

**RISK AND PROFITABILITY IN ALGERIAN BANKS USING  
MACROECONOMIC AND BANK SPECIFIC VARIABLES: A PANEL  
REGRESSION ANALYSIS**

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**ABSTRACT:** This study investigates the relationship between risk management and financial performance in Algeria banks for the period 2010-2019. The study conducted a panel regression analysis, to estimates the variation of the performance measures using OLS, fixed and random effects methods, after that, a Hausman's test was established to determine the appropriate model to estimate. The results show that financial performance in Algerian banks measured using ROA and ROE, have a significant relationship with both bank specific variables and macroeconomic variables: interest rate risk (IRR), funding liquidity ratio (FL), provision to total loans ratio (PTL), GDP, inflation, real exchange rate (USD/DZD) and to real interest rate. Findings also indicate that Algerian banks need to improve loan quality and have sound credit risk management procedures.

**Keywords:** Risk management, financial Performance, Algerian banks, ROA, ROE.

**JEL Classification:** L25 G2

## **1. INTRODUCTION:**

Our world's quotidian is experiencing several fortuitous incidences, from Human-caused episodes (as financial crisis, terrorism, political reversals) to unforeseen natural calamities (as global warming and other disasters) that make the bank's internal and external environment more and more uncertain, as it becomes subject to unbeknown proceedings that threaten its existence and sustainability.

Bank's financial performance can be affected by many factors. Those factors vary depending on the economic context as well as the stability of each bank. The quality of a bank's management directly influences its ability to work efficiently in a competitive environment. The aim of a bank's management is to achieve a profit, as the essential requirement for conducting any business. An important component of a bank's management geared to achieve a successful business result is the risk management. One of the decisive

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factors influencing a bank's profitability is the composition of its risk management philosophy. The structure of banking risks management influences not only the bank itself, but also the reliability of the complete financial system in particular country.

Bank profitability was a fundamental focus of the BASEL guides in the recent years, beside the risk exposure, capital adequacy, credit and operation risk. For this end, in this paper, we will analyze a dynamic financial statement and income statement of the Algerian banks. Afterwards, a panel data methodology is used to test if banking risk have a relationship with bank's profitability, which will help understanding the quality of risk management in Algerian banks. This work investigates, in a single equation framework, the effect of risk management on bank profitability. We utilize data from the Algerian banks over the period of 2010 to 2019.

**Problem statement:** This research aims to study the relationship between risk management and financial performance in Algerian banking system, to this purpose, the fundamental question of the study is: Does the practices of risk management affect the financial performance in Algerian banks?

**Hypotheses statement:** The research's principal hypothesis is that it does exist a positive relationship between risk management practices and financial performance in Algerian banks.

Beside the main hypothesis, the following secondary hypotheses may help as comprehend the nature of the relationship studied:

- ✓ Deposits and loans are key factors in determining bank's profitability in Algerian banks.
- ✓ Some factors are more influential than others, because of the specificity of the banking sector in Algeria.
- ✓ Governance risk, exchange rate risk, credit and liquidity risk are the main risks faced by the Algerian banks.
- ✓ The economic situation in Algeria effects negatively the banking financial performance.

**Research objective:** This paper examines the effects of risk management on financial performance in Algerian banks. These factors that influence banks 'profitability were classified as bank-specific variables. Various sources of empirical and theoretical reviews were adopted to lend support to the relationship between profitability and risk management.

**Research methodology:** The econometric approach of the paper is the panel data analysis: we are planning to estimate the effect of bank-specific variables and macroeconomic variables on the financial performance of 18 Algerian bank, over the period 200-2019, using the three patterns of panel analysis, which are OLS, Fixed and random effect. After the estimation, we will apply a Hausman's test to choose the appropriate method for our sample.

## **2. THEORETICAL BACKGROUND**

### **2.1. Risk in Algerian banks**

The banking world is facing several changes and uncertain events, risk is the uncertainties created from internal or external variations that may result profitability deterioration. The banking activity is characterize with risk, and knew a numerous type of it. However, the risk assessment and management witnessed a significant interest from professionals as from researchers in the few past years, where the risk management evolved from qualitative risk assessment to quantitative risk assessment.

### **2.1.1. Credit risk:**

In Algeria the corporate sector, comprising mostly SOEs, has reduced debt levels and hence leverage in recent years, because of capital injections by the sovereign to finance investment. Repeated government interventions in the banking system have shifted losses from public banks to the government balance sheet. Household debt is largely restricted to mortgages, which are subject to tight prudential norms-loan-to-value ratios are capped at 70 percent and debt-to-income ratios at 40 percent. The ban on consumption credit keeps credit risk contained (IMF, 2014, p. 15).

### **2.1.2. Interest rate risk:**

In Algeria, in case of liquidity shocks, risk is mitigated by banks' recourse to central bank funding facilities. Additionally, since there are no foreign inflows into the financial system, the risks associated with sudden outflows are currently absent (IMF, 2014, p. 17).

### **2.1.3. Foreign exchange risk:**

The banking sector in Algeria is largely insulated from FX risks. Lending in FX is prohibited, while a number of exchange controls require exporters to repatriate all export proceeds, with 50 percent converted into local currency. As a result, FX balance sheet risks are negligible. In addition, banks have a limited international footprint, limiting the impact of direct foreign shocks.

### **2.1.4. Liquidity risk:**

In case of liquidity shocks in the Algerian banking system, risk is mitigated by banks' recourse to central bank funding facilities. Additionally, since there are no foreign inflows into the financial system, the risks associated with sudden outflows are currently absent.

### **2.1.5. Hydrocarbon risk:**

The low degree of trade and financial integration with the world economy insulates Algeria from most external shocks. However, with hydrocarbon exports accounting for virtually all exports, and over two-thirds of direct government revenues originating from that sector, the banking system is highly sensitive to hydrocarbon shocks. By extension, hydrocarbon risk also becomes a concentration risk for the sovereign, given its dependence on oil revenues. During the boom years, easy credit conditions lay the seeds for higher credit risk during downturns.

### **2.1.6. Governance risk:**

The government continues to play conflicting roles with respect to SOBs (State Owned Banks) that weaken the banking sector's role in effectively intermediating credit. In particular, the government is the largest bank owner; it acts as regulator; and it is the main client (through the SOEs). Despite some improvements in the governance of the SOBs, important weaknesses remain. First, SOBs lack independent and seasoned experts on their boards. Second, the government lacks an ownership function to effectively manage the state's assets, e.g., policies and processes for setting performance contracts, tracking key performance indicators, nominating board members and voting shares are poorly defined or absent. Third, most SOBs have rudimentary incentive schemes linked to short-term

indicators. Finally, in all SOBs, the chair of the board is also the Managing Director of the bank, creating potential conflicts of interest between oversight and management functions.

## 2.2. Loan quality in Algerian banks

Algeria's banking system is characterized by an exceptionally strong and persistent presence of the public sector. The public banks direct the country's vast domestic savings to the state-owned enterprises operating in the country's hydrocarbon sector, which produces the country's chief exports. Moreover, although the banks appear to be well capitalized, the loan quality is very low, especially in the portfolios of public banks, requiring constant restructuring. The predominance of state-owned banks leads to a number of issues. Firstly, by providing funding primarily to public enterprises, the present structure restricts the diversification opportunities for the Algerian economy. According to recent figures, the share of loans to the private sector represent only one-fifth of total banking assets.

**Table N°01: Loan quality ratios in the Algerian banks from 2009 to 2012**

<b>Variables</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>
<b>NPLs/Regulatory Capital</b>	33.9	21.1	19.4	16.2
Public Banks	46.0	27.5	25.1	20.4
Private Banks	1.5	3.0	2.3	3.4
<b>NPL Ratio</b>	21.1	18.3	14.5	11.5
Public Banks	23.6	20.5	16.1	12.4
Private Banks	3.8	4.1	4.0	5.2
<b>Net NPL Ratio</b>	7.3	4.9	4.4	3.5
Public Banks	8.3	5.4	4.9	3.8
Private Banks	0.7	1.4	1.0	1.5
<b>Provisioning Rates for NPLs</b>	65.4	73.5	69.9	69.5
Public Banks	65.0	73.7	69.6	69.4
Private Banks	82.0	66.7	75.9	71.7

Source: Algeria financial system stability assessment, international monetary fund, 2014, p 27.

Algeria's banking system is dominated by six public banks, which continue to collect over 90% of the domestic deposits and divert a significant proportion to the mostly inefficient public enterprises concentrated in the hydrocarbon sector. Under current conditions, the Algerian financial sector is not providing the necessary funding for its private sector to successfully diversify its economy.

## 2.3. Performance indicators in Algerian banks

To create a strong financial banking sector in Algeria, the actors of the system have replied to the directions of the central bank regarding the prudential regulation by augmenting their capital. Therefore, during the period (2000- 2013), the Banks's capital amplified by 60%. Although that the solvency ratio recommended by the standards of Basel III for covering the risks is 7%, the Algerian banking system recorded 15.4% in 2012 (CBA, 2019). The Algerian banking system is recognize by an excess liquidity since the granted credits are lower than the banks' deposits, and that the ratio of credits/ deposits never went less than

50% in the last decade. The central bank policy is the reason of what it called idle capital caused by the excess liquidity, this policy was made to control the inflation.

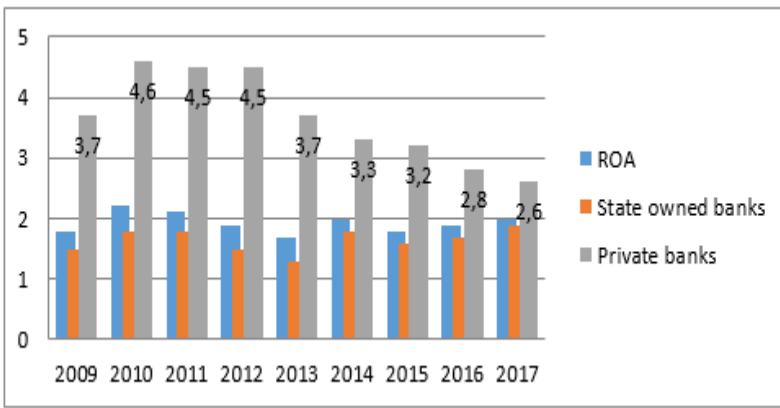
Concerning the financial soundness in the Algerian banking sector, the instructions of the central bank was executed by the banks, in term of prudential regulation of increasing their capital therefore the Algerian banks witnessed capital augmentation of 60% between 2000 and 2013. Referring to the IMF, the Algerian banking system give the impression to be sufficiently capitalized, profitable and liquid, essentially caused by the state assistance (Olson, 2011).

Furthermore, the asset quality in the Algerian banking system is quite high, where the assets are able to cover more than 70% of non-performing loans. The Algerian banking system was able to put an end to the nonperforming loans by the assistance of the state, and record an interest margin that contribute to 70% of the operating income, which increase its profitability comparing to neighbour countries. Aforementioned, the Algerian banks are liquid, back in 2015, the Algerian banks had 48% of their assets liquid, it is a fact that this liquidity is due to oil export operations (Ishaq HACINI, 2018).

Additionally, one of the other reasons of liquidity excess is the banks conservative policy in granting loans, this policy was taken by the Algerian banks to control credit risk, this procedure is justified by the situation explosion in 2007, where nonperforming loans reached 680 billion AD. This necessitated urgent measures to control this phenomenon, which helped to supervise this problem and decreased to 16% in 2011.

The following Figures highlight the development potential in terms of financial inclusion and the development of financial intermediation in Algeria.

**Figure N°1: Return on Assets (ROA) of the Algerian banks (2009-2017)**

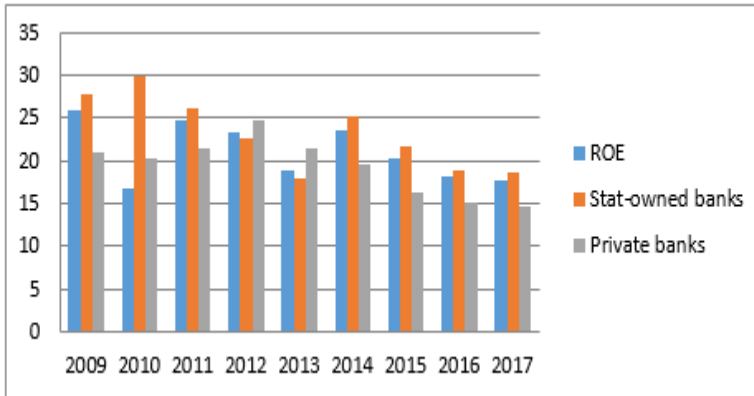


Source: Central bank of Algeria, 2019.

From the previous table it is clear that the profitability of Algerian banks has increased between 2009- 2017, and reach 2% in 2017. After the subprime crisis in 2008, the ROA as an indicator of profitability has gradually improved, this improvement shows that the Algerian banking still have potential to realise higher profits, where the Algerian market didn't reach the maturity stage and the competition didn't reach high levels.

The next figure present the evolution of ROE ratio over 2009-2017

**Figure N°02: Return on Equity (ROE) of the Algerian banks (2009-2017)**



Source: Central bank of Algeria, 2019.

Return On Equity (ROE) is a ratio that measures the profitability of the bank's equity. It is relatively decreasing from 26% in 2009 to 17.8% in 2017 this deterioration is due to results stabilization for the state-owned banks, and due to equity augmentation for the private banks.

It is clear the progress witnessed by the Algerian banking system, in term of regulation, quality of service and profitability. For the regulation and law aspect, different changes have been made to guide the system from the socialist system to market-oriented system, and also to give the needed autonomy for banks to establish their own strategy lines. Consequently, the banks' performance was positively affected by these reforms, and the banks' mission was more active in term of their capacity to collect the deposits and granting more loans to finance the economic development.

Despite of the improvement of the Algerian banking system, banks in Algeria still struggle from many deficiencies that hold back their development. One of these limitations is the dominance of the state-owned banks (06 banks) over the whole banking sector, and 87% of the loans market, which curb the improvement of the service quality (Abed, 2003). Therefore, the Algerian authorities need to encourage the implementation of the regulations and to strengthen the institutions. Furthermore, the state-owned banks can benefit from the experience of the foreign banks, of their management style, new technologies and risk management; also the Algerian banks need to obtain effective risk management tools and financial rules according to the international standards.

### **3. EMPIRICAL ANALYSIS**

The data used in the empirical work was obtained from the financial statements of the Algerian banks. The sample includes a panel of 18 banks operating in Algeria over the period 2010-2019 which represents a panel of 180 observations.

#### **3.1. Dependent variables**

The dependent variables that were chosen for this study are return on assets and return on equity. Where ROA tends to provide an image about how the bank is effectively taking earnings advantage of its base of assets. On the other hand, ROE is a measure of how

a ban is effectively taking advantage of its base of equity or capital. However, the ROA ratio can be risk adjusted for mitigated interest rate risk and for expected credit risk that is mitigated by a loan loss provision. Therefore, bank executives have always preferred the ROA in term of performance measures.

### **3.1.1. Return on assets:**

The ROA is defined as net income divided by total assets. Bank profitability is best measured by ROA because high equity multiplier cannot distort ROA. ROA in actual sense signifies managerial efficiency; in other words, it demonstrates how effective and efficient the management of banks has been as they seek to transform assets into earnings.

### **3.1.2. Return on Equity:**

ROE is the ratio of a bank's net after-tax income divided by its total equity capital. The return on equity (ROE) is considered as one of the profitability performance ratios. It indicates how effectively the management of the enterprise (bank) is able to turn shareholders' funds (i.e. equity) into net profit. It is the rate of return flowing to the bank's shareholders.

## **3.2. Independent variables**

The independent variables of the study are macroeconomic variables and specific variables to the bank.

### **3.2.1. Macroeconomic variables:**

Since all banks in the study are operating within the Algerian economy and under the same regulatory system. In addition, because the period of the study is ten (10) years and considered to be sufficient to detect significant influence of macroeconomic variables. We choose to focus on the following macroeconomic determinants: Inflation, GDP, USD/DZD real exchange rate and real interest rate. Several research studied the effect of macroeconomic variables on the bank's profitability. According to **Demirguc-Kunt and Huizinga (1998) and Bikker and Hu (2002)**: bank profitability variate in the same direction with the economic situation. To mitigate the study, we are planning to use GDP, inflation, real USD/DZD exchange rate and real interest rate as control variables for macroeconomic risk (Bikker, 2002).

### **3.2.2. Bank-specific independent variables:**

The bank specific characteristics assumed to affect the bank's profitability are:

- Size: There is consensus in academic literature that economies of scale and synergies arise up to a certain level of size. Beyond that level, financial organizations become too complex to manage and diseconomies of scale arise. The effect of size could therefore be nonlinear; meaning that profitability is likely to increase up to a certain level by achieving economies of scale and decline from a certain level in which banks become too complex and bureaucratic. Hence, the expected sign of the coefficient of bank size is unpredictable based on academic literature. Size is measured by logarithm of total assets.

- Deposits: Total deposits capture the effect of fund source in banks on profitability. Deposits are believed to be the major and the cheapest source of funding for banks, empirical

evidence provided by Husni Ali Khrawish, who studied the Jordanian commercial banks during the period from 2000 through 2010 prove that customer deposits impact banking performance positively as long as there is a sufficient demand for loans in the market.

- Funding liquidity ratio (FL):  $\text{Loan} / \text{Total assets}$ : Loan to total asset ratio, which is a measure for counterparty exposures of banks. Credit risk is a concept used to explain the default probability of a banking firm's loan portfolio.

- Unanticipated liquidity requirement ratio: Loans/ deposits (LTD): A commonly used statistic for assessing a bank's liquidity is by dividing the banks total loans by its total deposits. If the ratio is too high, it means that banks might not have enough liquidity to cover any unforeseen fund requirements; if the ratio is too low, banks may not be earning as much as they could be.

The performance of commercial banks is believed to be impacted by the amount of liquid assets they hold and the ability to raise funds quickly from other sources at a cheaper cost to finance loans. Some studies support the notion of positive relationship while others argue for negative relationship between banks level of liquidity and profitability.

- Interest rate risk ratio (IRR) :  $\text{Interest income} / \text{Total loans}$ : Interest sensitivity ratio is also included in the panel regression as a measure of sensitivity of bank's re-priceable assets and liabilities to interest rate fluctuation.

- Credit risk ratio (CR):  $\text{Non performing loans} / \text{Total loans}$ , Credit risk coverage ratio (PTL):  $\text{Loss provision} / \text{Total loans}$ , Non-performing loans (NPL):  $\text{NPL} / \text{Total loans}$ : NPL over total loans measures the credit management efficiency by the bank. In addition, Nonperforming loans over total loans as well as loan loss provision over total assets are two of the most independent variables used in similar research because credit creation represents the main activity of commercial banks and NPL give a general overview over the sanity of this activity.

- Equity-ratio :  $\text{Equity} / \text{Total assets}$ : This is defined as total equity over total assets. This is expected to uncover the capital adequacy and capture the general average safety and soundness of the banks. According to Molyneux (1992) banks with high level of equity can reduce their cost of capital and that could impact positively on profitability. There is dissimilarity in findings among researchers concerning the effect of this ratio on profitability (Molyneux P., Determinants of European bank profitability, 1992).

The following table illustrates the different variables used in the study, its description and measurement.

**Table N°02: Variables description, and measurement**

Variables		Aprior i	Description	Measurement
Performance variables	ROA		Return on Bank's total assets	Net income divided by total assets
	ROE		Bank's equity to total assets	Equity divided by total assets
Macroeconomic variables	GDP	(+)/(-)	Economic growth rate is proxy for cyclicity	Selected from the world bank database



	INFLA	(+)/(-)	Domestic rate of inflation	Selected from the world bank database
	USD/DZ D real	(+)/(-)	Real exchange rate USD/DZD	Selected from the world bank database
	T interest real	(+)/(-)	Real interest rate	Selected from the world bank database
<b>Liquidity ratio</b>	FL	(+)	Funding liquidity ratio	Total loans divided to total assets
	LTD	(-)	Unforeseen liquidity requirements	Total loans divided to total deposits
<b>credit risk ratio</b>	NPL	(-)	Non-performing loans	Doubtful loans divided to total loans
	CR	(-)	Credit risk ratio	Non-performing loans divided to total loans
	PTL	(-)	Credit risk coverage ratio	Loss provision divided to total loans
<b>interest rate risk ratio</b>	IRR	(+)	Interest rate risk	Total Interest income divided to total loans
<b>capital adequacy ratio</b>	Equity ratio	(+)	Equity-ratio	Equity divided to total assets
<b>Bank specific variables</b>	Size	(+)/(-)	This stands for total asset of the bank	Natural logarithm of total asset
	Deposits	(+)/(-)	This stands for total deposits of the bank	Natural logarithm of total deposits

Source: Established by the authors

The bank loans are expected to be the main source of income and are expected to have a positive impact on bank performance. Other things constant, the more deposits are transformed into loans, the higher the interest margin and profits. However, if a bank needs to increase risk to have a higher loan-to-asset ratio, then profits may decrease. Predicting the net effects of changes in leverage can be difficult; for example, banks with lower capital ratios are expected to have higher returns in comparison to highly capitalized financial institutions. On the other hand, banks with high capital ratios are less risky and typically perform better during difficult times and lower risk increases creditworthiness and reduces funding costs. Moreover, banks with a higher capital ratio often have a smaller need for external funding which has a positive effect on profitability. Given this, there should be a positive relationship between capital ratio and profitability. The ratio of provisions to total assets show the level of risk that the banks are being exposed to. The relationship between this ratio and financial performance is expected to be negative base on the concept that more risk reduces profitability.

Concerning the macroeconomic variables, several research investigated the effect of economic situation on bank profitability, Demirguc-Kunt and Huizinga illustrated that bank financial performance is sensible to economic changes in the country. Therefore, we expect different influences of the macroeconomic variables study on the financial performance in Algerian banks (Demirgüç-Knut, 1999).

### **3.3. Econometric Specification**

The main goal of this research as defined before is to find the nature of the relationship between performance variables (ROE, ROA) and bank risks variables that is generally determined by bank-specific factors. In this study, a panel analysis will be conducted to check the effect of macroeconomic factors such as inflation, GDP, real USD/DZD exchange rate and real interest rate, beside to bank specific indicators on bank performance in Algeria.

The study has chosen to make use of panel data analysis as statistical instrument to analyze the impact of the risk measures on profitability. Panel data model is a combination of time series and cross-sectional statistical analysis. Three patterns are provide by the panel data analysis and we can select the most appropriate for our study by conducting a Hausman's test.

Panel data analysis is a method of regression analysis that uses more than one explanatory variable to predict values of a single dependent variable. The model with interaction terms represents an alternative way of expressing the unconstrained model; instead of running separate regressions for each group, we run a single regression, with additional variables.

Eviews8.1 software is applied to obtain the regression results. Eviews is among the most widely used programs for statistical analysis in academic research.

To test the impact of different variables on profitability of commercial banks in Algeria, The next mathematical form of the panel regression is estimated:

$$Y_{jt} = C + \alpha X_{jt} + \epsilon_{jt} \text{ ----- (1)}$$

The j refers to an individual financial institution; t refers to year.

$Y_{jt}$  is an independent variable and refers a measure of profitability in a financial institution j in a particular year t.

The C is the intercept.

$X_{jt}$  represents the factors (determinants) of profitability in a financial institution j in a particular year t.

$\alpha$  represents the coefficients.

$\epsilon_{jt}$  represents the standard error term.

In our essay to provide answers for our fundamental problem, we will conduct a panel regression following three patterns: pooled model (OLS) using this model means, we pool all 180 observations together, and run the regression model, neglecting the cross section and time series nature of data. The main problem of OLS model that it does not distinguish between the different nature of banks that we have in our panel data, which deny the heterogeneity and individuality that may exist among 18 banks that we study. The second pattern is the fixed effect model (LSDV) permit to heterogeneity and individuality between the banks by allowing having its own intercept value. However, the term fixed effect is because although the intercept may differ across banks, but it does not vary over time, that it is a time invariant. Finally, the random effect model allows the existence of heterogeneity, individuality among banks and it allows the panel to vary over time. This model is favorited in case of random sampling pattern of the collected data similar to our panel data, some studies recommends the use of fixed effect model in case of specific set of observations, even though, the use of fixed effect model for large observations may lead to loss of degrees of freedom (Baltagi, 1995).

To determine the nature of the relationship among the dependent and independent variables of the study, we need to precise which model is more suitable for our panel data, than identify the appropriate model that would illustrate the best the effect of risk management on financial performance in Algerian banks.

A Hausman test is required to compare the fixed and random effects, after estimating the three models, we shall have to decide which model is suitable to accept, for this end, three stages are required:

- ✓ Hypothesis development and models identification;
- ✓ Estimating the parameters following the three models (OLS, fixed and random effect);
- ✓ Select the most appropriate model to explain the nature of the relationship between the variables of the study.

**4. ESTIMATES FOR PANEL REGRESSION MODEL**

**4.1. Hypotheses Development and Models Identification**

In developing the hypothesis, our main goal is to find whether there exist significant impact between independent variables and the dependent variable, and to assess the significance impact of the independent variables used together on the dependent variable, the null and alternative hypothesis are:

- 1- H0: there exists an insignificant impact of the chosen independent variables on financial performance of Algerian commercial banks.
- 2- H1: there exists a significant impact of the chosen independent variables on financial performance of Algeria commercial banks.

Before we estimates the parameters of the several variables study, we need to identify the models that we aim to analyze and interpret.

- ✓ **Model 1:** The first model aims to explain the variability in ROA. It is presented as follows:

$$ROA_{jt} = C + \alpha_0 FL_{jt} + \alpha_2 CR_{jt} + \alpha_3 Deposits_{jt} + \alpha_4 Equity\text{-}ratio_{jt} + \alpha_5 LTD_{jt} + \alpha_6 NPL_{jt} + \alpha_7 PTL_{jt} + \alpha_8 Size_{jt} + \alpha_9 T\text{-}interest\ real_{jt} + \alpha_{10} USD/DZD\ real_{jt} + \alpha_{11} GDP_{jt} + \alpha Infla_{jt} + \epsilon_{jt} \dots \dots (2)$$

- ✓ **Model 2:** The second model aims to explain the effects of independent variables on ROE:

$$ROE_{jt} = C + \alpha_0 FL_{jt} + \alpha_2 CR_{jt} + \alpha_3 Deposits_{jt} + \alpha_4 Equity\text{-}ratio_{jt} + \alpha_5 LTD_{jt} + \alpha_6 NPL_{jt} + \alpha_7 PTL_{jt} + \alpha_8 Size_{jt} + \alpha_9 T\text{-}interest\ real_{jt} + \alpha_{10} USD/DZD\ real_{jt} + \alpha_{11} GDP_{jt} + \alpha Infla_{jt} + \epsilon_{jt} \dots \dots (3)$$

The subsequent step is to estimate the models parameters using the different procedures enlightened earlier.

**4.2. OLS, Fixed and Random Effects Models Estimations**

The following table illustrates the estimates of parameters for panel regression model:

**Table N°03: Estimates of Parameters for Panel Regression Model**

Independent variables	Regression model					
	Panel OLS		Fixed effect (EGLS)		Random effect (EGLS)	
	Model1	Model 2	Model 1	Model 2	Model 1	Model 2

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<b>C</b>	0.1023 * (4.0597)	-1.5598 * (-3.4389)	0.2771 * (3.6897)	-2.7890** (-2.233)	0.1152 * (3.5310)	-1.469 ** (-2.3235)
<b>FL</b>	0.0312 * (4.8390)	0.2582 ** (2.2538)	0.0242 * (2.6464)	0.0755 (0.4961)	0.0252 * (3.4445)	0.11309 (0.8600)
<b>CR</b>	2255138.* (4.4452)	5173273. (0.57428)	-901735.3 (-1.48044)	-867461.0 (-0.0856)	-163216 (-0.2943)	4235924. (0.4432)
<b>DEPOSITS</b>	-0.0107** (-2.0832)		0.000839 (0.1542)	0.006075 (0.0671)	-0.00314 (-0.6216)	-0.04707 (-0.5432)
<b>EQUITY-RATIO</b>	-0.0084 (-0.7719)	* (-7.50)	-0.018562 (-0.94934)	-0.0077(- 0.02387)	-0.01297 (-0.8853)	-0.40203 (-1.5241)
<b>IRR</b>	0.242171* (6.2567)	1.956816* (2.84719)	0.233803 * (5.6242)	1.2701*** (1.837)	0.2012 * (5.2234)	1.5353** (2.3387)
<b>LTD</b>	-0.00142 (-1.5487)	- 0.044264* (-2.71871)	0.000344 (0.37721)	-0.000498 (-0.0328)	-0.0001 (-0.1833)	-0.00858 (-0.5854)
<b>NPL</b>	-0.00810 (-1.0403)	-0.042778 (-0.30931)	0.009503 (1.27168)	-0.027597 (-0.2221)	0.006470 (0.8992)	-0.05486 (-0.4512)
<b>PTL</b>	-0.09002 *(-3.821)	- 0.8685**(- 2.07631)	- 0.107602*(- 2.79080)	-0.075436 (-0.1176)	- 0.07184**(- 2.446)	-0.6061 (-1.1371)
<b>SIZE</b>	0.01126** (2.2157)	0.339847* (3.76608)	-0.0140** (-2.016)	0.166056 (1.43373)	-0.001280 (-0.2403)	0.149567 (1.6068)
<b>T_interet real</b>	-0.0006* (-3.4032)	-0.0074** (-2.3134)	-0.00047* (-2.80087)	-0.00429 (-1.5330)	-0.000707 * (-4.70)	-0.00354 (-1.3991)
<b>USD/DZD real</b>	-0.0002** (-2.5462)	-0.004674 * (- 2.936802)	-0.000173 *** (-1.95726)	-0.003422 ** (-2.3288)	-0.00030* (-4.06775)	-0.00281 ** (- 2.21924)
<b>GDP</b>	-0.00179 (-1.42819)	-0.051032 ** (- 2.284503)	-0.00285* (-2.70661)	-0.02648 (-1.50932)	-0.00326* (-3.162099)	-0.02690 (- 1.56059)
<b>INFLA</b>	-0.00061 (-0.8646)	-0.02341 *** (-1.868)	-0.00091 (-1.45667)	-0.01516 (-1.44457)	-0.00153* (-2.6230)	-0.01160 (-1.1824)
<b>R-squared</b>	0.430731	0.463040	0.692581	0.745759	0.435600	0.432963
<b>F-statistic</b>			11.18937	14.56862	7.328148	3.361511
<b>Prob(F-statistic)</b>			0.000000	0.000000	0.000000	0.000136
<b>Durbin-Watson stat</b>	0.864459	0.691624	1.034600	1.329351	1.015621	1.152737

Source: Established by the authors using Eviews8.1. The results shown in parentheses are absolute values of the t-statistic, with \*, \*\* and \*\*\* implying rejection of the null hypothesis at the 1%, 5% and 10% levels respectively. The panel Regression results were carried out on E-VIEWS 8.1.

We refer to Table 05 that shows the results of panel regression models, the table illustrates three patterns of estimates:

- ✓ OLS or ordinary least square model ;

- ✓ The fixed effect model;
- ✓ The random effect model.

To ensure that we estimated the right model, a Hausman test is conducted for correlated random effects in the next phase, which help us to interpret and analyze the optimal model.

In the previous table, we presented model 1 and 2 for each types of panel regression estimation. The results show that R squared in the fixed effects model is 69.25% for model 1 and 74.57% for model 2, than the OLS model, where the independent variables explains 43.07% of the variation in model 1 and 46.30% in model 2, finally the random effects model that R squared of model 1 is 43.56% and 43.29%.

Moreover, in term of the variables significance, we notice the following points:

- ✓ The NPL variables does not have a significant impact on ROE or ROA for the three panel regression estimations.
- ✓ The USD/DZD real and IRR have a significant impact on the performance variables for the three panel regression estimations.
- ✓ The FL, PTL, Size and T-Interest real have no significant affects the ROE variable, under the fixed and random effect estimations.
- ✓ The macroeconomic variables GDP and inflation are only significant for model 2 in OLS and random effects model.
- ✓ The equity ratio, CR and deposits have no significant effect over the dependent variables for both fixed and random effect models.

The rejection and acceptance of the null hypothesis was contradictable between model one and two following the different estimations procedures. To provide answers for our main problem, it is require determining the optimal model to survey (fixed or random effect), therefore, we substracted the next test.

#### **4.3. Husman’s Test: Selection of the Appropriate Model**

The following phase is the Hausman test presented in Table 4, at this stage, we will try to test the significance of the modeled parameters in the estimates of the fixed and random effect models to select the optimal model for the study. Where the null hypothesis of this test is that random effect model is appropriate for the study and the hypothesis 1: fixed effect model is appropriate. If the probability is less than 5% than we reject the null hypothesis, otherwise, we accept that the random effect model is appropriate, than we need to conduct the appropriate model using the random effect estimation. The subsequent table elucidates the results of the Hausman test:

**Table N°04: Hausman’s test**

Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
<b>Model 1</b>	Cross-section random	0.000000	13	1.0000
<b>Model 2</b>	Cross-section random	0.000000	13	1.0000

Source: Established by the authors using Eviews8.1.

The findings of Hausman test accepted the null hypothesis, so we should be concentrating our estimation following the random effect model. In addition, the previous table provide results from different procedures for a more comparative analysis.

Furthermore, the model 1 and 2 provided by the Hausman test are characterized with a considerable R squared equal 69.25% and 74.75% consecutively. In addition, prob (f-

statistic) equal 0.0000 shows that the parameters estimated are statistically significant at 0.01 level.

For the liquidity and interest rate ratio variables, we can conclude that the performance variables in the Algerian banks are positively associated with their liquidity position and interest rate levels. For all the models. This finding is coherent with literature review that illustrates a positive relationship between ROA and ROE variables with the FL and IRR ratio in Algerian banks.

Under the random effect model, all the macroeconomic variables shows a negative correlation with the performance variables with a slight difference among them. Where the inflation rate in Algeria remained approximatively high, and GDP levels float from 1% to 3 % during the last ten years. Therefore, the price determination of financing became a difficult mission for banks due to unstable interest rates. In addition to the complicated economic situation in Algeria it exist a huge parallel exchange market that aggravated the exchange rate stability consequently the USD/DZD real would have a negative impact as shown from the regression results. Therefore, we can say that the findings are consistent with the theoretical background of the study.

## **5. CONCLUSION**

The outcomes of the study show that there is a significant difference in model one that studied the variation of return on assets and model two that investigated the fluctuations of return on equity. In this study, we tried to understand the nature of the relationship between our dependent and independent variables using panel regression method. Under this method, we studied our sample using three patterns (OLS, fixed and random effects). To determine the appropriate econometric method, we used the Hausman's test that provide us with the optimal method to use for our sample.

The results of the study reveal that there is a positive and statistically significant relationship between funding liquidity (FL) and ROA ratio of Algerian banks. Due to this relation, financial performance will increase by 2.5% if (FL) ratio variates positively with one percent. The FL ratio illustrates the asset quality, we used total loans to total assets ratio that indicates how loaned up is the bank, so the higher the ratio, the more risky a bank may be to higher defaults. However, the results showed that FL ratio and ROA are positively related. As asset quality increases, ROA increases as well.

A statistically significant negative relationship was found between the provision to total loans ratio (PTL) and return on assets (ROA) ratio at 95% confidence level. We found that PTL has a negative impact on the profitability of Algerian banks. This result suggests that Algerian banks may not use the PTL in the right way it was designed for (PTL is a coverage ratio; to make some reserves for potential credit risk that resulted by credit failure).

The results also show that the interest rate risk (IRR) variable has positive and statistically significant effect on 99% confidence level. This means that an increase IRR ratio (equals total interest income divided to total loans) will increase the ROA ratio by 20.12% and ROE by 1.5353. This result emphasize the need for Algerian banks to adhere to prudential and regulatory guidelines that control interest rate volatility with the use of sound risk management practices in order to obtain higher valuations, achieve better financial performance.

The control variables of the study, which are the macroeconomic variables, had a negative and significant relationship with the Algerian bank's profitability, there was a negative correlation between gross domestic product growth rate (GDP) and (ROA) ratio and

a significant relationship between 99% confidence level. This result shows that a one-unit change in the gross domestic product will reduce the financial performance in Algerian banks by 0.003. The findings also demonstrated a negative and significant relationship between inflation and ROA ratio. If inflation variates with one unit, than the financial performance in Algerian banks would be reduced by 0.001 at 99% confidence level. Also for the real interest rate variables, results present a significant and negative relationship with ROA ratio, at confidence level of 99%. Same for the real exchange rate (USD/DZD) proven to have negative and significant relationship with (ROA) ratio at confidence level of 99%. These results lead us to conclude that the Algerian banking system, characterized with the dominance of SOB over the banking market, gives priority to the macroeconomic stability. Therefore, it is required for the monetary authorities in Algeria to enhance the implementation of the international standards in term of financial guidelines and risk management tools.

We conclude that financial performance of the Algerian banks depends on liquidity risk, interest rate risk, credit risk, GDP, inflation, real exchange rates (USD/DZD) and real interest rate. Overall, these empirical results provide evidence that the profitability of Algerian banks is shaped by bank-specific variables and macroeconomic variables that are not the direct result of a bank's managerial decisions.

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