheet items (Shim 2010; Rashid et al., 2011; Obamuyi 2013). Most studies agree that ROA primarily assesses the ability of bank managers to manage revenues and expenses while generating profits from assets (Rashid et al., 2011). ROA remains the measure commonly used by most empirical studies as the variable of bank profitability. As far as we are concerned ROA remains the main measure of bank profitability in our study (Turgutlu, 2014).

In addition, the control variables used in this analysis make it possible to refine the estimate of the impact of prudential regulation on the performance of commercial banks. We will therefore be dealing with bank-specific variables (size and credit risk) and macroeconomic variables (Gross Domestic Product (GDP) growth rate and consumer price index), which are summarised along with all the others in table 1 below.

Table 1: Summary of variables.

Variable types	Variables	Abbreviations	sources	Empirical references
Dependent variable	Return On Assets	<i>ROA</i>	COBAC	Rashid et al. (2011).
Independent variables	The bank capitalization ratio	<i>CB</i>	COBAC	Shrieves and Dahl (1992)
	ratio of provisions for risks and charges	<i>RPRC</i>	COBAC	Djekonbe Djimoudjiel (2018).
	Bank size	<i>TA</i>	COBAC	Rashid et al. (2011)).
	Economic growth rate	<i>TX</i>	WDI	Karels et al. (1989)
	Inflation	<i>INF</i>	WDI	Revel (1979) Ben Naceur and Kandil(2009)

Source: author based on empirical review.

2.3. Estimation strategy

In this study we opt for the Generalized Method of Moments (GMM) over other regressions (OLS, 2SLS and 3SLS) because this model allows us to overcome the problem of endogeneity of variables to explain profitability. This model also has the advantage of overcoming the problems of instrument choice required by instrumental variable models (2SLS, 3SLS). The GMM was introduced

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by Holtz-Eakin et al. (1988), Arellano and Bond (1991), and Arellano and Bover (1995). This method has a number of advantages for panel data, namely control of the problems of simultaneity bias, reverse causality and omission of variables. In addition, the GMM method makes it possible to control for both specific and temporal effects and to overcome endogenous biases in the variables, especially in the presence of several lags in the dependent variable reported as the explanatory variable. The econometric literature identifies two variants of GMM estimators for dynamic panels: the first-difference GMM estimator and the system GMM estimator.

The choice of the methodology of the study is motivated by the analysis of the work of Ben Naceur and Kandil (2009) which attempts to evaluate the impact of financial reforms on the competitiveness and performance of banks in the MENA sub-region (Middle East and North Africa). The results of this author's estimation and the construction of the empirical model are presented in the following paragraph.

By estimating the source of a bank's profitability using a specification in the GMM of a dynamic system, Chen and Lu (2021) develop the following dynamic equation model:

$$ROA_{it} = \beta_1 ROA_{it-1} + \beta_2 B_{ik,t} + \beta_3 R_{it} + \beta_4 M_{it} + \beta_5 F_{it} + \beta_6 I_{it} + \beta_7 C_{it} + n_i + \varepsilon_{it} \quad (1)$$

Where ROA_{it} is the performance of bank k in country i during period t and is measured by three alternative measures (cost of intermediation, operational performance and bank profitability), C measures bank concentration; B is a vector of internal characteristics; R is a vector of regulatory obstacles for banks; M is a vector of macroeconomic variables; F is a vector of financial development variables and I is a vector of institutional indicators of the country's development.

The GMM estimator for dynamic panels is currently one of the most widely used methods in macroeconomic studies. A dynamic model is a model in which one or more lags of the dependent variable appear as explanatory variables. Unlike dynamic panel GMMs, standard econometric techniques such as ordinary least squares (OLS) are unable to obtain efficient estimates of such a model because of the presence of the lagged independent variable (Ehrmann et al., 2001).

There are two variants of the dynamic panel GMM estimator: the first-difference GMM estimator and the system GMM estimator. The GMM first-difference estimator (by writing the equation to be estimated in first differences) eliminates individual and time-specific effects. The level values lagged by two or more periods are used as instruments for the first-difference explanatory variables, on the assumption that the errors in the level equation are not serially correlated. The advantages of this procedure are that it eliminates the biases generated by the omission of certain explanatory variables. The use of instrumental variables makes it possible to estimate the parameters more rigorously and to obtain better results, even in the event of measurement error (Bond et al., 2001). However, this estimator is not without flaws: the lagged values of the level variables are not good instruments for the first-difference variables. The GMM mathematical model takes the following form:

$$\ln Y_{i,t} - \ln Y_{i,t-1} = \beta_0 + \gamma (\ln Y_{i,t-1} - \ln Y_{i,t-2}) + \beta' (\ln X_{i,t} - \ln X_{i,t-1}) + (\lambda_t - \lambda_{t-1}) + (\varepsilon_{i,t} - \varepsilon_{i,t-1}) \quad (2)$$

Furthermore, since the error term $(\varepsilon_{i,t} - \varepsilon_{i,t-1})$ is correlated with the new lagged dependent variable $(\ln Y_{i,t} - \ln Y_{i,t-1})$ the "within" estimator is also biased, so we have to resort to system estimation.

The GMM system estimator (Blundell and Bond, 1998) exploits the assumptions relating to the initial conditions in order to obtain moment conditions which remain valid even for persistent series. The system GMM estimator used in this study is the work of Blundell and Bond (1998), inspired by Arellano and Bond (1991). This model makes it possible to combine first-difference equations with level equations in which the variables are instrumented by their first differences. Blundell and Bond (1998) have shown that the GMM system estimator is more efficient than the GMM first differences estimator, which is why we have chosen it for the economic estimates in our research.

The theoretical formalisation of Bain's (1951) SCP model provides the banking industry with an approach based on the hypothesis that the behaviour of banking firms significantly influences market structure and bank performance. In addition to other extensions (Efficiency-Structure model, Panzar and Rosse model), the work of Shrieves and Dahl (1992) has also made it possible to highlight the direct and simultaneous implications of the procyclicality of bank capital on bank risks. The implications for bank performance (profitability, margins and others) were its extension (Garba et al., 2016). However, given the significant contribution of Shrieves and Dahl's model in addressing the implications of bank recapitalisation norms, we implement an improvement of our model to be estimated taking into account bank capital size as well as macroeconomic variables.

To conclude, our research will consist of estimating the basic model of bank profitability, the specifications of which are as follows

$$ROA_{it} = a_1 CB_{it} + a_2 TX_{it} + a_3 TA_{it} + a_4 RPRC_{it} + a_5 INF_{it} + \mu_i + e_t + \varepsilon_t \quad (3)$$

With a_i and β_i being the coefficients of the two models; ε_t and δ_t the error terms; μ_i denotes the country-specific effect and e_t denotes the year-specific effect.

The variables are referenced in Table 2 below.

Table 2: variables

Explanatory variables	Indicators	Signs expected in relation to the variables to be explained
<i>CB</i>	Bank capitalisation ratio	+
<i>RPRC</i>	Ratio of provisions for risks and charges	+/-
<i>TA</i>	Logarithm of total assets	+/-
<i>TX</i>	GDP growth rate	+/-
<i>INF</i>	Consumer price index	+/-

Source: author based on empirical review

3. RESULTS.

3.1. Descriptive statistics results.

Looking at figure 1, compliance with prudential regulations, particularly those based on capital adequacy, has improved significantly since the creation of the Banking Commission, which is responsible for supervising the banking system in the CEMAC countries. The number of banks complying with prudential regulations has increased compared with the early 1990s, when virtually no banks in the Community complied. In terms of solvency, 81% of banks have a risk-weighted net equity coverage ratio equal to or greater than the minimum of 8%. In terms of risk division standards, 83% of banks manage to comply with the overall limit by keeping the sum of weighted risks in excess of 15% of net equity below eight times net equity, but only 33% comply with the individual limit by not maintaining weighted risks incurred on a single beneficiary in excess of 45% of net equity (the standard set by the Basel Committee is 25%).

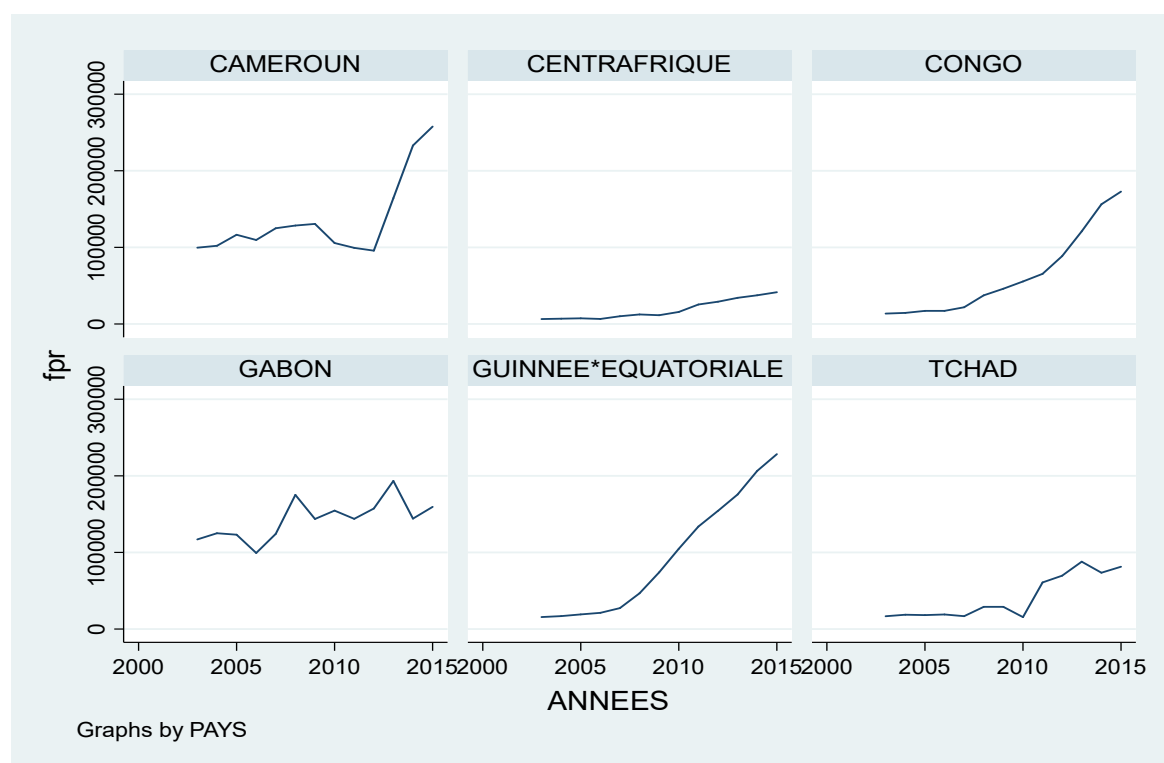


Figure 1: Changes in regulated capital.

Source: Author based on COBAC data from 2003 to 2015.

In terms of bank profitability, the income statement shows an improvement in net banking income in all CEMAC countries except the Central African Republic, where it has stagnated. Transactions with customers and miscellaneous transactions are the main contributors to net banking income. These two main components of net banking income are relatively stable, even though some banks carry out more miscellaneous transactions than transactions with customers. Overheads, on the other hand, appear to be contained, although they have been rising since 2006. On the other hand, gross profit is positive and rising gradually. Profitability appears to be good in the sector following the restructuring of the system. Cameroon's net banking income is still very high compared to other EU countries. This gap is maintained regardless of the year. On the other hand, the Central African Republic and Chad have very low levels of bank profitability. Figure 2 shows changes in net banking income in the CEMAC zone.

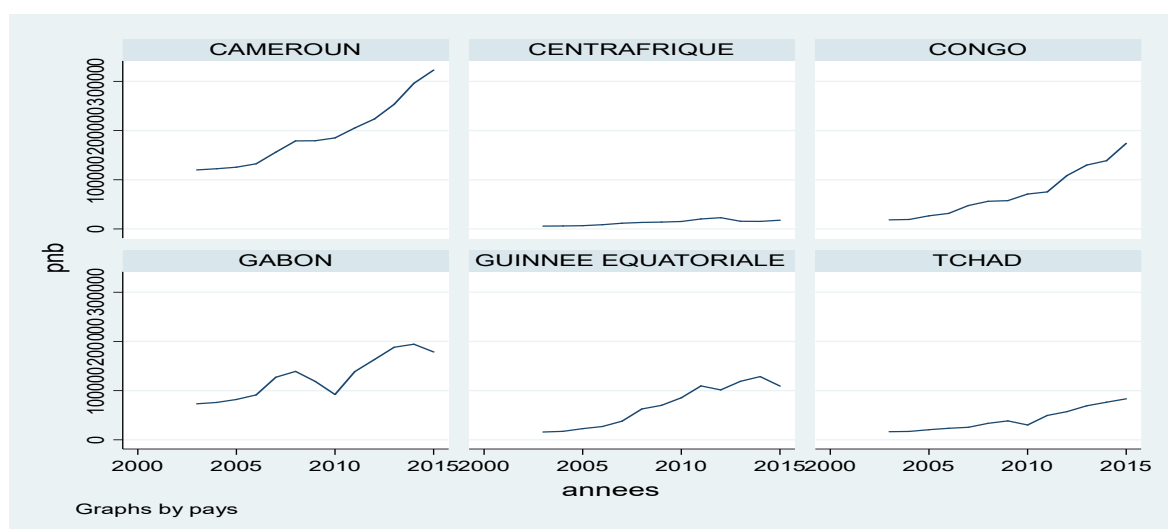


Figure 2: Net banking income.

Source: Author based on COBAC data from 2003 to 2015.

In addition, table 3 below gives the descriptive statistics for the variables in the model to be estimated. Throughout the CEMAC region, the average bank capitalisation ratio (Tier 1 and Tier 2 capital) as a proportion of total bank assets is 8.17%. The share of bank capital in banking assets remains low throughout the study period, while lending activities are not negligible on average. In addition, the average proportion of provisions set aside for risks and charges is low (6.65%). Similarly, the average level of net income across the sub-region was 1.6% of total bank assets. The logarithmic total of assets measuring the size of banks is on average equal to 5.87%. Macroeconomic data also show an average GDP growth rate of 3.94% and an overall average inflation rate of 3.81% for the CEMAC zone as a whole.

Table 3: common statistical indicators.

Variables	Comments	Average	Standard deviation	Min	Max
ROA	78	1.602289	0.8332049	0.025064	4.065611
CB	78	8.170843	3.768865	2.924122	20.96978
TX	78	3.942716	7.610899	-36.69995	33.62937
TA	78	5.859314	0.5121675	4.715134	6.662856
RPRC	78	6.648629	6.725118	.2097683	28.58031
INF	78	3.813414	5.785511	-8.97474	37.14221

Source: Author using STATA 15.0 software

Table 4, which shows the correlation matrix, shows that bank profitability has a positive relationship with prudential regulation, with an intensity of 22.93%. There is also a positive correlation between profitability and bank risk, measured here by the risk and expense provision ratio with a low intensity of 14.71%. On the other hand, it can be seen that bank profitability is negatively correlated with macroeconomic variables and bank size, measured respectively by the GDP growth rate, inflation and the logarithm of total assets, whose linear correlation coefficients in relation to the profitability indicator are 18.54%, 14.71% and 32.88% respectively.

Table 4: Correlation matrix of study variables.

ROA	1.0000					
CB	0.2293	1.0000				
TX	-0.1854	-0.3872	1.0000			
TA	-0.3288	-0.4780	-0.0123	1.0000		
RPRC	0.1409	0.5323	-0.1930	-0.6516	1.0000	
INF	-0.1471	0.3965	-0.0456	-0.1581	0.2175	1.0000

Source: Author using STATA 15.0 software

3.2. Econometric results.

Table 5 below presents the results of the specification tests carried out to determine the degree of efficiency of the system-based GMM estimation method used. The Sargan test is used to test the validity of the instruments used in the GMM model; it is a test of over-identification of the instruments. In the case of our study, the p-values of the two models indicate non-rejection of the null hypothesis at the 1% threshold. S. Consequently, the instrumental variables are not correlated with the residuals and are therefore valid for our estimates. In addition, the Arellano and Bond test performed on the two estimates indicates the absence of autocorrelation of orders 1 and 2. The estimation models are therefore significantly good.

Table 5: specification tests.

Specification testing	statistics	Dependent variable
		ROA
Sargan over-identification test	chi2(60)	108.36 (0.000)***
Arellano and Bond autocorrelation tests	AR (1)	-1.83 (0.067)**
	AR(2)	-1.20 (0.023)**

Source: by the author using STATA 15.0 software. (The values in brackets indicate the probabilities associated with the statistical tests. ***, ** and * indicate rejection of the hypothesis at the 1%, 5% and 10% thresholds respectively.

From Table 6, we find that prudential regulation measured by bank capital adequacy ratio and bank profitability showed a positive and significant association at the 10% threshold by an estimated coefficient of 0.0506992. Odongo et al. (2013) and Nyawira (2017) also found a positive association between capital requirement regulation and bank profitability. However, these findings are inconsistent with the conclusions of Karemera (2013), who found no association between capital requirement regulation and financial performance. Furthermore, Van Roy (2003) also notes differences in behaviour across countries and in particular that regulation is ineffective in increasing the ratios of "undercapitalised" French and Italian banks. Heid et al (2004) note that German banks, which are only just well capitalised, have a certain tendency to increase their safety cushion (a level of capital corresponding to the regulatory standard of 8%) by increasing their level of capital while simultaneously reducing their profitability. On the other hand, for "overcapitalised" banks, they find a positive relationship between the level of profitability and the level of capital, which can be explained by the fact that these banks maintain their safety cushion by increasing their level of return when the level of capital increases.

Table 6: GMM regression results.

explanatory variables	OLS	GMM
CB	0.0856191 (0.022)*	0.0506992 (0.069)*
TX	-0.0022681 (0.863)	-0.0006296 (0.950)
TA	0.1682597 (0.000)***	0.212571 (0.000)***
RPRC	0.0101308 (0.546)	0.0244684 (0.066)*
INF	-0.0416514 (0.022)*	-0.0423448 (0.001)***
F(5,73)/Wald chi2(5)	60.10	519.64
Prob > chi2	(0.000)***	(0.000)***
Number of observations	78	78

Source: by the author using STATA 15.0 software. (The values in brackets indicate the probabilities associated with the statistical tests. ***, ** and * indicate rejection of the hypothesis at the 1%, 5% and 10% thresholds respectively.

CONCLUSIONS AND RECOMMENDATIONS.

Our study analysed the relationship between regulations on minimum capital requirements and the performance of commercial banks in the CEMAC zone. To achieve this, we collected data on banking activity in the sub-region produced by COBAC on a panel of 6 countries from 2003 to 2015. The estimation of an econometric model by the GMM in system, allowed us to highlight a

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positive and significant relationship between the prudential regulation measured by the bank capitalization and the profitability measured by the ROA; this result agrees with our hypothesis formulated on the positive link between the prudential regulation and the bank profitability. However, these results remain fragile due to the size of the observations, the specific nature of our study, the statistical analysis and the limited field of investigation. It would therefore be interesting, in the perspective of future research, to extend our field of research not only by integrating other variables than those used in the present study but also to explore contexts other than that of the CEMAC.

In addition, the introduction of stronger regulations and their application by banks pose a number of problems that need to be resolved at both CEMAC and bank level.

On the basis of the above, we can make the following recommendations at CEMAC level:

1. Internal and independent monitoring of credit decisions by a Credit Review Committee,
2. The creation of an agency responsible for overseeing the authority needed to examine banking operations and balance sheets,
3. Closing failing banks and setting entry criteria,
4. The appropriate definition of capital and risk limits,
5. The implementation of asset classification, provisioning rules and prudent valuation of guarantees that accurately reflect the instability of asset markets.
6. The introduction of micro prudential regulations adapted to each bank, especially the smaller ones.

The following recommendations are specific to banks:

1. Shareholders and other stakeholders of commercial banks should play a central role in ensuring that bank management applies good corporate governance by putting in place a mechanism to monitor and control corporate governance.
2. Commercial banks should comply with COBAC laws and regulations to reap the benefits of increased business.
3. A competent board of directors should be elected and even employees should be recruited on the basis of their skills, abilities and knowledge.
4. Investigate whether there are other elements of prudential regulation and strike a balance between financial stability, financial performance and shareholder return.
5. Put in place an efficient system for collecting information on customer projects, enabling a better assessment of credit risk for optimum capital adequacy.

Conflicts of interest.

The author declare that they have no conflict of interest.

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