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Bank Capital and Credit Supply in African Countries: Evidence from Pooled Mean Group Estimation

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Abstract

This paper provides an empirical assessment of the relationship between bank capital adequacy requirements and the supply of bank credit in 15 African countries, over the period 2002 to 2015; using Pool Mean Estimator Group (PMG) advocated by Pesaran, Shin and Smith (1999). The Study concludes that the improvement of the Cooke ratio, the market share of the three banks and the growth rate of GDP per capita, positively influence bank credit granted to the private sector. In addition, the inflation rate negatively and significantly affects credit to the private sector. The study also notes that an increase in lending rates is unfavorable to the supply of credit. In the long run, no variable is significant. Other factors including institutional factors may influence the development of the private sector in the long term.

Keywords: Capital ratio; Capital adequacy regulation; financial development; economic growth; WAEMU.

Classification J. E. L.: G21; G28

1. Introduction

After several financial crises, a real and new consensus about financial regulation occurred. Microprudential regulation having shown its limits, henceforward, it is worth singling out macroprudential regulation. Besides, substantial efforts of research have been engaged to help in working out macroprudential policies (Galati and Moessner (2013)). One of the microprudential tools remains the minimal capital requirements that banks must meet to cover their credit. In fact, the more a bank has higher capital stock, the more solid that bank is in supporting the stability of the banking system. However, it can equally discourage the loan offer because the bank has to internalize the potential social cost of credit default that is by increasing the lending rate triggered by the high cost of the stockholders'equity (Morrison and White (2005), Adrian and Shin (2010), Shleifer and Vishny (2010), Andrian and Boyarchenko (2012), Jeanne and Korinek (2013), Malherbe (2015). In fact, the tax advantages of debt financing and the asymmetrical information at the level of the bank imply that the increase in financing by external stockholders' equity can be more expensive for banks than debt financing (Tirole (2006), Hanson and al. (2011), Gornall and Strebulaev (2013)). Beyond the constraints related to the supply of banking products, demand for credit and monetary policy instruments, the respect of regulatory standards could lead to a shortage of resources, which, in turn, is likely to discourage the offer of bank credit. As a matter of fact, the rules prescribed by the Basel Committee are based on the principle that each increase in the volume of loans is accompanied by the need of Stockholder's equity of banks. This could force the banks to supply more loans. Thus, taking into account the possibility of a tightening of the credit the implementation of the Agreement of Basle I, many studies were realized to address the range of these measures.

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On the empirical level, many authors contributed through their writings namely, Pazarbasioglu (1997) on Finland, Ghosh and Ghosh (1999) on East Asia, Konishi and Yasuda (2004) on Japan, Chiuri and al. (2002) on 16 emerging countries, Dionne and Harchaoui (2003) on Canada, Van Roy (2003) on the countries of G-10, Barajas, Steiner and Cosimano (2005) on Latin America, Berger and Udell (1994) and Peek and Rosengren (2000) on the United State. Despite this empirical literature very documented, the debate on the probable effects of the requirements in minimum Capital from banks on the distribution of credit persists.

In 2007, the West African Economic and Monetary Union (WAEMU) officials decided to raise the minimum share capital applicable to banks and financial establishments of the Union to ten billion and three billion respectively. This decision comes within the framework of the promotion of a healthy and solid banking and financing system likely to make a real contribution to the financing of the economic development union. Furthermore, It is also justified by the need of revising the old standard of capital aged fifteen whereas the economic and financial environment as well as the operating conditions have strongly changed. The implementation of the new standard is expected as well as a strong consolidation of the banking system of WAEMU, with in particular a noticeable improvement of the lawful stockholders' equity and overall solvency of the credit institutions. Consequently, a central question emerges: up to what point could the requirement of minimum capital from the banks affect the supply of loans? Thus, this study aims to analyze the effect of the regulation on the banking equity capital on the offer of loans in African economies.

Methodologically, the study uses the Pool Mean Group (PMG) estimator advocated by Pesaran, Shin and Smith (1999). Contrary to the traditional methods (fixed effects or generalized moments), the PMG method introduces a heterogeneity into certain coefficients to be estimated. In fact, the PMG method reconciles in the same specification the usual approach imposing fixed coefficient and the one supposing specific coefficient per country. Thus, it is possible to specify that the long term relation between the variables is identical for all the countries but that each country follows its own dynamics to tend towards this common relation. This hypothesis seems reasonable for countries indeed belong to concentric circles but aspire to a long-term integration. This paper contributes to the empirical literature on the link between banking regulation and the distribution of credit in Africa over the period 2002-2015. The results obtained from this study are the following: in the short run,no variable is significant. This result may reflect the more cautious behavior of the banks when extending credit to the private sector in environments with high information asymmetries and contract-enforcement problems. In the long-run,all the explanatory variables reveal significant coefficients. The improvement of the ratio Cooke, the market share of the first three banks and the growth rate of the GDP per capita have a positive influence the bank credit granted to the private sector. Moreover, more the banks have a big share of the market, more they manage to finance the activity. Furthermore, the inflation rate negatively and significantly affects the credit granted to the private sector. The study also concludes that an increase in the debtor's interest rates is unfavorable to the credit grant.

This paper is organized as follow: section 2 is devoted to the review of the literature on the relation between the requirements in stockholders' equity of the banks and the offer of bank credit. Section 3 will present the methodology of the study. Section 4 will deal with empirical results, particularly the results of the econometric analysis of the relationship between the minimal requirements in banking stockholders' equity and the grant of bank credit.

2. Literature review

This section revisits the theoretical and empirical literature on the link between the requirements in stockholders' equity of the banks and the bank credit offer. But prior to that, let us analyze the determinants of the credit offer.

2.1. The review of literature on the determinants of the offer of credits.

The economic growth and the financial deepening would explain the credit grant provided by the foreign banks in Central and Eastern European countries (Burcu Aydin, 2008). By studying the determinants of the loans granted to the private sector in the euro zone, Calza and al. (2001) pointed out that the loans are positively correlated with the real GDP and negatively with the long and short-term interest rates. In a recent study, Guo and Stepanyan (2011), show that credit growth is associated to national and foreign economy financing. A strong economic growth leads to an increase in credits whereas a higher inflation decreases the amount of credits offered.

From a sample of 26 Pakistan trade banks, over the period 2001-2010, Hussain and Junaid (2012), found that the growth of the GDP, the development of the industrial sector, the solidity of the banks, the size of the banks, the depreciation of the exchange rate and the budget deficit have a significant and positive impact on the bank credit offer. We are still in Pakistan, Imran and Nishat (2013), over the period of 1971 to 2008, using the time series based on the econometric approach (ARDL), indicated that the foreign debt, the national deposits, the economic growth, the exchange rate and monetary conditions have significant effects on the offer of bank credits granted to the private sector in Pakistan, particularly in the long-run.

2.2. Literature review on the relation between the requirements of stockholders' equity of banks and credit offers.

At the theoretical level, the requirement of minimum capital concerning the banks is justified. In fact, the bank must satisfy the international standards of earning on assets required by the shareholders on the one hand. On the other hand, the microprudential requirements oblige the banks with a strict cover of the stockholders' equity to face the risks (Plihon, Couppey-Soubeyran, Saïdane, 2006). Its implications at the macroeconomic level are also numerous. Generally banks are to make decisions on the amount of capital they must hold for three reasons. Firstly, the capital is used to avoid bankruptcies. Thus, a bank holds a capital to reduce its probability of becoming insolvent. Secondly, the amount of capital affects the return of the bank owne. In fact, given the yield coefficient, the weaker the banking capita, the higher the owners' profit is. It results from this that the owners of a bank may wish the bank not to hold too high capital. Thirdly, a minimal amount of capital is imposed by the regulator. Given that the detention of capital generates high costs, the managers of the banks often wish to have less stockholders' equity compared to their credits than the minimum imposed by regulation the officials. In this case, the amount of capital is determined by the requirements in the equity capital.

In macroeconomic implications terms, the regulation of the banking capital affects the financial stability by reducing ex- ante the propensity of the banks to the risk and making it possible for the bank to amortize the banking losses ex-post. Using a theoretical model, Martines-Miera and Suarez (2014), underline that the bank chooses its exposure to the systemic risk by making an arbitration between the profits resulting from risk taking and reduce not only the cost but also the frequency of the systemic crises. However, the requirements in stockholders' equity can exacerbate risk taken by banks. New funds being obtained, the banks can use them to invest in the speculative and risky activities (Martynova and al. 2015). By using a model CAPM, Miles and al. (2012) conclude that a strongly capitalized bank reduced the scope for banking crises. In a sample made up of the emerging and developing countries, De Haan and Klomp (2015) show that the requirements in stockholders' equity reduce the risk of banking credits. On the other hand, on a sample of more than 3000 banks in 86 countries, Demirguc-Kunt and Detragiache (2011) point out that the regulation of the banking capital is not significantly associated to banking risk measured by the Z-scores of the banks. Talking about the link between banking capitalization and the capacity of the banks to make loans, it was also strongly documented. Some writings addressed the theoretical bases of the capital regulation and its potential effects on the credit expansion .The theoretical foundations of this argument are exposed in Bernanke and Gerther (1995). The incapacity for banks to comply with the requirement of a new issue of stockholders' equity leads them to reduce the credit grant (Myers and Majluf, 1984). By using some transversal cut variations, Bernanke and Lown (1991) shows that the increase in the loans between 1990 and 1991 was positively correlated with the level of the stockholders' equity of the bank. Using a sample of 16 emergent countries, Chiuri and al. (2002) show that introducing requirements of higher banking equity capital could lead to a deceleration of the bank credit. Based on some German data from 1965 to 2009, Buch and Prieto (2014) find that a one percent (1%) increase in the banking capital is associated to an increase of 0.23% of banks loans. But the bank loans drop with the banking capital only when the ratio of the stockholders' equity gained on assets exceeds 33%. Albertazzi and Marchetti (2010) based on some Italian data, from 2007 to 2009, indicate that a contraction of bank credit is associated with the weakness of the banking stockholders' equity. On the other hand, Barrios and Blanco (2003), using data from the Spanish trade banks between 1985 and 1991, note that the banks were not forced by the regulation of the capital during the period of the study. Beatty and Gron (2001) found similar results by using data from 438 American holdings listed on the Stock Exchange between 1986 and 1995. Barajas and al. (2005) analyze the impact of Basle I on the declaration of the credit in Latin America and do not come to a clear conclusion. Holmstrom and Tirole (1997) show that, the ratio of capital behaves in a pro-cyclic way increasing during the expansion and decreasing during the contraction.

There is a close connection between the assets and liabilities of banks (Diamond and Rajan (2000)): Parallel to the bank credit, the deposits increase during the expansion, generating an increase in the ratio of solvency.

3. Data and variables description

The empirical study uses the annual data of 15 African countries gathered within four sub-groups: West Africa, East Africa, Southern Africa and North Africa. In West Africa, there are four countries of the WAEMU; namely, Côte d'Ivoire, Senegal, Niger, Mali and Nigeria. In East Africa we have Kenya, Uganda and Rwanda. In Southern Africa, there are South Africa, Lesotho, Namibia, Mozambique and Swaziland. As for North Africa, it cames down to Morocco and Egypt. The data of the study come mainly from the World Development Indicators (WDI), the International Monetary Fund (IMF data base) and from the Central Bank of West African States (BCEAO). For the case of Morocco, the series on the debtor interest rates, results from the Central Bank of the country. The study is related to the period from 2002 to 2015. The descriptive statistics of all the variables are recorded in table 1. The matrix of the coefficients of correlation of Pearson is summarized in table 2.

Table1. Descriptive statistics

Variables	Obs.	Mean	Std.Dev.	Min	Max
Bank credit to private sector (CRED)	210	32.51	32.88	0	160.12
Cooke Ratio (CAR)	210	9.17	3.57	1.49	23.9
Concentration Ratio (CR3)	210	71.91	18.10	0	100
Lending Rate (LR)	210	13.44	4.23	5.75	26.15
Growth rate per capital (GR)	210	2.66	3.21	-6.57	30.34
Inflation Rate (INF)	210	6.05	5.69	5.69	39.89

Source : Auther's computation

Table 2. Matrix of Pearson correlation coefficients

	CRED	CAR	CR3	LR	GR	INF
CRED	1.00					
CAR	-0.14*	1.00				
CR3	0.08	-0.04	1.00			
LR	-0.34*	0.24*	-0.20*	1.00		
GR	-0.06	0.11	-0.02	0.19	1.00	
INF	-0.02	0.16*	-0.16*	0.29*	-0.05	1.00

Note : * significativité au seuil de 5%

Table 2 shows a weak correlation between the explanatory variables. Of all these variables, the pair bank credit to the private sector (CRED) and the debtor interest rates (LR), present the highest coefficient of correlation (0.34) but largely lower to 0.8. Nevertheless, we decide to include all the variables in our model because of their theoretical interest.

4. Methodology

In this section, we firstly present the specification of the model and the methodology of PMG estimate secondly.

4.1. Model specification

The model to be estimated in this paper can be specified as follows:

$$CRED_{it} = \theta_0 + \theta_1 CAR_{it} + \theta_2 CR3_{it} + \theta_3 LR_{it} + \theta_4 GR_{it} + \theta_5 INF_{it} + \mu_{it} \quad (1)$$

Where *CRED* is the bank credit granted to the private sector returned on the GDP, *CAR* the stockholders' equity returned on the engagement (ratio cooke), *CR3* is a banking concentration index that measures the share of the first three banks, *LR* the debtor interest rate, *GR* the growth rate of the GDP per capita and *INF*, the inflation rate. In theory, the ratio Cooke has a positive impact on the offer of loans. Basle I which was initially negotiated between the developed countries has now become a major component of the world banking regulation; setting down common rules to control the amount of capital that a bank must hold and defining requirements of minimum capital based on the risk.

4.2. The Pooled Mean Group Estimation

The estimation technique selected is that proposed by Pesaran and Al (1999), Eq. (1) can be seen as an autoregressive model with a delay in instalments (ARDL) of the form:

$$y_{it} = \sum_{j=1}^{m} \lambda_{ij} y_{it-j} + \sum_{j=0}^{n} \delta_{ij}^{'} x_{it-j} + \mu_i + \varepsilon_{it} \quad (2)$$

Where $y_{it} = CRED_{it}$, $x_{it} = (CAR_{it}, CR3_{it}, LR_{it}, GR_{it}, INF_{it})$ is a (5*x*1) vector with explicative variables; δ_{ij} is a (5 *x* 1) vector with coefficients; λ_{ij} a scalar and μ_i represents the fixed effect per country. From that model derive the following long-term relation:

$$y_{it} = \theta_i^{'} x_{it} + \mu_{it} \quad (3)$$

If the variables are co-integrated, then the term ε_{it} is a stationary process. In this case, the model can be re-specified in the form of a model of errors correction in which the short term dynamic is influenced by the sidelines of the long term relation:

$$\Delta y_{it} = \phi_i \left(y_{it-1} - \theta_i^{'} x_{it}\right) + \sum_{j=1}^{m-1} \lambda_{ij}^{*} \Delta y_{it-j} + \sum_{j=0}^{n-1} \delta_{ij}^{*'} \Delta x_{it-j} + \mu_i + \varepsilon_{it} \quad (4)$$

Where ϕ_i is the coefficient of adjustment, is the θ_i vector of the long term coefficients and Δ is the variation operator between two successive dates. One expects that $\phi_i < 0$. One of the advantages of the models ARDL is that the multipliers of short and long terms are estimated jointly. Moreover, these models authorize the presence of the variable that can be integrated in different ways, either *I (0)* or *I (1)*, or co-integrated (Pesaran and Shin, 1999). The PMG estimator allows the coefficients of short term and the coefficients of adjustment to be varied according to the countries. But, the long term coefficients are identical for all the countries ($\theta_i = \theta$). In this study, the PMG estimator is based on the following model of error correction:

$$\Delta CRED_{it} = \theta_0 + \phi_i S_{it-1} + \sum_{j=1}^{p} \gamma_{1ij} \Delta CRED_{it-i} + \sum_{j=0}^{p} \gamma_{2ij} \Delta CAR_{it-i} + \sum_{j=0}^{p} \gamma_{3ij} \Delta CR3_{it-i} + \sum_{j=0}^{p} \gamma_{4ij} \Delta LR_{it-i} + \sum_{j=0}^{p} \gamma_{5ij} \Delta GR_{it-i} + \sum_{j=0}^{p} \gamma_{6ij} \Delta INF_{it-i} + \mu_{it} \quad (5)$$

Where $S_{it-1} = (CRED_{it-1} - \theta_1 CAR_{it} - \theta_2 CR3_{it} - \theta_3 LR_{it} - \theta_4 GR_{it} - \theta_5 INF_{it})$

It was shown that the imposition of an identical coefficient for the force of recall could lead to skews (Kiviet, 1995). The MG estimator allows heterogeneity at the same time in the parameters of short term and the coefficients of long term. The MG estimator assesses the equation for each country of the sample and calculates the unweighted average of the coefficients on the whole of the panel. The hypothesis of homogeneity of the coefficients of long term is tested empirically. To that purpose, we resort to a test of the Hausman type applied to the difference between the estimators MG and PMG. Under the null hypothesis, this difference is not significant and the PMG estimator is then preferable.

5. Empirical results

The empirical analysis works with the following steps. Firstly, we apply to the series, tests of unit root in order to study the stationary of the variables. Secondly, we estimate the long term coefficients , by the estimator PMG. The order of integration of the variables is tested according to the test of Im, Peseran and Shin (IPS, 2003), Breitung (2000) and Maddala and Wu (1999). The results rcorded in table 3 show that the ratio Cooke, the debtor rates, the GDP growth rate per capita, and the inflation rate, is stationary in level. But all the variables are stationary of difference first. Table 4 in appendix, according to the test of co-integration of Kao; shows the existence of a long term relationship.

Table 3. Results of panel Unit root tests

Variables	IPS (2003)		Breitung (2000)		MW (1999)	
	Niveau	Diff (1)	Niveau	Diff (1)	Niveau	Diff (1)
CRED	-1.18 (0.11)	-5.66 (0.00)***	0.978 (0.83)	-4.97 (0.00)***	18.36 (0.95)	117.21 (0.00)***
CAR	-2.61 (0.00)***	-6.00 (0.00)***	0.12 (0.54)	-3.69 (0.00)***	47.12 (0.02)**	136.20 (0.00)***
CR3	-2.71 (0.00)***	-6.41 (0.00)***	0.01 (0.50)	-4.08 (0.00)***	29.54 (0.48)	159.00 (0.00)***
LR	-3.50 (0.00)***	-5.86 (0.00)***	-1.63 (0.05)*	-5.48 (0.00)***	113.31 (0.00)***	150.22 (0.00)***
GR	-6.44 (0.00)***	-7.79 (0.00)***	-5.27 (0.00)***	-5.88 (0.00)***	196.50 (0.00)***	397.82 (0.00)***
INF	-6.69 (0.00)***	-7.88 (0.00)***	-4.39 (0.00)***	-4.80 (0.00)***	248.77 (0.00)***	391.27 (0.00)***

Source : Auther's computation

Note. IPS, MW and Breitung are the Im, Pesaran and Shin (2003) and Maddala and Wu (1999), Breitung panel unit test. Values in parentheses are p-value. * (**) signifies rejection of the unit root hypothesis at 5% (10%) level. The results of the estimations of PMG and MG are consigned in tables 5 and 6. According to the test of Hausman, it results from this that the hypothesis of homogeneity of the coefficients of long term cannot be rejected. In this case, the interpretation of the results will be related to those of the method PMG.

Table 5. Mean Group and pooled mean group estimates (short term relation)

	PMG			MG		
Variables	Coef.	Std.Dev.	z-ratio	Coef.	Std.Dev.	z-ratio
ΔCAR	-0.3	0.43	-0.71	0.08	0.78	0.11
ΔCR3	-0.01	0.05	-0.21	0.13	0.17	0.79
ΔINF	-0.02	0.04	-0.59	0.47	0.29	1.62
ΔGR	-0.15	0.09	-1.64	0.25	0.23	1.07
ΔLR	0.11	0.21	0.52	0.33	0.28	1.19
Test d'Hausman	0.20 0.99					

Source : Auther's computation

Note: PMG model constrains the long-run coefficient vector to be equal across countries while allowing for specific-group short-run and adjustment coefficients. MG model allows all parameters to vary across countries and fits parameters as averages of N individual group regressions. The Hausman test is a test of the restriction that all countries have the same long-run

In the short run, as table 5 shows it, no variable is significant. It may be that additional factors, in particular institutional ones, influence development of the financial sector, in the short run.This result may also reflect the more cautious behavior of the banks when extending credit to the private sector in environments with high information asymmetries and contract-enforcement problems. But in the long run, as table 6 shows it, all the explanatory variables revealed significant coefficients.

Table 6. Mean Group and pooled mean group estimates (long term relation)

			PMG	MG		
Variables	Coef.	Std.Dev.	z-ratio	Coef.	Std.Dev.	z-ratio
CAR	2.82	0.45	6.18	0.58	6.8	0.86
CR3	0.08	0.04	1.63	1.17	2.27	0.52
INF	-0.91	0.19	-4.59	-0.75	0.87	-0.86
GR	0.86	0.34	2.47	4.5	5.14	0.88
LR	-3.96	0.34	-11.56	-36.42	33.96	-1.07
Coefficient d'ajustement	-0.14	0.05	-2.58	-0.67	0.16	-4.16

Source : Authors' computation

The improvement of the ratio cooke (CAR), the market share of the first three banks (CR3) and the GDP growth rate per capita (GR) positively influence bank credit granted to the private sector. The respect of prudential supervisory tools shows that the banks have a sound knowledge of the risks, which increase the loan offers.

Consequently, raising of the minimum capital of the banks within the WAEMU is likely to encourage bank credit grant. Our results revealed a procyclic evolution of the unbalanced simple solvency ratio not balanced of banks. Additionally, the more banks have big shares in the market, the better they can manage to finance their activities. Their capacity to better diversify the risk and an access to a more flexible financing through capital market give them less aversion for risk taking. The significant and positive relationship between the GDP growth rates per capita is in accordance with the thesis of Robison (1952). It results from this that the economic development stimulates the request for financial services which results in an increase in the credit granted to the private sector. Two other significant results are the followings. Firstly, the inflation rate negatively and significantly affects the credit granted to the private sector. This result suggests that a policy that aims to reduce the inflation rate will be favorable to the development of the financial sector of the African economies. It is a result that is in conformity with the literature on financial repression. Secondly, an increase in the debtor interest rates is unfavorable to credit offer. Stiglitz and Weiss (1981) coined the idea that an increase in the interest rates helps the banks to rationally practise credit grant.

6. Concluding remarks

Our objective in this study was to analyze the effect of the minimal requirement in stockholders' equity of the banks on the grant of loans in 15 African countries, over the period from 2002 to 2015. To achieve this aim, we estimated a data model of panel between five explanatory variables and the bank credit granted to the private sector reported to the GDP. The results show that the respect of prudential supervisory tools, especially an increase in the minimum capital of the African banks is favorable to bank financing of the private sector. The same applies to the wealth per capita and to the market share for the three banks. However, high inflation and an increase in the debtor rates are unfavorable to bank financing of the private sector.

In a nutshell, these results provide a certain number of implications in terms of policies. Firstly, the policy of raising banks capital in Africa must continue. In addition, a strongly capitalized bank helps the banks to resist shocks. Secondly, a good monetary policy likely to control the rise of prices is useful to encourage banks to offer credits to the private sectors in Africa.

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Appendix

Table 4. Kao Residual Cointegration Test

Kao Residual Cointegration Test				
Series: CSP_PIB C_A_R CR3 TX_INFL TX_PIB_HBT TX_PRET				
Date: 11/26/17 Time: 16:02				
Sample: 2002 2015				
Included observations: 210				
Null Hypothesis: No cointegration				
Trend assumption: No deterministic trend				
User-specified lag length: 1				
Newey-West automatic bandwidth selection and Bartlett kernel				
			t-Statistic	Prob.
ADF			-2.072118	0.0191
Residual variance			14.00448	
HAC variance			15.00729	