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Determinants of capital adequacy ratio of Algerian commercial banks: A Panel Data Analysis

BENILLES Billel* (1)

b_benilles@esc-alger.dz

EPSCSG Laboratory, High School of Commerce, (Algeria)

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Abstract

This study aims to identify and analyze the determinants of capital adequacy of banks operating in Algeria. The study is based on a sample of nineteen (19) Algerian banks over a period of ten (10) years, from 2011 to 2020. Hence, the panel data regression method is used to meet the goal of the study. The capital adequacy is presented by the capital adequacy ratio (CAR). The results of the multivariate analysis indicate that deposits, size, off-balance sheet, liquidity, loan loss reserves, ownership, and economic growth had a negative effect on the CAR. However, lending, leverage, and return on assets had a positive effect on the CAR.

Keywords: Capital adequacy; Determinants; Panel data; Algerian banks.

Jel codes: C23, G21.

* Corresponding autho : BENILLES Billel, b_benilles@esc-alger.dz

1. Introduction

Banks, as financial intermediaries, play an important role by connecting economic agents with surplus funds with agents in need of funds. However, this activity is highly exposed to risks, including credit risk, liquidity risk, market risk and operational risk, which can lead to significant losses for banks. If these risks are not properly managed, they can lead to serious consequences, such as bank failures, financial crises and poor economic outcomes. It is therefore crucial for banks to put in place sound risk management policies and procedures to minimize losses and ensure their financial stability.

In this context, regulators were forced to put in place prudential regulations to protect banks and depositors againt these risks. This regulation was introduced in 1974 with the creation of the Basel Committee, which established agreements to ensure the safety of the financial system. The central pillar of this international regulation is the capital adequacy of banks. Regulators focused on bank capital adequacy because the capital plays a critical role in preserving the safety and soundness of banks, as well as the safety of banking systems as a whole.

Moreover, the identification of the determinants affecting the capital adequacy ratio of banks has long attracted the attention of researchers, and Thus studies have been conducted such as Al-Tamimi and Obeidat (2013) focusing on Jordanian commercial banks listed on the Amman Stock Exchange, Raharjo et al. (2014) looking at Indonesian banks and El-Ansary and Hafez (2015) examining Egyptian banks. Recent studies, such as Kablay and Gumbo (2021) on Botswana banks, have also shown that the capital adequacy ratio of the banks studied is influenced by both internal and external factors.

In line with this, Algeria has put in place prudential regulations inspired by the Basel agreements. Thus, the capital adequacy of Algerian banks is at the same level of importance as it is internationally. However, the factors determining the capital adequacy of banks in Algeria still need more studies.

This article aims to examine and analyze the determinants of capital adequacy of Algerian banks. To achieve this objective, we used uses annual data of (19) commercial banks representing the whole Algerian banking sector, observed from 2011 to 2020, and panel data was employed for the analysis.

The rest of the paper is organized as follows: the first section presents the determinants of capital adequacy and the development of the research hypotheses. The second section shows elements of the methodology used. The results obtained are presented and discussed in the third section and are followed by a conclusion.

2. The solvency of Algerian banking sector: a brief overview

With regard to the provisions of regulation n° 14-01 on solvency coefficients applicable to banks and financial institutions, banks and financial institutions are obliged to permanently respect a minimum solvency coefficient at least equal to 9.5% between, on the one hand, their total regulatory equity and, on the other hand, the sum of weighted credit, operational and market risks. In addition to this coverage, they must build up a safety cushion, consisting of core capital covering 2.5% of weighted risk.

In addition, the core capital must cover the weighted credit, operational and market risks, up to at least 7% (Article 03 of Regulation n° 14-01).

The above-mentioned ratios must be declared quarterly to the Banking Commission and to the Bank of Algeria, according to the modalities set by instruction of the Bank of Algeria. The Banking Commission may request ratio declarations at earlier dates.

In 2020, the Bank of Algeria decided to exempt banks and financial institutions from the constitution of safety cushions in response to the global health crisis, which allowed banks to increase their activities while maintaining capital levels above the minimum regulatory requirements.

he following table presents the evolution of the level of capital adequacy of the Algerian banking sector which is measured by two ratios: the overall solvency ratio (in relation to regulatory capital) and the core capital solvency ratio.

Table 1. Evolution of the solvency of the Algerian banking sector from 2011 to 2020.

Year	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Overall solvency ratio	23.77%	23.62%	21.5%	15.98%	18.39%	18.9%	19.45%	19.05%	17.99%	19.17%
Solvency ratio on Tier I	17.00%	17.48%	15.51%	13.27%	15.75%	16.36%	15.03%	14.98%	14.26%	15.38%

Source: Bank of Algeria Annual Report 2013, 2016 and 2022.

In terms of solvency, the situation of the Algerian banking sector has improved significantly over the past ten years. Solvency ratios are at a comfortable level, well above the minimum rates recommended by the Basel Committee.

3. Determinants of Bank Capital Adequacy: Literature review

The determinants of bank capital adequacy have been extensively studied, leading to the proposal of the following factors:

3.1. Size

The impact of bank size on the capital adequacy ratio (CAR) has been the subject of considerable debate among researchers. Some studies suggest that larger banks are better equipped to maintain higher CARs due to economies of scale and diversification (Mekonnen 2015; Shingjergji and Hyseni 2015), Huang and Ratnovski's (2011) study found that larger banks tend to have higher CARs because of their ability to diversify risk across a larger portfolio of assets. Similarly, Berger, Hancock, and Humphrey's (1993) study found that large banks had higher CARs than small banks because of their ability to access capital markets more easily.

However, Other studies have shown that large banks may be more prone to leverage and thus have lower CARs. For example, Aggarwal and Jacques' (2001) study found that large banks had lower CARs due to their greater reliance on short-term funding and higher leverage ratios.

H1: There is a relationship between bank size and capital adequacy ratio.

3.2. Liquidity

The relationship between bank liquidity and solvency ratio (CAR) has been the subject of many studies. Aspal and Nazneen (2014) examined the private banking sector in India and found a positive relationship between liquidity and CAR. Similar findings were reported by Toha and Ngoc (2017) in their study of Vietnamese banks.

However, Thoa et al. (2020) found a negative relationship, explaining that a higher liquidity ratio indicates a higher allocation of risky assets, which leads to a higher liquidity situation for the bank. On the other hand, some studies, such as Setiawan and Muchtar (2021), found no impact of liquidity on CAR. In summary, the relationship between bank liquidity and CAR is complex and has yielded mixed results in the literature. However, it is generally accepted that adequate liquidity is important for banks to manage liquidity risk and maintain a strong CAR.

H2: : There is a positive relationship between bank liquidity and the capital adequacy ratio.

3.3. Loan loss reserves

Several studies have been conducted on this variable, including the one established by Ahmet (2011) which shows a positive correlation between CAR and LLR. This finding is consistent with that obtained by Masooud and Ansari (2016). On the other hand, research conducted by Lestari et al. (2019) and Xuan and Ngoc (2017) indicates a negative correlation between the two variables. However, it is generally accepted that the higher the loan loss reserves of a financial institution, the higher its capital adequacy level will be. This is because loan loss reserves act as a buffer for potential losses on delinquent loans, thereby reducing net losses and protecting the financial institution's capital.

H3: There is a positive relationship between the bank's loan loss reserves and the capital adequacy ratio.

3.4. Deposits

Bank deposits are a primary source of funding for banks, and they play a critical role in the bank's ability to maintain its CAR. If a bank's deposits increase, it may have more funds to lend, but this also creates more liabilities for the bank, which may reduce its CAR. On the other hand, if a bank experiences deposit outflows, it may have to reduce its lending activity, which can also affect its CAR.

Several studies have shown that an increase in bank deposits leads to an increase in CAR. For example, Boyd and De Nicolò's (2005) and Akhtar et al.'s (2011) studies found that higher deposit levels were associated with higher CAR levels.

In contrast, the study by Sufian and Habibullah (2009) found a negative relationship between bank deposits and CAR for Malaysian banks. The study suggested that banks with higher levels of deposits may have lower CAR due to their increased lending activities and credit risk exposure. The authors also suggested that larger banks may be more likely to have lower CARs because they have a greater capacity to assume risk.

H4: There is a relationship between deposits and bank's capital adequacy ratio.

3.5. Leverage

When a financial institution uses leverage to finance its investments, it increases the risk of losses. As a result, the capital adequacy of the institution may be negatively affected. The results of the Michael et al. (2009) study indicate that there is a negative relationship between bank leverage and capital adequacy ratio. Banks that have voluntarily reduced their leverage ratio (deleveraging), perhaps in response to a higher capital requirement, will achieve their desired total risk by increasing their asset risk. On the other hand, Ahmet and Hasan (2011) argue that highly leveraged banks hold less capital than low-leveraged banks. On the other hand, the results of Yonas Mekonnen's (2015) study revealed that leverage does not have a statistically significant effect in the study area.

H5: There is a negative relationship between bank leverage and capital adequacy ratio.

3.6. Loans

Bank loans can have both positive and negative effects on a bank's capital adequacy ratio (CAR). On the positive side, loans generate income for the bank, which can improve its profitability and increase the level of capital available to the bank. This can have a positive impact on CAR, as it measures a bank's capital level relative to its risk-weighted assets. However, on the negative side, loans also represent a potential risk to the bank. If a borrower defaults on a loan, the bank can incur losses that can deplete its capital.

The study of Kusiyah al (2020) showed the existence of a positive and significant relationship, banks are expected to continue to exercise strict monitoring of loans, so that the loans made are not much larger than the deposits. Thus, banks with high liquidity tend to maintain high capital adequacy (CAR). Similarly, Eldomiaty al (2016) and Romdhane (2012) found that bank loan ratio has a positive impact on CAR.

On the other hand, the studies of Toha and Anh, (2017), Polat & Al-Kalaf (2014) and (Binh & Thomas, 2015) confirmed the existence of a significant and negative impact of loans on CAR. This is because the higher the amount of loans, the worse the bank's liquidity, indicating that the bank will not be able to meet its debt in the short term because this bank does not have enough assets to fund the promised loans.

H6: There is a positive relationship between loans and a bank's capital adequacy ratio.

3.7. Profitability of assets

In general, profitability is considered a key determinant of capital adequacy, as banks with higher profitability have more resources to meet their capital needs. A higher capital ratio is in turn associated with improved financial stability and reduced systemic risk.

Studies of Setiawan and Muchtar (2021), Bateni et al. (2014) concluded that profitability has a significant and positive impact on capital adequacy. The higher the profitability achieved by the bank, the higher the net profit after tax is also, which means that retained earnings accumulate and therefore the capital adequacy ratio of a

bank will increase. According to Ini and Eze, (2018), profitability allows banks to absorb shocks due to volatile earnings, in addition it ensures the survival of banks and their ability to attract deposits.

H7: There is a positive relationship between the profitability of assets and the capital adequacy ratio of a bank.

3.8. Off-balance sheet activities

Off-balance sheet activities (OBS) are financial transactions that do not appear on a bank's balance sheet, but which nevertheless have an impact on the bank's financial position and risk profile. In order to address the impact of off-balance sheet activities on capital adequacy, regulators require banks to calculate risk-weighted assets that include the potential impact of these activities.

According to Jagtiani et al. (1995) the common explanation for the explosive growth of banks' off-balance sheet activities (OBS) is due to the failure to meet capital adequacy requirements. They studied the impact of significant changes in capital adequacy regulations on OBS expansion rates, they found that changes in capital requirements did not have a consistent impact on the speed of expansion of OBS activities

H8: There is a negative relationship between off-balance sheet activities and the capital adequacy ratio.

3.9. Ownership

A bank's ownership can impact the bank's capital adequacy. For example, a bank's ownership structure can affect its risk profile, which in turn can affect its capital adequacy requirements.

In addition, the ownership structure of banks can affect other parameters that have a direct influence on capital adequacy such as liquidity and bank risk. In this framework, Yeddou & Pourroy (2020) showed that ownership concentration has a significant and positive impact on liquidity creation. They found that banks tend to create more liquidity when the owner is another bank or a government, holding a

significant equity stake.

Some studies have shown that public ownership can lead to higher levels of capital adequacy in banks. For example, a study by Demirgüç-Kunt and Huizinga (1999) found that public banks in developing countries had higher capital ratios than private banks.

Other studies have shown that private ownership can lead to higher levels of capital adequacy. For example, a study by Barth, Caprio and Levine (2004) found that private banks in developed countries had higher capital ratios than public banks. Similarly, a study by Cihák and Demirgüç-Kunt (2013) found that private banks in emerging markets had higher capital ratios than public banks.

H9: There is a relationship between bank ownership and capital adequacy ratio.

3.10. Economic growth

According to Bokhari et al. (2022), economic growth is the key component that explains CAR. In a period of positive economic growth, the risk is low and banks keep a low capital ratio and invest more in other financial sectors. While when there is a negative growth rate, then the bank may need relatively high capital or may face sudden economic losses, to cover this risk, banks maintain a high capital ratio. For McClelland, (2019) and Panayotou, (2016) the relationship between economic growth and the banking sector is bidirectional. Indeed, favorable economic conditions make the banking sector more stable, on the other hand, a well-structured and developed banking system promotes economic activities. In addition, high growth rates reflect the high pace of economic activity in the country and the increased demand for financing. Similarly, Asarkaya and Ozcan (2007) pointed out that when economic growth is high, banks make more profit. This may contribute to their capital increase.

H8: There is a positive relationship between economic growth and a bank's capital adequacy ratio

4. Methodological framework

4.1 Sample and data collection

This study is based on data from nineteen (19) Algerian banks: 6 public and 13 private, which encompass all banks currently operating in Algeria. To carry out this study, a set of data taken from the financial statements (balance sheet, off-balance sheet and income statements) of the period 2011-2020 has been used. These documents are collected from the National Center of the Trade Register (CNRC) and the banks' websites. The capital adequacy ratio was collected manually from each bank. As for the macroeconomic data, they are collected from the official website of the World Bank.

4.2 Variables measurement

Before specifying our model, we will describe all the variables retained for the econometric analysis and indicate the studies that used the measures we retained.

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4.2.1. Explained variable

Based on international prudential regulations, Regulation 14-01 of February 16, 2014 on solvency ratios applicable to banks and financial institutions in Algeria has defined the minimum overall solvency ratio as the ratio between total regulatory capital and the sum of weighted risks (credit risk, market risk and operational risk). Thus, the capital adequacy ratio, named CAR in our study, is calculated as follows:

$$CAR = \frac{Regulatory\ capital}{Total\ weighted\ risks}$$

4.2.2. The explanatory variables

The measures of explanatory variables selected to explain the CAR of Algerian banks and their sources are presented in the following table:

Table 2. List of explanatory variables.

Variable	Notation	Measure	Source	hypotheses
Size	**Size**	*Log Total assets*	Raoudha (2016)	H_1 : +/-
Liquidity	**LIQ**	$\frac{Total\ Loans}{Total\ deposits}$	Bateni et al. (2014)	H2 : +
Loans Loss Reserves	**LLR**	$\frac{Provisions\ for\ loan\ losses}{Total\ loans}$	Ahmet (2011), Lestari et al. (2019)	H_3: +
Deposits	**DAR**	$\frac{Total\ Deposit}{Total\ assets}$	Aspal et Nazneen (2014)	H_4 : +/-
Leverage	**LEV**	$\frac{Equity}{Total\ Liabilities}$	Octavia et Brown (2010)	H_5 : -
Loans	**LOA**	$\frac{Total\ loans}{Total\ assets}$	Sanyaolu et al. (2020), Thoa et al.(2020)	H_6 : +
Profitability of assets	**ROA**	$\frac{Net\ income}{Total\ assets}$	Alsabbagh (2004)	H_7 : +
Off balance sheet	**HB**	$\frac{\text{Off – balance sheet commitments}}{Total\ assets}$	Proposée par l'auteur	H_8 : -
Ownership	**OWN**	0 : if the bank is public. 1 : if the bank is private.	Proposée par l'auteur	H_9 : -
Economic growth	**GDP**	GDP growth rate	Mili et al. (2016)	H_{10} : +

Source: Compiled by the researcher.

4.2.3. Specification of the model

The objective of this study is to identify the determinants of capital adequacy of banks in Algeria. To do this, we have opted for the panel data regression method. Our panel is composed of 190 bank-year observations. The model to be estimated is specified as follows:

$$CAR_{it} = \beta_0 + \beta_1 LOA_{it} + \beta_2 LIQ_{it} + \beta_3 ROA_{it} + \beta_4 LEV_{it} + \beta_5 DAR_{it} + \beta_6 LLR_{it} + \beta_7 OWN_{it} + \beta_8 HB_{it} + \beta_9 SIZE_{it} + \beta_{10} GDP_t + \varepsilon_{it}$$

4.3 Descriptive Study

In this section, we will first present some descriptive statistics on the variable to be explained and the internal explanatory variables, distinguishing between public and private banks.

Table 3. Descriptive statistics of variables by banking sector

OWN		CAR	DAR	HB	LOA	LEV	LIQ	LLR	ROA	SIZE
Public banks	MOY	0,215	0,816	0,314	0,681	0,091	0,716	0,104	0,010	28,01
	SD	0,126	0,081	0,133	0,083	0,025	0,219	0,053	0,006	0,53
	MAX	0,661	0,928	0,617	0,841	0,135	1,051	0,302	0,023	28,88
	MIN	0,081	0,629	0,057	0,457	0,045	0,216	0,041	0,000	26,64
Private banks	MOY	0,317	0,635	0,776	0,613	0,239	0,871	0,038	0,024	25,24
	SD	0,192	0,135	0,753	0,143	0,119	0,284	0,034	0,011	0,76
	MAX	1,159	0,832	4,703	0,870	0,635	1,924	0,168	0,066	26,68
	MIN	0,103	0,303	0,211	0,231	0,096	0,278	0,000	-0,008	23,63
Total	MOY	0,284	0,692	0,629	0,634	0,192	0,822	0,059	0,019	26,12
	SD	0,180	0,147	0,662	0,131	0,121	0,274	0,051	0,011	1,46
	MAX	1,159	0,928	4,703	0,870	0,635	1,924	0,302	0,066	28,88
	MIN	0,081	0,303	0,057	0,231	0,045	0,216	0,000	-0,008	23,63

Source: Results produced from statistical processing by the STATA 11.2 software.

The results presented in the table above indicate that the average capital adequacy ratio of Algerian banks during the period 2011-2020 is 28.4%, it varies between a minimum of 8.1% and a maximum of 115.9%. Distinguishing between public and private banks, we find that the capital adequacy ratio of public banks is lower than that of private banks (21.5% against 31.7%). The t-test indicates that this difference is significant ($p = 0.0000 < 5\%$).

Regarding the independent variables, the average size of the banks in the sample, measured by the logarithm of total assets, is 26.12 with a very high standard deviation. This high dispersion is mainly due to the significant difference between the average size of public banks (28.00998) and private banks (25.13806) composing the study sample. In terms of other characteristics, the above table also shows that public banks differ significantly from private banks. On average, public banks are less profitable,

have poorer asset quality, have a lower deposit-to-credit ratio, have larger shares of loans and deposits in total assets, hold less equity and liabilities given total assets than private banks. These differences are statistically significant.

The following table summarizes the descriptive statistics for the only external explanatory variable retained for the entire sample:

Table 4. Descriptive statistics of the external explanatory variable

	Min	Max	Mean	SD
GDP	-0,051%	3,80%	1,81%	1,07%

Source: Based on statistical processing by the STATA 11 software.

These statistics indicate that the average growth rate of real GDP in Algeria is 1.81% during the period 2011-2020. Since the oil shock of 2014, GDP growth in Algeria has slowed significantly from 3.8% in 2014 to -0.051% in 2020. This situation confirms once again the increased dependence of the Algerian economy on hydrocarbons and the absence of a serious alternative that could reduce the loss in terms of growth.

Before testing empirically, the hypotheses of our study, it is necessary to establish the correlation matrix in order to test beforehand the relationship between the dependent variable and the independent variables, and to detect possible problems of multicollinearity between the explanatory variables.

Table 5. Correlation matrix between the variables of the model

	CAR	DAR	HB	LOA	LEV	LIQ	LLR	ROA	OWN	GDP	SIZE
CAR	1										
DAR	-0.538*	1									
HB	-0.0255	-0.1685*	1								
LOA	-0.0167	0.1580*	0.0753	1							
LEV	0.5209*	-0.8407*	0.2965*	-0.0620	1						
LIQ	0.1200	-0.6373*	0.1059	0.2520*	0.6135*	1					
LLR	-0.1539*	0.2584*	-0.3458*	0.1995*	-0.2627*	-0.0933	1				
ROA	0.4093*	-0.5183*	0.3084*	-0.0492	0.5158*	0.3734*	-0.4109*	1			
OWN	0.2639*	-0.5741*	0.3259*	-0.2437*	0.5725*	0.2626*	-0.6041*	0.5661*	1		
GDP	0.1423	-0.1783*	0.0318	-0.1141	0.1465*	-0.0888	0.0510	0.1706*	0	1	
SIZE	-0.4282*	0.7634*	-0.3608*	0.2102*	-0.8134*	-0.4128*	0.4840*	-0.5738*	-0.8808*	-0.1402	1

(*) Significant at the 5% threshold

Source:

Based on statistical processing with STATA 11.2 software.

The correlation matrix above indicates that the capital adequacy ratio is positively and significantly correlated with leverage (LEV), bank profitability measured by ROA and bank ownership (OWN) and it is negatively and significantly correlated with deposits (DAR), loan loss reserve (LLR) and size (SIZE). The matrix also indicates that there are significant positive or negative correlations between some explanatory variables. The highest correlation coefficients are those linking deposits (DAR) , leverage (LEV) and ownership (OWN) with size (SIZE) as well as that linking deposits (DAR) with leverage (LEV) . To ensure the absence of the multicollinearity problem, a complementary examination of the VIF coefficients and the tolerance was carried out

Table 6. VIF test

Variable	VIF	1/VIF
SIZE	13.95	0,07
OWN	8.01	0,12
LEV	6.27	0,16
DAR	4.86	0,21
LIQ	2.53	0,40
LLR	1.82	0,55
ROA	1.74	0,57
LOA	1.40	0,72
HB	1.33	0,75
GDP	1.28	0,78
Mean VIF	4.32	

Source: Results produced from statistical treatments by the STATA 11.2 software.

The table above shows that the FIV of the SIZE variable is greater than 10, which shows that multicollinearity is a serious problem in this model. This is due to the strong correlation between size (SIZE) and ownership (OWN). This collinearity can be problematic in interpreting the regression coefficients of the independent variables. In such a situation, the most common solution is to remove all the explanatory variables responsible for the multicollinearity or to introduce them one by one to avoid this kind

of problem. In this study, the solution adopted is to introduce the explanatory variables responsible for multicollinearity (size and property) separately in two models to avoid the multicollinearity problem.

5. Results and discussion

Our study focuses on a sample of 19 banks observed over a period of 10 years. In order to perform a panel data regression, we have imperatively followed the order of certain econometric steps, notably the specification tests, to determine the adequate estimation method.

First, we note that the fixed-effects model was discarded from the estimation of the first model (model A), since this model includes a time-invariant dummy variable (OWN). Performing a fixed-effects regression would have meant arbitrarily removing this variable from the set of explanatory variables. We therefore used an estimation of a random model and then performed the "Breusch Pagan Lagrangian Multiplier test for random effects" which is used to identify the existence or not of individual random effects. The result of the "Breusch-Pagan Lagrangian Multiplier test for random effects" indicates a significant chi-square statistic (Prob>chi2=0.0000). This allows us to confirm the existence of individual effects. We therefore retain the random effects model for the estimation of model A.

As for model B, the first step is to verify the homogeneous or heterogeneous specification of the data generating process (Doucouré, 2008). The Fisher test is used to verify the overall homogeneity of the model. The results of this test indicate that the probability of the calculated Fisher statistic is less than 1% (Prob > F = 0.0000). Therefore the H0 hypothesis will be rejected, and the specific effect model (fixed or random) is more appropriate. To distinguish between the fixed and random effect model, we performed the Hausman specification test. The results of this test indicate that the Chi2 probability is less than 5% (Prob>chi2 = 0.0002), which confirms the existence of a fixed individual effect. We therefore retain the random effects model for the estimation of model B.

Next, we performed the Wooldridge autocorrelation test to test for error autocorrelation. The results of this test confirm the presence of autocorrelation for both models. As for heteroscedasticity, the test also indicates its existence (Prob > chi2 = 0.0000).

To correct the two problems of autocorrelation and heteroscedasticity, we used the PCSE (Panel Corrected Standard Error) method proposed by (Beck & Katz, 1995, 1996). This method provides unbiased coefficients especially for the micro-panels (Beck & Katz, 1995). The regression results after correction are presented in the following table:

Table 7. Results of the multivariate analysis

Variables	Expected sign	Model A Coef	Model B Coef
DAR	+/-	-.8231349 0.000***	-.798649 0.000***
HB	-	-.0721614 0.000***	-.0710277 0.000***
LOA	+	.377266 0.000***	.3896747 0.000***
LEV	-	.7369643 0.000***	.8331109 0.000***
LIQ	+	-.4706584 0.000***	-.4584605 0.000***
LLR	+	-.4211437 0.000***	-.2072548 0.115***
ROA	+	5.206396 0.000***	4.484442 0.000***
OWN	-	-.1222346 0.000***	
SIZE	+/-		.0313216 0.000***
GDP	+	-2.301943 0.000***	-1.6633287 0.037***
_cons		.9763301 0.000***	.0048327 0.984***
R-squared		0,5891	0,5655
Wald chi2 **Prob > chi2**		201.02 0.0000***	194.92 0.0000***

(***) significant at the 1% threshold.

Source: Results produced from statistical processing by the STATA 11.2 software.

The estimation results presented in the table above show a coefficient of determination that amounts to 58.91% for model A and 56.55% for model B. In other words, the variables of the model manage to explain a good part of the capital adequacy of Algerian private banks. Moreover, the Wald chi2 test of overall significance of the two models indicates that the models are significant at the 1% level.

The results show a negative and significant relationship at the 1% level between the deposits and the capital adequacy ratio. This means that the higher the share of deposits in the total assets of Algerian banks, the lower the capital adequacy ratio. This can be explained by the fact that Algerian banks use deposits to finance activities that reduce the capital adequacy ratio, for example by increasing lending or investing in risky projects or investments. Such an aggressive growth strategy may also increase the risk of default in adverse economic conditions. If a bank uses deposits to make more risky loans, this may result in an increase in the bank's risk-weighted assets without a commensurate increase in its capital. If the bank experiences large losses, this may reduce its capital adequacy ratio. This result confirms hypothesis H4.

The results also indicate a negative and significant relationship at the 1% level between the off-balance sheet and the capital adequacy ratio. This result leads to confirm the hypothesis H8. It should be noted that the ratio calculated is the total of the commitments given over the total assets. These liabilities represent an additional risk for banks. An increase in the bank's off-balance sheet may increase its risk-weighted assets, which are used as the denominator to calculate the capital adequacy ratio. If the bank does not increase its capital to compensate for this increase in assets, its capital adequacy ratio will decrease, which may make it less able to cope with potential losses. This result shows that banks in Algeria do not increase their capital buffers to face the risks related to the given commitments. However, they do require financial guarantees in order to meet them. The fact of not devoting more capital cushions, the CAR of the banks decreases in front of the increase of the risks related to the increase of the given commitments.

In line with our expectations (H6), loans (measured by their share in total assets) positively and significantly affect the capital adequacy ratio of Algerian banks at the 1% threshold. The increase in loans exposes the bank to higher risks, it can reduce the liquidity of the bank and increase the number of defaulters, therefore, the CAR should increase to cover these risks. The results indicate that the regulatory capital of Algerian banks is in line with the credit risk borne by these banks. This result reinforces the explanations put forward by Mili et al, (2015).

The results revealed that leverage, measured by the ratio of equity to total liabilities, has a positive and significant impact on CAR. This means that the higher the equity to total liabilities ratio, the higher the capital adequacy ratio. This means that banks with low leverage have low capital adequacy ratios and vice versa. This leads to the rejection of hypothesis H5.

Regarding the liquidity variable, the measure taken by the study really expresses the illiquidity of a bank, which means that the higher this ratio is, the less liquidity and, of course, the higher the liquidity risk. The results of the study show a significant negative relationship between the liquidity ratio and the CAR, at the 1% threshold. This leads to the rejection of the H2 hypothesis. The results indicate that when the LIQ ratio is low, the liquidity position is more secure and the CAR can increase. The lower the liquidity position, the higher the possibility of bankruptcy and the higher the risk-weighted assets, leading to a decrease in CAR. These results are consistent with Shimizu (2015).

For loan loss reserves, the results show a significant negative impact at the 1% threshold on CAR. This leads to reject hypothesis H3. The negative relationship can be explained by the fact that a large amount of loss reserves indicates poor loan quality due to the considerable existence of non-performing loans, this will have an effect on lowering the bank's regulatory capital level, which in turn will decrease the capital adequacy ratio. This result is consistent with Toha and Anh, (2017)

As for the profitability of assets, we find a significant positive relationship at the

1% level between ROA and CAR. This leads to confirm the H7 hypothesis. This positive impact of profitability, as measured by the return on assets (ROA), emphasizes the fact that high returns lead to high risks, which are reflected in the adjustment of the CAR. In other words, high profitability is often the result of high risk. Because of this, and because banks are risk averse, they always design investment strategies that would preserve capital and cushion the effects of rising risk levels. Banks are aware that increasing the level of risk would increase their risk of failure, which implies their increase in capital. This result is consistent with that of Büyükşalvarcı and Abdioğlu, (2011) and Abusharba et al, (2013).

The results show that the capital adequacy ratio of public banks is higher than that of private banks. This result confirms the hypothesis H9 . This could be explained by the dominance of public banks on Algerian banking sector in terms of credits and deposits, this position of strength on the market can allow them to maintain high levels of capitalization and meet the regulatory requirements for capital adequacy. This result is consistent with Demirgüç-Kunt and Huizinga (1999). The results also indicate that the size of the bank positively and significantly influences the capital adequacy ratio of Algerian banks. This means that the larger the size of the bank, the higher the value of this ratio.

We find also a significant negative relationship, at the 1% level, between GDP and RAC. This result confirms hypothesis H10 . This is due to the fact that the greater the growth and economic stability, the less the increase in capital due to economic security. Indeed, bank risk is lower in periods of strong economic growth, leading banks to reduce their regulatory capital.

6. Conclusion

The main objective of this paper is to identify the factors impacting the capital adequacy ratio of banks operating in Algeria, during the period from 2010 to 2019 by applying a regression on panel data.

This study provided a brief discussion on the different determinants of banks' capital adequacy. The research on the relationship between these determinants and capital adequacy has provided insight into the nature and meaning of these relationships. In general, the research on these relationships is far from unanimous. Indeed, the empirical results are different, some studies confirm a positive relationship, others show a negative relationship. On the other hand, others find no significant relationship between some determinants and capital adequacy.

The application of a panel data regression using data on some characteristics of Algerian banks and some macroeconomic factors led to significant results. Regarding the relationship with the CAR of Algerian banks, the following independent variables were found to have a negative effect on the capital adequacy ratio of Algerian banks: deposits collected, off-balance sheet, liquidity, loan loss reserves, ownership and economic growth. On the other hand, lending, leverage and return on assets had a positive effect on the CAR. Moreover, the results indicate that the capital adequacy of Algerian public banks is higher than that of private banks.

Important managerial contributions can be drawn from this research, insofar as this study provides managers, shareholders and future investors with levers for action to improve their capital adequacy. This could be done indirectly by focusing on the improvement of the factors mentioned above.

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