

The effect of interest rates policy on the performance of Algerian public banks

أثر سياسة أسعار الفائدة على أداء البنوك العمومية الجزائرية

Dr. Souad Guesmi

Associate professor, Faculty of Economics,

University of Saida, Algeria

ITMAM laboratory

souadguesmi98@yahoo.com

Abstract:

This study attempts to examine the performance of public banks being operated in Algeria based on the interest rates policy. For this purpose, an analysis of the financial statement of five major banks over the period (1997-2012) has been done. Meanwhile, the paper uses correlation and regression analysis for a panel data sample in order to evaluate the impact of interest rate changes measured by real interest rate (RIR) over the performance indicators: return on equity (ROE), return on assets (ROA), and net interest margin (NIM). The results show that interest rate policy does not impact the performance of the Algerian public banks. Therefore, the study recommends that the interest rate in the financial market must be market-driven to allow for efficient financial process.

Keywords: public banks, interest rates, performance, panel regression, Algeria.

JEL classification: E43; E52; G21

الملخص:

تهدف الورقة البحثية إلى دراسة أداء البنوك العمومية الجزائرية من منظور سياسة أسعار الفائدة. من أجل ذلك تم إجراء تحليل للوضع المالي للبنوك العمومية الخمس خلال الفترة 1997-2012. فضلا عن ذلك، تم استخدام تحليل ارتباط وانحدار لعينة معطيات بانل بهدف تقدير تأثير تغير أسعار الفائدة - مقاساً بمعدل الفائدة الحقيقي - على مؤشرات الأداء التالية: العائد على حقوق الملكية، العائد على الأصول وصافي هامش الربح. توصلت الدراسة إلى عدم وجود تأثير لسياسة معدل الفائدة على أداء البنوك العمومية. وبناءً عليه توصي الدراسة بضرورة إخضاع معدلات الفائدة لآلية السوق قصد بلوغ الكفاءة المالية.

1. Introduction

Banking system is the vital organ of any economy that facilitates every business. The Algerian banking sector plays an important role in country's economy since it helps in mobilising resources, alleviating poverty and controlling public finance. In Algeria, the law on money and credit (10/90) came to be in the same line as with the new situation of transition to the market economy. This law was issued on April 14,th 1990 in accordance with the new economic and political orientation of the country towards openness on market economy, especially after the difficulties that witnessed Algeria in the late 1980s. At that time there has been the burden of the foreign indebtedness where we find that the American Dollar is at the summit of currencies that the Algerian debt was recorded

by, where it reached in 1989 the proportion of 40% of the total indebtedness, to be followed by the French Franc in the years of 1988-1989 with a proportion of 4.80% and 14.60% respectively. Besides, the country faced many social problems and it turned for the first time to a multiparty political system.

The financial and banking system knew many changes and developments. The issuance of credit and Loan law (10/90) was a real breakthrough for the financial liberalization policies in Algeria which included all the ideas that came in the law of 1986 and 1988 in addition to the new ideas in the performance of banks such as the liberalization of interest rates and the banks from the restrictions imposed on them. The objective of this paper is to review the effectiveness of bank interest rate policy and its effect on the performance of the Algerian public banks.

The Algerian banking sector has had four crucial development periods. The first one was before independence, i.e., before 1962. In that period, Algerian financial market was under the control of French colonial banks. The second period lasted from 1962 until 1968. At that time, new-state-owned banks were established namely: BNA, BEA, and CPA. The third period was between 1968 and 1990. At that period, all foreign banks have been nationalized and replaced by state-owned banks, where BDL and BADR were set up by the government in the 1980s. The final period, from 1990 onwards, took place after the Algerian authorities have initiated financial liberalization process.

In 1990, the law on money and credit (10/90) was the first step to be taken by Algerian government to remove many barriers towards domestic and foreign banks. Therefore, the law led to various changes in the structure of Algerian banking sector, where it enabled both private and foreign banks to operate in parallel with state-owned banks. It also allowed state owned banks to select their borrowers and finance a variety of industries. Moreover, other programs were adopted in order to achieve financial liberalization, such as the gradual interest rate liberalization, reduction of credit control, improvement of reserve requirement, and capital account liberalization. Therefore, from these important reforms, the importance of this study is derived. The research project analyses the effect of interest rates policy on the performance of the Algerian public banks.

2. Literature review

2.1. Interest rate background

Fisher (1930) considered interest rate as the price of money and the link between income and capital. Interest rate is the price a borrower pays for the use of money he/she borrows from a lender (financial institutions) or fee paid on borrowed assets. Interest can be thought of as "rent of money". Interest rate is fundamental in a capitalistic society and is normally expressed as a percentage rate over the period of one year (Sayedi, 2013). Annual interest rate is the rate over a period of one year. Other interest rates apply over different periods, such as a month or a day, but they are usually annualised.

In a loan structure whatsoever, the interest rate is the difference (in percentage) between money paid back and money got earlier, keeping into account the amount of time that elapsed. If you are given \$100 and you give back \$120 after a year, the interest rate you paid is 20% a year. Nominal interest rate is laid down in contracts between involved parties whereas real interest rates somehow adjust the nominal ones to keep inflation into account. For instance, if inflation is 15%, in

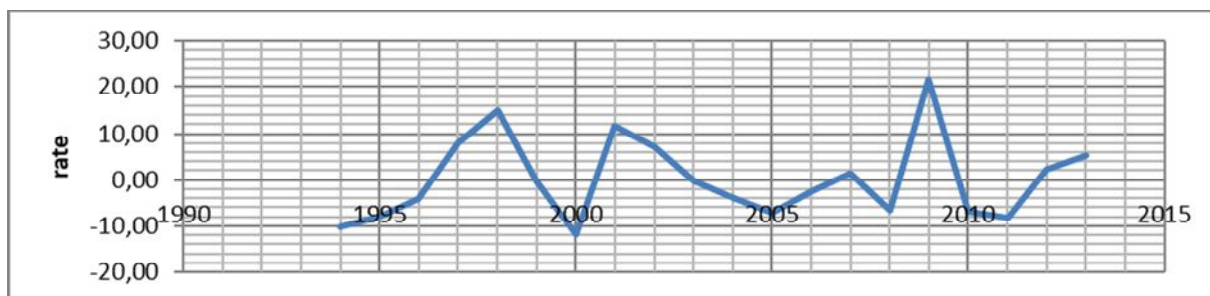
the previous example the real interest rate can be said to be $20\% - 15\% = 5\%$, in a simplified way of computation.

Interest rate as a price of money reflects market information regarding expected change in the purchasing power of money or future inflation. Interest rates are derived from macroeconomic factors which are related to the study of the behaviour of the economy as a whole such as total output, income, employment levels and the interrelationship among diverse economic sectors (Karl et al., 2009).

2.2. Interest rate policies of the Algerian banks

The Algerian monetary authorities began in 1990 the liberalization of the interest rates in a gradual process, and the aim was to stimulate the savings and to mobilize the greatest possible financial savings and get a real positive interest rates. The liberalization of interest rates with the decline in inflation starting in 1995* thanks to the most stringent demand management policies has led to the emergence of positive real interest rates.

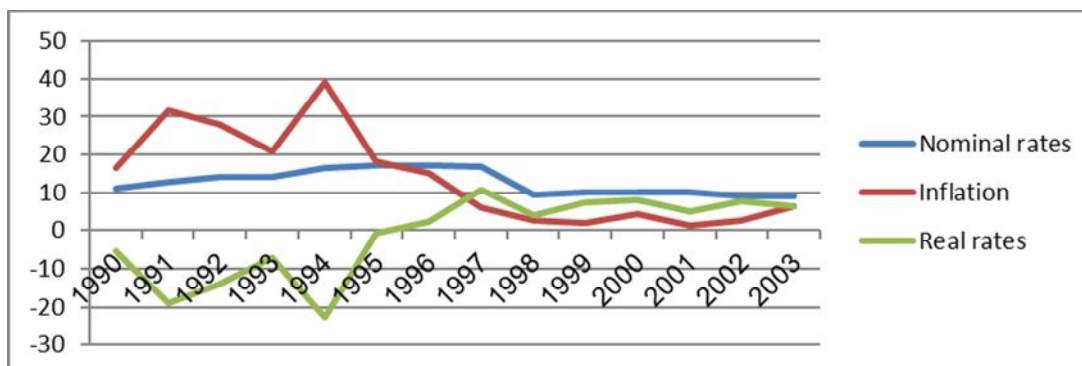
Figure 1: Real interest rates in Algeria (1994-2013)



Source : www.data.worldbank.org

For the debtor interest rates, they did not become positive till the year 1996, and this is due to the high inflation rates that Algeria knew in the phase between 1990 and 1996 as shows the following figure:

Figure 2: The evolution of the creditor interest rates in Algeria (1990-2003)

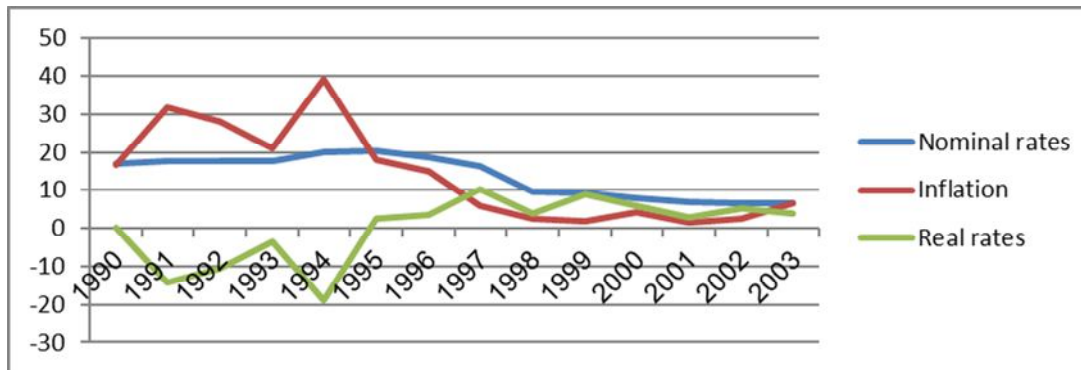


Source: Benbouziane and Gharbi, 2009.

* One of the goals of the installation program 1994-1995 is to achieve financial stability by reducing the inflation rate to less than 10%. The program also focused on the liberalization of debtor interest rates, with rise creditor interest rates and thus achieve real interest rates.

For the creditor interest rates, they became positive in 1995 as it is shown in the following figure:

Figure 3: The evolution of the debtor interest rates in Algeria (1990-2003)



Source: Benbouziane and Gharbi, 2009.

3. Empirical evidence

Demirgü-Kunt and Huizinga (1999) attempted to study bank profits and macroeconomic indicators such as interest rates. They found that high interest rates are associated with higher profit margins especially in the developing countries. In their study, Claessens et al. (2017) used a sample of 3,385 banks from 47 countries from 2005 to 2003. The results showed that a one percentage point interest rate drop implies an eight basis points lower net interest margin, with this effect greater (20 basis points) at low rates. Low rates also adversely affect bank profitability, but with more variation. For each additional year of “low for long”, margins and profitability fall by another 9 and 6 basis point respectively.

Murty et al. (2018) used regression analysis to investigate the impact of interest rate changes on profitability of the banking industry in India. The study covers a period of 30 years. The results showed that the interest rate has significant effects on the profitability in the commercial banks.

Enjioko (2012) examined the performance of Nigerian banks and macroeconomic performance based on the interest rate policies. By analysing published audited accounts of twenty out of twenty-five banks that emerged from the consolidation exercise and data from the central banks of Nigeria. He concluded that the interest rate policies have not significantly improved the overall banks' performance and also have marginally contributed to the growth of the economy for sustainable development. Obidike et al. (2015) investigated the impact of interest rate spread on the performance of Nigerian banking industry for the period 1986-2012. The study used OLS method of estimation to analyze the data generated from CBN statistical bulletin and World Bank online data base. They found that interest rate spread, negatively and significantly impact on bank performance in the long-run. Exchange rate and GDP was found to be positively and significantly affecting bank performance in Nigeria at the long-run.

Irungu (2013) used regression analysis to analyse the data and find out whether there exists a relationship between interest rate spread and the performance of commercial banks in Kenya. The study found that there is a strong positive relationship between financial performance of

commercial banks and interest rate spread. For the same country, Ngure (2014) studied the effect of interest rates on financial performance of commercial banks. The study used descriptive research design using secondary data obtained from central bank of Kenya for the period of five years from 2009 to 2013. Data obtained were analyzed using SPSS version 21 and the results obtained were tested for significance using ANOVA. The study found that interest rates have a significant positive effect on the financial performance of commercial banks in Kenya at 95% confidence level. The relationship between interest rates and financial performance was also found to be linear with the increase in interest rates leading to higher profitability. Mugabi (2017) studied the effect of interest rates on commercial bank profitability and performance in Kenya. Using a statistical method and testing techniques like correlation and regression analysis. He found that interest rates have a positive correlation with bank performance in Kenya. Basically all other factors remaining constant, the higher the interest rates, the better the financial performance of commercial banks. Duacan et al. (2018) examined the effect of interest rate capping on the financial performance of commercial banks in Kenya. Multiple Linear regression analysis and paired sample T-test was used in the analysis. Interest rate capping was found to have a statistically significant negative effect on the performance of commercial banks.

Sattar (2014) studied interest rates changes and its impact on the profitability of commercial banks being operated in Pakistan by examining the financial statements of four major banks during 2008 and 2012. Using Pearson correlation method, he found that there is a strong and positive correlation between interest rate and commercial banks profitability. It means if the value of interest rate increases/decreases, this will result in an increase/decrease value of banks profitability. Afzal et al. (2018) evaluated the impact of interest rate fluctuations on the profitability of Pakistani banks using correlation and regression analysis whose findings indicate that deposits with other banks and interest rate are negatively affecting the profitability of banks, while advances and loans and investment are having positive influence over profitability of banks.

4. Research methodology

In order to investigate the association between market interest rates and public banks' performance in Algeria, a quantitative approach is used. The data (bank level and general data) for this analysis are drawn from secondary sources: bank level data were collected from bank balance sheets and income statements of five public banks during the period 1997-2012 as available from bank scope prepared by *VANDIJK* (Paris). General economic data were collected from International Monetary Funds, International Financial Statistics and data files, the World Bank, World Development Indicators (WDI) databases.

This study uses data on public commercial banks operating in the Algerian banking sector during the period 1997–2012. It employs a balanced panel of five banks, which gives us a total of eighty bank-year observations. Panel data approach (known also as longitudinal data) is used given to its advantages over either cross-section or time series data (Green, 2009 and Wooldridge, 2002). Firstly, by combining time series and cross-section observations, panel data approach offers more informative data with more variability (Gastineau et al., 1999). Furthermore, it provides an increased number of data points and hence generates additional degrees of freedom and more efficiency (Baltagi, 2001). Secondary, by incorporating information relating to both cross-section and time series variables, it can substantially reduce the problems that arise from omitted variables

(Wooldridge, 2002). Panel data models are usually estimated using either fixed effects or random effects method. In order to identify which of these models is the most appropriate, Hausman specification test is conducted.

The relationship between interest rate policies and bank performance is examined applying a basic model using banks' performance as dependent variable. Besides, this model includes independent variables which are namely bank specific variables, macroeconomic variables, and interest rate.

This relationship is defined by the following equation:

$$BP_{it} = \alpha_0 + \beta_1 BS_{it} + \beta_2 M_{it} + \beta_3 RIR_{it} + \varepsilon_{it} \dots\dots\dots(1)$$

The explanation of the above variables is as follows:

- BP_{it} : bank performance indicators,
- BS_{it} : bank specific variables,
- M_{it} : macroeconomic variables,
- RIR_{it} : real interest rate,
- i : bank,
- t : year,
- ε_{it} : error term,
- α_0 is intercept coefficient, and β is the regression coefficient.

In order to investigate the effect of interest rate policy on the performance of public Algerian banks, dependent and independent variables are included:

A. The dependent Variables

The dependent variable in this study is mainly profitability. Theoretically and empirically speaking, researchers have employed different measures of profitability to determine the factors affecting banks' performance. The main measures of profitability employed are: return on assets (Scott et al., 2011; Oladele et al., 2012; Babalola, 2012), return on equity (Saona, 2011), return on assets and return on equity (Akhtar et al., 2011; Macit, 2012; Sharma et al., 2012; Riaz, 2013), return on assets, return on equity and return on deposits (Jahan, 2012), return on assets and net interest margins (Demirguc-Kunt & Huizinga, 1999; Naceur et al., 2008), return on assets, return on equity and net interest margins (Fadzlan et al., 2009; Naceur et al., 2011); return on assets, return on equity, profit margin (BTP/TA) and net interest margins (Hassan et al. Bashir, 2005).

For this study, bank profitability is proxied by return on assets (ROA) which measures the profit earned on assets and reflects how well bank management uses the bank's real investment resources. The second measure return on equity (ROE) reflects the return earned on the funds invested in the bank by its stockholders. On the other hand, ROE reflects how effectively a bank management is using shareholders' funds (Jahan, 2012). The third one is net interest margin (NIM) which focuses on the profit earned on lending, investing and funding activities.

B. The Independent Variables

Prior literature on bank profitability explains profitability through internal and external variables. Short (1979) and Bourke (1989) provide the first studies on bank profitability. Internal or bank-specific factors are under the control of bank management. External variables trace the effect of the macroeconomic environment on bank performance.

There are common factors influencing profitability identified by several researchers. These determinants, which will be taken in consideration in our study, are divided into three main sub-categories: bank-specific (internal variables), macroeconomic determinants (external variables), and financial liberalization measures.

B-1 Bank Specific Independent Variables

- **Capital Adequacy (CA):** The ratio of equity to total assets is considered as one of the basic ratios for capital strength. It is expected that the higher this ratio, the lower the need for external funding and the higher the profitability of the bank.
- **Credit Risk (CR):** Credit risk is broadly defined as the risk of financial loss arising from borrowers' failure to honour their contractual obligation for banks; credit risk arises basically from lending activities. A proxy for credit risk that will be used is the proportion of provisions for loans losses over total loans. In fact, theory suggests that increased exposure to credit risk is normally associated with decreased firm profitability. Hence, we expect a negative relationship between profitability and loan loss provision ratio.
- **Bank Liquidity (BL):** Liquidity implies how a bank can quickly convert its assets into cash at face value to satisfy its maturing liabilities (those of positions and borrowers) as they fall due even under adverse conditions. The ratio of net loans to total assets is used in this study as a measure of liquidity.
- **Bank Size (BS):** In most finance literature, total assets of the banks are used as a proxy for bank size. This later is represented by natural logarithm of total assets. The effect of bank size on profitability is generally expected to be positive.

B-2 Macroeconomic independent Variables:

- **GDP Growth:** Gross domestic production is the total market value of all final goods and services produced in a country in a given year where $GDP_{t2} \text{ growth} = (GDP_{t2} - GDP_{t1})/GDP_{t1}$.
- **Inflation rate (INF):** This measures the overall percentage increase in consumer price index (CPI) for all goods and services. Inflation affects the real value of costs and revenues; it is measured by annual country inflation rate.

Besides, we use three governance indicators developed by Kaufmann et al. (2006) to proxy institutional differences which are namely:

- **Rule of law (RL):** Rule of Law captures perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. This estimate gives the country's score on the aggregate indicator in units of a standard normal distribution, i.e. ranging from approximately -2.5 to +2.5.
- **Political Stability and Absence of Violence/Terrorism (PS):** Political Stability and Absence of Violence/Terrorism captures perceptions of the likelihood that the government will be destabilized

or overthrown by unconstitutional or violent means, including politically-motivated violence and terrorism. This estimate gives the country's score on the aggregate indicator in units of a standard normal distribution, i.e. ranging from approximately -2.5 to +2.5.

B-3 The Cost of Capital (RIR):

The cost of capital is approximated by the real interest rate. In particular, a move from negative to positive real interest rates is indicative of progress in financial sector reform.

C. Models in detail

In order to test the model (1), three selections will be tested in detail:

-selection one, two and three ($S1$, $S2$ and $S3$) will test the null hypothesis that there is no impact of real interest rate on the performance of Algerian public banks:

$$S1: ROA_{it} = \alpha_0 + \beta_1 BS_{it} + \beta_2 M_{it} + \beta_3 Rir_{it} + \varepsilon_{it} \dots \dots \dots (2)$$

$$S2: ROE_{it} = \alpha_0 + \beta_1 BS_{it} + \beta_2 M_{it} + \beta_3 Rir_{it} + \varepsilon_{it} \dots \dots \dots (3)$$

$$S3: NIM_{it} = \alpha_0 + \beta_1 BS_{it} + \beta_2 M_{it} + \beta_3 Rir_{it} + \varepsilon_{it} \dots \dots \dots (4)$$

5. Results and discussion

Using the econometric methods outlined earlier, this section is devoted for analysing the empirical results of the panel data study. The analysis is basically aimed at investigating the impact of financial liberalization on the performance of Algerian public banks.

Before conducting a panel data study, it is recommended to check first for unit root tests in order to ascertain the stationarity of data series. In fact, a variety of procedures for the analysis of unit root in a panel context have been developed. Here we use both ADF (Dickey and Fuller, 1981) and PP (Philips and Person, 1988). The results of ADF and PP tests are shown in table 1.

Table 1: Results of panel unit root tests (significant at 5%)

Variable	Order	ADF		PP	
		Level	First difference	Level	First difference
BL	I (1)	12.1485	31.8677	6.47428	31.7193
BS	I (1)	0.63828	33.6490	0.56788	33.5965
CA	I (1)	6.92096	32.3548	7.74530	51.3820
CR	I (0)	29.9534	62.3584	28.7244	80.0342
GDP	I (0)	33.6156	94.7462	34.5609	95.6794
INF	I (1)	13.7232	30.4314	13.7232	52.2837
NIM	I (1)	12.8975	58.6596	12.7702	66.3152
PS	I (1)	7.81041	35.5246	6.55442	37.8751
RL	I (1)	4.83035	68.3702	114.487	92.1034

ROE	I (1)	8.84504	26.2943	33.1010	26.2943
ROA	I (1)	16.4217	79.4277	17.3421	93.9015
RIR	I (1)	7.44924	59.6201	78.0016	135.223

Source: Author's own calculation using E-views 8.0

Based on the Table 1, both ADF and PP tests suggest that all variables representing the five public banks are not stationary at level, except GDP growth and credit risk variables. Accordingly, first differences of the series are required for BL, BS, CA, INF, RL, PS, RIR, NIM, ROA, and ROE variables. It is concluded that these variables are stationary at first differences, thus “spurious regression” problem would not be encountered in any model formed in this study.

Besides, co-integration test is now possible since variables are stationary at the same level I (1), except those of GDP.

Results of the three selections

Table 2: Results of Kao's Residual Co-integration Test for S1, S2, and S3

ADF selections	S1	S2	S3
t-Statistics	-0.743263	0.078117	-3.683985
Prob.	0.2287	0.4689	0.0001

Source: Author's own calculation using E-views 8.0

Kao residual co-integration test results are given in Table 2. Accordingly, P value equals 0.2287, 0.4689, and 0.0001 for S1, S2, and S3 respectively. Only P value for S3 is less than 5%, so the null hypothesis is rejected, and we accept the alternative one, meaning that the variables for S3 are co-integrated; therefore, they have long-run relationship. Rather, the P values for S1 and S2 are more than 5%, so the null hypothesis is accepted, meaning that the variables for each selection (S1, S2) are not co-integrated; therefore, they don't have a long-run relationship.

Hausman specification test for S1

The results of the Hausman specification test for the S1 is given in the following table:

Table 3: Hausman specification results test for S1

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	4	1.0000

Source: Author's own calculation using E-views 8.0

According to table 3, P value equals 1.0000 which is more than 5% that means we could not reject the null hypothesis, but rather we accept it. That means random effect model is appropriate.

Results of VAR, Wald and Granger causality test for S1

The Hausman test result for S1 indicates that we should use random effect model to estimate panel data VAR of ROA and RIR for the five banks as a group. In addition, we implement the Wald and Granger causality tests. The results of these three tests are given in the table below:

Table 4: Granger causality test for S1

Vector Auto Regression							Wald test	Causality direction
Dep. Var.	Constant	ROA(-1)	ROA(-2)	RIR(-1)	RIR(-2)	R2 F-stat	H0: P>5%	H0: P>5%
ROA	0.001884 [2.49142]	0.438316 [4.09010]	0.351361 [3.06495]	1.97E-05 [0.32842]	-4.79E-05 [-0.78194]	0.51 17.2	0.40229 (0.6704)	0.39941 (0.6724)
RIR	0.944810 [0.77630]	326.0906 [1.89034]	-449.0153 [-2.43325]	-0.284438 [-2.93871]	-0.360841 [-3.65717]	0.23 5.07	-----	3.16190 (0.0489)*

Source: Author's own calculation using E-views 8.0

1. Inside [] is t-statistic
2. The p-value is in the parenthesis ().
- 3.*denotes rejection of null hypothesis at the 5% level of significance.
4. In Wald test, the null hypothesis is $c(4) = c(5) = 0$.

According to table 4, Wald test indicates that joint causality does run from RIR to ROA, as the test accepts the null hypothesis that there is no causality at 5% significance level, meaning that $c(4)$: RIR(-1) and $c(5)$: RIR(-2) are equal to zero which means that RIR (-1) and RIR (-2) jointly do not cause ROA.

These results are also confirmed from VAR test where t-statistic is less than 1.99, which means that RIR (-1) and RIR (-2) separately are not associated with ROA. The results indicate that only ROA (-1) and ROA (-2), given to t-statistic, are positively associated with the dependent variable ROA. Moreover, the model is significant given to F-statistic value (17.2). R^2 value equals to 0.51 which denotes that the independent variables explain 51% of the variation in the dependent variable (ROA).

On the other hand, causality Granger test, according to P values, indicates that RIR does not cause ROA; whereas, ROA causes RIR.

Hausman specification test for S2

The results of the Hausman specification test for the S2 is given in the following table:

Table 5: Hausman specification results test for S2

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	4	1.0000

Source: Author's own calculation using E-views 8.0

According to table 5, P value equals 1.0000 which is more than 5%. That means we could not reject the null hypothesis, but accept it. In this case, random effect model is appropriate.

Results of VAR, Wald and Granger causality test for S2

The Hausman test result for S2 indicates that we should use random effect model to estimate panel data VAR of ROE and RIR for the five banks as a group. Besides, we implement the Wald Granger causality tests. The results of these three tests are given in the following table:

Table 6: Granger causality test for S2

Vector Auto Regression							Wald test	Causality direction
Dep. Var.	Constant	ROE(-1)	ROE(-2)	RIR(-1)	RIR(-2)	R ² F-stat	H0: P>5%	H0: P>5%
ROE	0.043344 [2.57868]	0.236101 [3.58055]	0.318385 [4.89869]	0.001073 [0.72077]	0.000271 [0.17793]	0.45 13.4	0.25683 (0.7743)	0.26266 (0.7698)
RIR	0.319214 [0.28316]	6.820931 [1.54236]	-4.033160 [-0.92526]	-0.285751 [-2.86144]	-0.371535 [-3.63948]	0.23 5.09	-----	1.31409 (0.2758)

Source: Author's own calculation using E-views 8.0

1. Inside [] is t-statistic
2. The p-value is in the parenthesis ().
- 3.*denotes rejection of null hypothesis at the 5% level of significance.
4. In Wald test, the null hypothesis is $c(4) = c(5) = 0$.

According to table 6, Wald test indicates that joint causality does run from RIR to ROE, as the test accepts the null hypothesis that there is no causality at 5% significance level, meaning that $c(4)$: RIR(-1) and $c(5)$: RIR(-2) are equal to zero, which means that RIR (-1) and RIR (-2) jointly do not cause ROE.

These results also confirmed from VAR test where t-statistic is less than 1.99, which means that RIR (-1) and RIR (-2) separately are not associated with ROE. The results indicate that only ROE (-1) and ROE (-2), given to t-statistic, are positively associated with the dependent variable ROE. Moreover, the model is significant given to F-statistic value (13.4). R² value equals to 0.45 which denotes that the independent variables explain 45% of the variation in the dependent variable ROE. On the other hand, causality Granger test, according to P values indicate that RIR does not cause ROE, as well as ROE does not cause RIR.

Hausman specification test for S3

The results of the Hausman specification test for the S3 is given in table 7.

Table 7: Hausman specification results test for S3

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	0.000000	4	1.0000

Source: Author's own calculation using E-views 8.0

According to table 7, P value equals 1.0000 which is more than 5%. That means we could not reject the null hypothesis, so we accept it, meaning that random effect model is appropriate.

Results of VAR, Wald and Granger causality test for S3

The Hausman test result for S3 indicates that we should use random effects model to estimate panel data VAR of NIM and RIR for five banks as a group. Besides, we implement the Wald Granger causality tests. The results of these three tests are given in this table:

Table 8: Granger causality test for S3

Vector Auto Regression							Wald test	Causality direction
Dep. Var.	constant	NIM(-1)	NIM(-2)	RIR(-1)	RIR(-2)	R ² F-stat	H0: P>5%	H0: P>5%
NIM	0.830294 [3.00404]	0.641722 [5.50414]	0.059775 [0.57936]	-0.004251 [-0.35426]	-0.004857 [-0.39929]	0.51 17.2	0.129612 (0.8787)	0.12611 (0.8817)
RIR	2.274765 [0.98502]	0.786776 [0.80766]	-1.34008 [-1.55444]	-0.258294 [-2.57602]	-0.369944 [-3.63993]	0.23 5.07	-----	1.27400 (0.2866)

Source: Author's own calculation using E-views 8.0

1. Inside [] is t-statistic
1. The p-value is in the parenthesis ().
- 3.*denotes rejection of hull hypothesis at the 5% level of significance.
4. In Wald test, the null hypothesis is $c(4) = c(5) = 0$.

According to table 8, Wald test indicates that joint causality does run from RIR to NIM, as the test accepts the null hypothesis that there is no causality at 5% significance level, meaning that $c(4)$: RIR(-1) and $c(5)$: RIR(-2) are equal to zero, which means that RIR (-1) and RIR (-2) jointly do not cause NIM.

These results are also confirmed from VAR test, where t-statistic is less than t-statistic table (1.99) which means that RIR (-1) and RIR (-2) separately are not associated with NIM. The results indicate that only NIM (-1), given to t-statistics, is positively associated with the dependent variable NIM. Besides, the model is significant given to F-statistic value (17.2). R² value equals to 0.51, which denotes that the independent variables explain 51% of the variation in the dependent variable NIM.

On the other hand, causality Granger test, according to P values indicate that RIR does not cause NIM as well as NIM does not cause RIR.

Conclusion

This study is motivated by the recent financial developments in the Algerian banking system since the initiation of financial liberalization in early 1990s. In light of these structural reforms, the importance of this study is derived. Thus, the main research problematic was to investigate the impact of interest rate policy on the performance of Algerian public banks.

The empirical findings From S1, S2, and S3 (ROA_{it} ROE_{it} NIM_{it}) showed that there is no relationship between real interest rate (RIR) and performance measures which means that interest rates don't affect the performance of the Algerian public banks. The interest rates policies which

are applied by the Algerian government are not effective due to the higher restrictions on the interest rate's determinants where there are no changes over real interest rates values. This result supports the findings on the Algerian case done by Jbili et al. (1997), also the findings on the Nigerian case done by Enyioko (2012). However, according to theorists of financial liberalisation, the removal of government controls on interest rates would lead to greater competition and improve the performance of the financial institutions. For instance, Mckinnon and Shaw (1993) argued that financial liberalization does enable developing countries to stimulate domestic savings and economic growth. Besides, Demirgü-Kunt and Huizinga (1999) found that high interest rates are associated with higher profit margins, especially in the developing countries. The study recommends that the interest rate in the financial market must be market-driven to allow for efficient financial process.

References

- Afzal, A., Raja, R., Imran, and Saima, S. (2018). Interest rate and financial performance of banks in Pakistan. *International Journal of Applied Economics, Finance and Accounting*, 2 (1), 1-7.
- Akhtar, A., Ahmed, H. Z. (2011). Bank specific and macroeconomic indicators of profitability: Empirical evidence from the commercial banks of Pakistan. *International Journal of Business and Social Science*, 2(6), 235-242.
- Babalola, Y. A. (2012). The determinants of bank's profitability in Nigeria. *Journal of Money, Investment and Banking*, 2(4), 6-16.
- Baltagi, B. H. (2001). *Economic analysis of panel data*. London: John Wiley and Sons LTD.
- Benbouziane, M., Gharbi, N. (2009). The effect of interest rate liberalization on savings: a standard study of the situation of Algeria. Paper presented to the International Forum on the current financial crisis and financial and banking alternatives, University of Khamis Meliana. Algeria.
- Bourke, P. (1989). Concentration and other determinants of bank profitability in Europe, North America and Australia. *Journal of Banking and Finance*. 13 (2), 65-79.
- Claessens, S., Nicholas, C., and Michael D. (2017). "Low-For-Long" Interest Rates and Banks' Interest Margins and Profitability: Cross-Country Evidence. *International Finance Discussion Papers*, 1197.
- Demirguc-kunt, A.. and Huizinga, H. (1999). Determinants of Commercial Bank Interest Margins and Profitability: Some International Evidence. *The World Bank Economic Review*, 13(2): 379-408.
- Duncan, T, K., Jared, M. A., Zablon, E. (2018). Effect of Interest Rate Capping on the Financial Performance of Commercial Banks in Kenya. *International Journal of Business Management and Economic Research* (IJBMER), Vol 9(1).
- Enyioko, N. (2012), Impact of Interest Rate policy and performance of deposit money banks in Nigeria, *Global Journal of Management and Business Research*, 12 (21).
- Fadzlan, S., and Habibullah, M. (2012). Globalizations and bank performance in China. *Research in International Business and Finance*, 26(1), 221- 239.
- Fisher, I.1930. *The Theory of Interest*. New York: Macmillan.

- Gastineau, C.L., Kritzman, M. P. (1999). *Dictionary of financial risk management*. (1st ed). Geneva: Swiss Bank Corporation.
- Green, W. (2009). *Econometric analysis*. New Jersey: Englewood Chiff, INC.
- Hassan, M. K., Bashir, A. (2003). *Determinants of banking profitability*. Paper presented of the proceeding of the economic research forum 10th annual conference, Morocco.
- Irungu, P. N. (2013). The effect of interest rate spread on financial performance of commercial banks in Kenya. A master thesis of science in finance, university of Nairobi.
- Jahan, N. (2012). Determinants of Bank's Profitability: Evidence from Bangladesh. *Indian Journal of Finance*, 6(2), 32 – 38.
- Jbili A., Aneders, K., and Treichel, V. (1997). Financial sector reform in Algeria, Morocco and Tunisia: A performing assessment working paper N° 97/81, Washington, DC: International monetary fund, Middle Eastern dept.
- Karl, E., Ray, C., and Shannon, M. (2009). *Principles of economics*. New York: Pearson International Editionl.
- Kaufman D., Mehrez, G. (2000). Transparency , liberalization and banking crises. World Bank Policy Research Working Paper N° 2286.
- Macit, F. (2011). Bank specific and macroeconomic determinants of profitability: Evidence from Participation Banks in Turkey. *Economics Bulletin*, 32 (1).
- Mckinnon, R. I. (1973). *Money and Capital in Economic Development*. Washington, D. C.: Brookings Institution.
- Mugabi, S. P. (2017). Interest rate and commercial bank profitability in Kenya. A master of science in finance, University of Nairobi.
- Murty. A., Roshma, C. (2018). Effectiveness of Interest Rates Changes on Profitability of Banking Industry in India: An Empirical Research on the Profitability Performance of Nationalized Banks in India, *IOSR Journal of Business and Management*. 20 (2).
- Naceur, B. S. (2003). The determinants of the Tunisian banking industry profitability: panel evidence. Université Libre de Tunis Working Paper.
- Ngur, I. M. (2014). The effect of interest rates of financial performance of commercial banks in Kenya. A master of science in finance, University of Nairobi.
- Obidike, C., Ejeh, C.; Ugwuegbe. S. (2015) The Impact of Interest Rate Spread on the Performance of Nigerian Banking Industry. *Journal of Economics and Sustainable Development*. 6 (12).
- Oladele, O., Sulaimon, A., Akeke, N. I. (2012). Determinants of Bank Performance in Nigeria. *International Journal of Business and Management Tomorrow*, 2(2), 1-4.
- Riaz, S. (2013). Profitability determinants of commercial banks in Pakistan. Proceedings of 6th International Business and Social Sciences Research Conference, 3-4 January, Dubai. [<http://www.wbiconpro.com/603-Samina.pdf>]
- Saona, P. H. (2011). Determinants of the profitability of the US banking industry. *International Journal of Business and Social Science*, 2(22), 255 – 269.

- Sattar, A. (2014). Impact of interest rate changes on the profitability of four major commercial banks in Pakistan. *International journal of accounting and financial reporting*. 4 (1).
- Sayedi, S. (2013). Bank specific, industrial specific and macroeconomic determinants of banks profitability in Nigeria. *Journal of Finance*.
- Scott, J. W., Arias, J. C. (2011). Banking profitability determinants. *Business Intelligence Journal*, 4(2), 209-230.
- Sharma, P., Gounder, N. (2012). Profitability determinants of deposit institutions in Small, Underdeveloped Financial Systems: the Case of Fiji. Griffith Business School Discussion Papers 2012(6). [http://equella.rcs.gri&th.edu.au/research/items/ Financial systems. pdf]
- Shaw, E. (1973), *Financial Deepening in Economic Development*. New York: Oxford University Press.
- Short, B.K. (1979). The Relation between Commercial Bank Profit Rates and Banking Concentration in Canada, Western Europe and Japan. *Journal of Banking and Finance*, 3 (1) 209-219.
- Wooldridge, J. M. (2002). *Economic analysis of cross section and panel data*. MIT University.
www.worldbank.org
www.govindicators.org
[www. Bank-of-Algeria.dz](http://www.Bank-of-Algeria.dz)
www.ons.dz