Profitability and determinants of bank risk-taking in CEMAC

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Results: It appears that economic profitability, as well as liquidity and gross domestic product, significantly reduces the bank risk-taking in the CEMAC while inflation and high equity encourage it.

Originality/Relevance: To expand the empirical literature on the effects of profitability on the taking of banks in the CEMAC. Studies of this kind within the sub-region being quite rare

Theoretical/methodological contributions: Mobilize different theoretical concepts in order to provide a corpus of the effects of profitability on banks' risk-taking.

Social/management contributions: This study provides private and public decision-makers with a toolbox to deal with banks'risk-taking, the consequences of which can be harmful for society as a whole.

JEL Classification: C23 G24 G32

Keys words: Economic profitability, financial profitability, bank risk-taking

Rentabilité et déterminants de la prise de risque des banques dans la CEMAC

Objectif: L'objectif de cette étude est d'évaluer l'effet de la rentabilité sur la prise de risque des banques dans la CEMAC.

Méthode: Pour parvenir à cet objectif, cet article fait recours à une analyse de corrélation, aux moindres carrés à variables indicatrices et corrige les problèmes d'hétéroscédasticité, de dépendance et d'autocorrélation des termes d'erreurs par le panel standard corrected error (PCSE) et les moindres carrés réalisables (FGLS).

Résultats: Il en ressort que la rentabilité économique, tout comme la liquidité et le produit intérieur brut, réduit significativement la prise de risque des banques dans la CEMAC. Alors qu'une inflation et des fonds propres élevés l'encouragent.

Originalité / pertinence: Agrandir la littérature empirique des effets de la rentabilité sur la prise des banques dans la CEMAC. Des études de ce genre au sein de la sous-région étant assez rares.

Classification JEL: C23 G24 G32

Mots clés: Prise de risque des banques, rentabilité économique, rentabilité financière.

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1. Introduction

The annual reports of the Bank of Central African States (BEAC) and the Central African Banking Commission (COBAC) on 2017 sounded the alarm bells on the increasingly risky behavior of CEMAC banks. In fact, since the subprime crisis, particular attention has been paid to banks' loan portfolios. Although the CEMAC countries did not suffer from this crisis, they experienced a similar phenomenon in the 1970s. A set of reforms were made to avoidhaving to deal with this type of situation in the future (Avom and Eyeffa, 2007; Ekomane and Yamb, 2016). This involved, among other things, a withdrawal of the state from this sector, a liberalization of the interest rate. These reforms should have resulted in hyperactivity of the banks (Avom and Eyeffa, 2007). However, the results are not the most pleasant. Indeed, data from the World Bank (WDI, 2018) show that in 1991 the CEMAC banks granted loans to the private sector amounting to 18% of their gross domestic products, but that in 2017 this rate was only 14%.

Considering this observation, one can suppose that if banks do not sell their main product, they will have difficulties in being profitable. This could explain why since the beginning of the 2010s they are more inclined to take risks. Since the economic literature teaches that if a bank has difficulty in being profitable and therefore tends towards a certain default, it will embark on risky projects which could yield big returns (Rajan, 2005). This is why this study sets out to determine the effect of profitability on the risk-taking of banks in the CEMAC region. In order to measure profitability two indicators are used, namely, economic profitability (ROA) and financial profitability (ROE). In terms of risk taking, non-performing loans serve as a measure. Added to these, the size, capital and liquidity of banks are used to capture the characteristics of banks. In addition, the growth rate of gross domestic product and the rate of inflation provide a measure of the health of the economy.

The data for this study comes from the World Bank, BEAC and the Financial Structure and Development database. The corrected standard Error panel and the achievable least squares were used and made it possible to find that the risk-taking of banks in the CEMAC region depends negatively on the economic profitability, the liquidity of the banks and the growth rate of the gross domestic product. But also that it depends positively on the capitalization of banks and the rate of inflation. The remainder of this article is organized as follows, the next section focuses on the literature review, the third on methodology, the fourth on results and analyzes,and the last on the conclusion and some recommendations of economic policies.

2. Literature review

Despite the work of Martynova et al. (2019), which shows that profitable banks are more risky, the prevailing economic literature does not. The purpose of this section is to briefly review the theoretical as well as empirical literature.

2.1. Theoretical review

The work of Stiglitz and Weiss (1981) has emphasized that banks in order to grant credit compare returns and risks. The more the borrower is risky, the higher the rate applied to him. Stiglitz and Weiss (1981) argue that profitability is linked to the default risk of borrowers. However, they specify that beyond a certain level of risk banks prefer not to grant credit. A little later in 1993 Aglietta will explain that the search for profitability of banks can lead them to turn a blind eye to the risks presented by their customers. Indeed, according to Aglietta (1993) because of competition between banks, borrowers with high default probabilities will receive loans. Competition remains an advantage for customers. Banks in a fierce battle to attract customers will give credit to borrowers not necessarily for the quality of their projects but because they say to themselves that if they do not give out the credit, another bank will. So the frenzied search for bank profitability sometimes pushes them to take more risks. Rajan (2005) continues this idea by explaining that a bank at risk of bankruptcy does not really have a choice. In front of her are two possibilities: either go bankrupt with certainty, or take risks and thus give herself a chance of survival. The survival instinct will lead the bank to opt for risk taking.

The theory of income inequality also explains the link between profitability and risk taking of banks. According to this literature, the rich are more likely to obtain a loan to finance projects of approximate quality while the poor even with projects of good qualities will get it hard. This can be explained by the risk-return dilemma (Bourguignon 2004, Demirgüç-Kunt and Levine 2008). The poor offer few guarantees so they are more risky despite the likelihood of high returns. The rich are likely to offer good guarantees so they are less risky for banks despite the poor project they offer. Abbate and Thaler (2019) demonstrate that profitability and risk-taking are linked.They explain then that there is an optimal threshold of risk taking that would maximize the profitability of banks. Above this threshold, profitability and risk-taking have an inverse relationship and below that they have a positive relationship. In the same spirit, Martynova et al. (2019) support the idea that profitable banks, by relaxing their credit constraints will take more risks. This proximity between profitability and risk taking has recently been taken into the risk-taking channel. Borio and Zhu (2012) have shown that monetary policy affects banks' risk taking through three main groups of effects: the effect of monetary policy on the borrower's situation, the latter affecting bank risk-taking, the effect of the communication policy and the bank's reaction function on banks and the effect of monetary policy on banks' profitability.

2.2. Empirical review

This growing theoretical literature on the effect of profitability on banks' risk-taking has given rise to some empirical studies, but most of them are done within the general framework of the risk-taking channel. For example, the work of Paligorova and Santos (2017) finds that between 1990 and 2008 banks with a certain appetite for risk gave low-price credit to risky borrowers compared to less risky borrowers because of the relaxation of the monetary policy. Dell'Ariccia et al. (2017) find similar results in the United States between 1997 and 2011. Using a panel with fixed effects, a discrete choice model, a duration model and a double difference estimator on the data of Portugal between 1999 and 2007, Bonfim and Soares (2018) found that ex-ante; risky borrowers have easier access to credit during periods of low interest rates. The work of Neuenkirch and Nöckel (2018) assess the effect of monetary policy on the risk taking of banks in the euro zone between the first quarter of 2003 and the second quarter of 2016. Thanks to a VAR they found that an expansionary monetary policy shock leads banks to lower their lending standards. These results confirm the existence of the risk-taking channel and therefore the effect of profitability on risk taking. However, studies of this kind in the CEMAC region are almost non-existent. Moreover, empirical studies that focus solely on the direct effect of profitability on bank risk-taking are rather rare. This study undertakes to contribute to enrich this literature, especially in the CEMAC region.

3. Methodology

The purpose of this section is to relate the methodological tools that are used in this study to assess the effect of profitability on the risk taking of banks in the CEMAC region. The first point deals with the choice of variables and sources of data, the second point deals with the specification of the model and the third point with the estimation method.

3.1. Choice of variables and sources of data

Studies on risk-taking use a variety of indicators for bank risk-taking. Many of them use the ratio of non-performing loans (NPL) to GDP (Gonzales 2005, Agoraki et al 2011 Maraghni 2017). This indicator is used in this study to measure risk taking by CEMAC banks. In order to measure the profitability of the banks, two variables are retained. Economic profitability (ROA), which is the returnon assets, and financial profitability (ROE), which is the return on equity. These measures are part of the most used measures. They are found in particular in the work of Daoud and Kammoun (2017); Kimani and Koori (2018).Both theoretical and empirical literature holds that banks' risk-taking depends on their characteristics (Rajan 2005, Borio and Zhu 2012, Altunbas et al 2014). As such, the liquidity of the banks (LIQ), the capitalization of banks (FP) and the size of the banks (TA) are mobilized. The size of the banks represents the total balance sheet of the banks of each country.

Capitalization refers to the capital of banks in each country. Liquidity is captured by the money supply of each country. Finally, the GDP growth rate (TGDP) and the consumer price index (CPI) make it possible to take into account the economic health of the CEMAC countries.

The data used for this study are secondary data covering the six CEMAC3 countries between 2010 and 2017. The data on non-performing loans, the consumer price index and the GDP growth rate come from the World Bank (World Development Indicators, 2018). Data on bank characteristics and bank profitability come from the BEAC and Financial Structure and Development (FSD, 2015). In order to avoid the problem of scale, the size of the banks (TA), the capitalization of the banks (FP) and the liquidity of the banks (LIQ) are used in logarithms. That is, LTA, LFP and LLIQ respectively.

3.2. Model specification

The specification of the model used for this study is made according to the approach of Jiménez et al. (2013) who evaluate the effect of competition on the risk taking of banks in Spain. In accordance with this, the following model is retained.

$$NPL_{i,t} = \alpha_i + \beta_1 ROA_{i,t} + \beta_2 ROE_{i,t} + \beta_3 LTA_{i,t} + \beta_4 LFP_{i,t} + \beta_5 LLIQ_{i,t} + \beta_6 TGDP_{i,t} + \beta_7 CPI_{i,t} + \varepsilon_{i,t}$$

Where $i = 1, \dots, 6$ and $t = 2010, \dots, 2017$

$NPL_{i,t}$which refers to non-performing loans from banks in country i at period t, is the bank's risk-taking measure. $ROA_{i,t}$ and $ROE_{i,t}$ are the measures of profitability. They represent the economic profitability of the banks of country i at period t and the financial profitability of the banks of country i at period t. The economic profitability is equal to the ratio between the net profits of the bank and its assets while the financial profitability is equal to the ratio between the net profits of the bank and its own funds. $LTA_{i,t}$,$LFP_{i,t}$ and $LLIQ_{i,t}$ are respectively the logarithm of the total balance sheet of banks in country i at period t, the logarithm of banks' funds in country i at period t, and the logarithm of the money supply of country i at period t. These three indicators thus make it possible to see how the characteristics of banks influence their risk taking. $TGDP_{i,t}$is the GDP growth rate of country i at period t, it captures the economic situation of the CEMAC. $CPI_{i,t}$is the consumer price index of country i at period t. It is the measure of the rate of inflation that is used in this model. β_1,β_2, β_3, β_4, β_5, β_6 and β_7 are parameters to be estimated. Finally, α_i is the individual specific effect.

Table 1. Description of variables

Variables	Descriptions	Sources
NPL	These are ratio of non-performing bank loans and GDP	WDI (2018)
ROA	It is equal to the ratio between the net profits and total assets	BEAC (2017), FSD (2015)
ROE	It is equal to the ratio between the net profits and total owns funds	BEAC (2017), FSD (2015)
LTA	This is the log of the total balance sheet of banks	BEAC (2018)
LFP	This is the logarithm of banks' equity	BEAC (2018)
LLIQ	This is the logarithm ofM2 (availability of money and quasi-money)	BEAC (2018)
TGDP	This is GDP growth rate, a measure of the economic conjuncture	WDI (2018)
CPI	This is the consumer price index which is a measure of inflation	WDI (2018)

Source: Authors

[3] Cameroon, Central Africa Republic, Congo, Gabon, Equatorial Guinea and Chad

3.3. Estimation method

In order to estimate this model, the first step is to undertake a unit root tests. For this the tests of Levin, Lin and Chu (LLC) and Im, Pesaran and Shin (IPS) are mobilized. Moreover, since the individual dimension (6) is smaller than the temporal dimension (8), a Hausman test (1978) is made to choose between the fixed specific effects model and the random effects model. Depending on the model chosen at the end of the test, an appropriate estimation method is used. If the random effects model is chosen, the generalized least squares are retained. On the other hand, if it is the fixed specific effects model that is retained, it is the least squares with dummy variables that will make it possible to estimate this model. Following this estimation, post estimation tests are carried out namely, a heteroscedasticity test, a transversal dependence test of the error terms and an autocorrelation test of the error terms. If at least one of these problems is detected, the panel corrected standard error (PCSE) and the feasible least squares (FGLS) will be used to solve it.

4. Results and analyzes

This section first presents a descriptive analysis, then the results of the unit root tests, the Hausman test and the results of the estimations, the post estimation tests and the correction of the detected problems.

4.1. Descriptive analysis

Table 2. Descriptive statistic

Variable	Obs	Mean	Std. Dev.	Min	Max
NPL	48	11.51111	8.498157	0.9643723	30.86475
ROE	48	13.37728	9.789799	-6.5	38.3
ROA	48	1.274275	1.051583	-1.8	4.2
LTA	48	15.91038	1.402851	12.27795	17.77572
LLIQ	48	14.03336	0.8882582	12.09644	15.25821
LFP	48	12.31306	0.7086555	11.03887	13.71329
TGDP	48	1.932564	7.462123	-36.69995	13.5501
CPI	48	4.340779	7.163201	-3.704296	37.14221

Source: Authors using Stata

Table 2 shows that CEMAC banks sometimes have non-performing loan rates of 30%. The financial and economic returns are on average 13.38 and 1.27. They are at the same time negative, i.e. -6.5 and -1.8, which reflects the difficulty of certain banks in making their activities profitable. These figures show that CEMAC banks sometimes experience some profitability concerns. This could push them to take more risks in order to avoid a certain default. Table 3 below tends to support this idea.

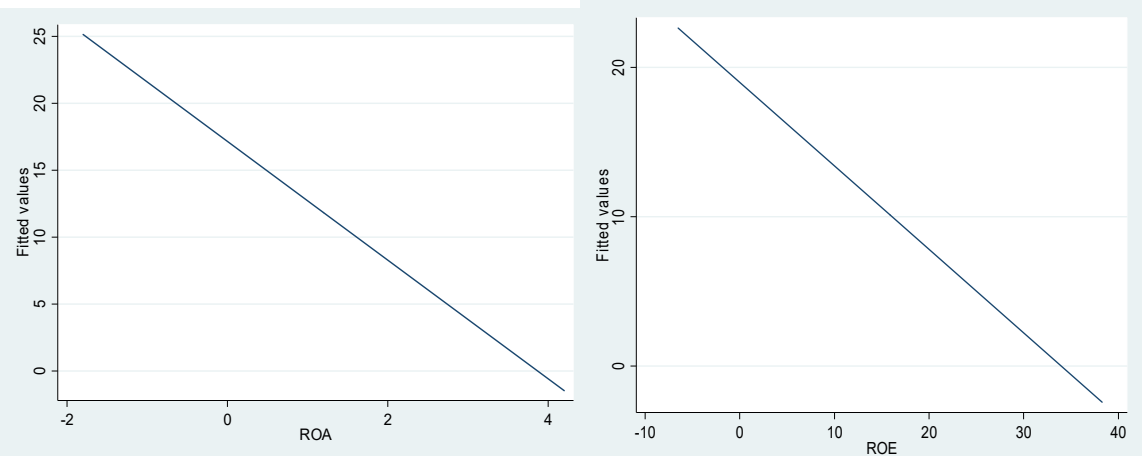
Table 3. Pearson correlation matrix

	NPL	ROA	ROE	LTA	LLIQ	LFP	TGDP	CPI
NPL	1							
ROA	-0.5488*	1						
ROE	-0.6445*	0.7973*	1					
LTA	-0.6135*	0.2476	0.4447*	1				
LLIQ	-0.5361*	0.0843	0.2313	0.6813*	1			
LFP	-0.1275	-0.0929	-0.094	0.4078*	0.8394*	1		
TGDP	-0.4885*	0.4380*	0.3587*	0.2777	0.2381	0.0237	1	
CPI	0.4847*	-0.4452*	-0.4565*	-0.3876*	-0.4816*	-0.3410*	0.0632	1

Source: Authors using Stata

The above results show that bank profitability and non-performing loans are negatively correlated. In fact, the previous Pearson correlation matrix shows that economic profitability (ROA) is negatively and significantly correlated with non-performing loans. This is also the case for financial profitability (ROE), whose correlation with non-performing loans is higher. Also, the previous table shows that bank characteristics are negatively and significantly correlated with banks' risk taking. Then, they show that the GDP growth rate and non-performing loans are also negatively correlated and this correlation is significant at 5% level. Finally, Pearson's correlation matrix shows that banks' risk taking and inflation rate are positively and significantly correlated at 5% threshold.

Graph 1. Graphical representation of the linear relationship between profitability and risk taking of banks in the CEMAC region.



Source: Authors using Stata

The preceding graphs confirm the results offered by the Pearson correlation matrix. These graphs show that there is a negative relationship between economic profitability (ROA) and non-performing loans. They also reveal a negative relationship between bank risk-taking and financial profitability (ROE). This first descriptive analysis suggests that the more profitable the CEMAC banks are, the less likely they are to take risks.

4.2. Results of unit root tests

It is necessary to first test the optimal delay of each variable. For this purpose, this study uses the Schwartz information criterion to automatically detect this delay.

Table 4. Unit root tests

Variables	LLC	IPS	Final Decision
NPL	0,0345	0,8463	Stationary at level
ROA	0,0000	0,0022	Stationary at level
ROE	0,0000	0,0205	Stationary at level
LTA	0,0053	0,8048	Stationary at level
LFP	0,0000	0,3128	Stationary at level
LLIQ	0,0000	0,5643	Stationary at level
TGDP	0,0056	0,6074	Stationary at level
CPI	0,0000	0,2679	Stationary at level

Source: Authors using Eviews

The LLC and IPS tests do not agree repeatedly on the stationarity of the variables. If in doubt, the choice is one of the two tests. In this respect, all the variables are considered stationary at level.

4.3. Hausman test and estimations results

The following table reports estimations of fixed specific effects models and random effect models, followed by the results of the Hausman test (1978).

Table 5. Hausman tests and estimations

NPL4	Model 1		Model 2		Model 3	
	FE	RE	FE	RE	FE	RE
ROA			-1,801** (0,799)	0,799** (0,879)	-3,218** (1,273)	-2,428* (1,292)
ROE	-0,085 (0,099)	-0,136 (0,099)			0,211 (0,149)	0,054 (0,139)
LTA	-0,820 (0,759)	-0,544 (0,731)	-0,600 (0,726)	-0,524 (0,691)	-0,489 (0,720)	-0,573 (0,710)
LLIQ	-3,128 (4,66)	-8,377*** (2,105)	-4,603 (4,451)	-9,924*** (2,060)	-5,923 (4,487)	-10,290*** (2,283)
LFP	7,258** (3,328)	8,484*** (2,165)	8,837** (2,853)	9,575*** (1,935)	12,146 (3,657)	10,012*** (2,253)
TGDP	-0,284** (0,103)	-0,261** (0,107)	-0,152 (0,117)	-0,151 (0,118)	-0,098** (0,121)	-0,142 (0,122)
CPI	0,303** (0,128)	0,252** (0,126)	0,170 (0,134)	0,141 (0,135)	0,158 (0,133)	0,139 (0,136)
R-square	0,6371	0,8659	0,6755	0,8709	0,6931	0,8686
Fisher	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000
Hausman	0,02010		0,0149		0,0099	

Source: Authors using Stata

The Hausman test (1978) has as null hypothesis the random effect model (RE) and the fixed specific effects model (FE) is the alternative hypothesis. Its critical decision threshold is 10%. The previous table thus shows that for the three estimations used, the fixed specific effects model is not rejected. It also permits us to see the results of the estimations with these fixed specific effects. Nevertheless, before analyzing these results one must evaluate their robustness by carrying out other tests.

4.4. Post-evaluation tests

The results of the transversal dependence tests of the error terms (Breush-Pagan test), heteroscedasticity (modified Wald test) and autocorrelation of the error terms (Wooldridge test) are summarized in table 6.The Breush-Pagan dependence test has as null hypothesis the transversal independence of the error terms. The modified Wald test has as null hypothesis homoscedasticity. And the Wooldridge test has as null hypothesis the absence of autocorrelation of the error terms. The significance level of each of these tests is 5%.In light of this, the previous table shows that for these models the null hypotheses of these tests are not accepted.

Table 6. Post estimations tests results

	Model 1		**Model 2**		**Model 3**	
Tests	Prob	Decisions	Prob	Decisions	Prob	Decisions
Breush-Pagan	0.0264	Dependence	0.0340	Dependence	0.0183	Dependence
Modified Wald	0.0000	Heteroscedasticity	0.0000	Heteroscedasticity	0.0000	Heteroscedasticity
Of Wooldridge	0.0007	Autocorrelation	0.0004	Autocorrelation	0.0004	Autocorrelation

Source: Authors using Stata

[4]* means significant at 10%, ** means significant at 5% and *** means significant at1%.

The models therefore suffer from transversal dependence of error terms, heteroscedasticity, and autocorrelation of error terms.

4.5. Corrected model

In order to remedy the problems detected above, two methods are retained. The Panel Corrected Standard Error (PCSE) and the Feasible Generalized Least Squares (FGLS).

Table 7. Results of the correction of detected problems

NPL	Model 1		Model 2		Model 3	
	PCSE	FGLS	PCSE	FGLS	PCSE	FGLS
ROA			-1,549**	-1,337**	-2,275**	-2,437**
			(0,497)	(0,463)	(0,837)	(0,776)
ROE	-0,091*	-0,027			0,097	0,147*
	(0,054)	(0,042)			(0,086)	(0,078)
LTA	-0,514	-0,237	-0,567	-0,367	-0,630	-0,458
	(0,675)	(0,494)	(0,654)	(0,504)	(0,639)	(0,485)
LLIQ	-8,503**	-8,734***	-9,500***	-8,842***	-10,253***	-9,954***
	(2,639)	(2,335)	(2,336)	(2,027)	(2,455)	(2,070)
LFP	8,554**	8,267***	9,444***	8,079***	10,352***	9,340***
	(2,590)	(2,273)	(2,342)	(2,066)	(2,496)	(2,114)
TGDP	-0,240**	-0,264***	-0,136*	-0,167**	-0,101	-0,115
	(0,078)	(0,073)	(0,082)	(0,075)	(2,088)	(0,081)
CPI	0,184*	0,220**	0,127	0,175**	0,124	0,175**
	(0,097)	(0,096)	(0,086)	(0,087)	(2,084)	(0,085)
Fisher	0,0000	0,0000	0,0000	0,0000	0,0000	0,0000

Source: Authors using Stata

These estimations show that economic profitability (ROA) reduces banks' risk taking in the CEMAC. Indeed, according to the table above, an increase in the economic profitability of banks, ceteris paribus, significantly reduces the risk taking of banks in the CEMAC. With regard to financial profitability, it seems to have no significant effect on the risk taking of CEMAC banks. However, it shows a negative effect at 10% in the first model and a positive effect at 10% when taken with economic profitability. In general, when CEMAC banks are profitable they are less inclined to take risks. These results are consistent with the work of Rajan (2005) and Borio and Zhu (2012). These authors explained that banks are inclined to take more risks when they do not make profits. Indeed, according to them, a bank that runs to a certain default has the choice between going bankrupt with certainty and embarking on risky projects and having a chance to get away. It is therefore a little clearer that, according to these authors, profitable banks have less reason to invest in high-risk projects. However, it goes in the opposite direction compared to the work of Martynova et al. (2019), which explains that profitable banks ease their borrowing conditions and therefore take more risks.

With regard to the characteristics of the banks, the results of the estimations show that the size of the banks has a negative but not significant effect on the risk taking of these banks in the CEMAC. Secondly, these results show that bank liquidity significantly reduces banks' risk taking in CEMAC. Indeed, an increase in the liquidity of banks, ceteris paribus, reduces their preponderances to take risk. This result is in agreement with Borio and Zhu's concept of "liquidity multiplier" (2012). Borio and Zhu (2012) explain that liquidity plays an important role in bank risk-taking. Banks that face liquidity problems are pushed to take more risks. This could explain why for several years the CEMAC banks were over-liquid and rationed (Avom and Eyeffa, 2007). After the crisis of the 1970s caused by a rapid deterioration of their loan portfolios, CEMAC banks made arrangements to stop dealing with this kind of problem. It is then easy to assume that they have become greedier in terms of collateral securities and liquidity to reduce their risk taking.

As to what concerns equity, the results show that the most capitalized banks are the ones that take the most risk. Indeed, an increase in equity, ceteris paribus, leads banks to take more risks. This result is consistent with the literature that banks that comply with capital requirements tend to take more risks. Thus Trinnou and Igue (2015) explain that banks that have constituted a "security capital" will be confident and thus afford to embark on risky investments. This result therefore raises the debate on the optimality of banking regulation, especially in terms of equity. Finally, it appears that an increase in the rate of growth of the GDP, ceteris paribus, reduces the risk taking of banks in the CEMAC. They also show that a rise in the rate of inflation, ceteris paribus, leads to increased risk taking by banks. These results therefore show that in a healthy economy, banks are less inclined to take risks.

5. Conclusion

The objective of this study was to expand the empirical literature on the effect of profitability on banks' risk taking in the CEMAC. To do this, it used data on non-performing loans from WDI (2018), then data from BEAC (2017, 2018), FSD (2015) for data on economic and financial profitability. Subsequently, it used descriptive analysis, and precisely, correlation analysis. Then, it used an econometric analysis, the fixed-effects model corrected from the problems detected on the error term by the PCSE and the FGLS. It has emerged that banks that are the most economically profitable take significantly less risk. In terms of bank characteristics, the most liquid banks and the least capitalized banks are the least risky in the CEMAC. In terms of the external environment at the bank, the results showed that economic growth, in contrast to inflation, significantly reduces banks' risk taking in the CEMAC. These results suggest that CEMAC banking regulators and academics should be interested in the elements that make CEMAC banks economically viable in order to encourage CEMAC banks, which is an important element in reducing risk-taking. In addition, CEMAC's regulatory authorities must closely monitor the liquidity of banks and try to assess the optimality of capital regulation, as these characteristics of the bank significantly affect its risk-taking.

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