

## The impact of bank-specific and macroeconomic factors on banks profitability: Panel evidence from Algeria

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Received: 27/04/2021

Accepted: 26/06/2021

Publication: 01/12/2021

### Abstract:

This paper investigates the impact of bank-specific and macroeconomic variables on banks' profitability in Algeria during (2012-2019). For this purpose, Return on assets and return on equity are taken as indicators of the banks' profitability. On the other hand, the factors affecting the profitability of banks were divided into two categories: bank-specific variables, and macroeconomic variables. To this end, a random effect model of Panel Data used to analyze the data. Therefore, the study results revealed that capital adequacy, efficiency, and inflation are among the independent factors that have a statistically significant effect on commercial banks' profitability operating in Algeria.

**Keywords:** Profitability; bank-specific; macroeconomic; Panel data; Algeria.

**JelClassificationCodes :** C33, G21, E00.

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## 1. INTRODUCTION

As financial intermediaries banks play an important role in the operation of an economy. Banks are the sole providers of funds, and their stability is of paramount importance to the financial system. If a financial system is, efficient it should show improvement in profitability, increasing the volume of funds flowing from saver to borrowers, and better quality services for consumers. Performance-related to the goals that commercial banks strive to achieve. Whereas, achieving profits and maximizing them is one of the main objectives of managing commercial banks, as it is, considered the main goal that it seeks to accomplish. In order for the bank to be able to make profits, it must invest its money obtained from various sources. Whether internal sources (equity) or external sources (debts) with the highest possible efficiency, by maximizing revenues and reducing their expenses.

As the commercial banks obtain deposits at the lowest possible cost and invest them in various, and investments with returns that exceed the cost of obtaining those funds. To achieve the greatest amount of profit, taking into account liquidity and security (acceptable degree of liquidity and low risk).

As for profitability, it expresses the relationship between profits and investments that contributed to achieving them. It is a measure of the efficiency and effectiveness of a bank's management in using its resources. Therefore, the factors affecting profitability are at the core of bank management as well as shareholders, the central bank and the government. Examining these factors can increase productivity levels and help bank and investor's management to resist adverse changes. The main purpose of this research is to use panel data models during the period (2012 – 2019) to identify the significant determinants that have an effect on the Algerian banks' profitability. To this end, the analysis focuses on the internal and external determinants of bank profitability. More specifically, the variables used to measure profitability are Return on Assets (ROA), Return on Equity (ROE). The determinant variables include bank-specific variables: Capital adequacy (CAR), Liquidity Ratio (LR), Efficiency (EFF), Credit Risk (RIS), Deposits Growth (DG), Bank size (BS). Moreover, macroeconomic variables: Inflation (INF) and Gross domestic product growth (GDP).

### 1.1. Main Question:

In light of the above, the main question of our research revolve around the following question:

- **During the study period, what are the most important factors affecting the profitability of the operating banks in Algeria?**

### 1.2. Research hypotheses:

- **H1:** There is a statistically significant effect of bank specific variables on the bank's profitability.

**H2:** There is a statistically significant effect of Macroeconomic variables on the bank's profitability.

## 2. Banking Profitability

### 2.1. Profitability

Profitability can be defined as:

The relationship between, the company's earnings, and the investment that help to achieve those earnings. Profitability is the company's goal, and it is also an index to measure the performance of the company as a whole or part of the units, or the partial units.(ABOU ZAITER, 2006, p. 73). Profitability is an indicator of the bank's ability to take risks and/or increase capital, indicating the bank's competitiveness and measuring management quality.(BENSHENA, 2018, p. 538)

## 2.2. Profitability Indexes in Commercial Banks

Profitability measured in a variety of ways, including return on assets, return on equity, or profit margin. In this paper, we focus on return on assets (ROA) and return on equity (ROE). These indexes are widely used by economists in their studies to reveal banks' ability to generate profits from their activities.

– **ROA:** The return on assets (ROA) is one of the dependent variables that measure probability in a bank. The return on assets (ROA) is calculated as the ratio of net income to total assets. ROA reflects the profitability of a company relative to its total assets. In other words, it shows how efficiently the management department uses its assets to generate profits. ROA is used to evaluate the competition and operating performance of banks. So far, return on assets has been the most commonly used measure of profitability in the literature as a better indicator than other profitability indicators.(ALYOUSEF, SAFFOURI, & ALQASSAR, 2019, p. 171)

– **ROE:** Return on equity (ROE) is also one of many indicators that determines the profit earned by a bank relative to the total equity shown on the balance sheet. ROE is termed as the percentage of the return on capital invested by the bank's shareholders per unit. The higher the return on equity, the better for the bank because it can raise more funds within the company.(SERWADDA, 2018, p. 1328)

## 2.3. Profitability Factors

In most researches on bank profitability, the factors of profitability are divided into bank-specific and macroeconomic factors. Furthermore, it refers to the bank-specific as the internal factors of profitability, while the macroeconomic variables refer to the external factors of profitability.

### 2.3.1. Bank Specific Factors

It is represented in the following:

– **Capital Adequacy:** The ratio of capital to balance sheet (CA) is regarded as one of the main reasons for capital strength. It is expected that the higher the ratio, the lower the demand for external funds and the higher the profitability of the bank. Shareholders make up for losses and manage risks. The relationship between equity and total assets is expected to be positively correlated with profitability. Banks with strong capital will face lower bankruptcy costs, thereby reducing financial costs and risks.(TATJANA, et al., 2017, p. 36)

– **Liquidity:** The ratio of loans to customer deposits as an indicator of liquidity risk. Banks with sufficient liquidity can perform their obligations even in difficult circumstances such as bank flight. From this perspective, the "comfort" ratio reduces the risk of bankruptcy, which can reduce financing costs and increase profitability. On the other hand, if the return from the

liquid assets is very low, which will reduce profitability in return. (PETRIA, CAPRARU, & IHNATOV, 2015, p. 520)

– **Efficiency:** the ratio of operating expenses to net income is negatively related to the profitability of the bank. Previous research has proven the opposite of efficiency and profitability. Because direct costs reduce profits when banks can effectively control operating costs. In addition, reasonable reduction of operating costs will be the basis for banks to reduce service prices (such as interest rates on loans, commissions, etc.) to attract customers. Operational costs can be reduced through better management and the use of new technologies. (PHAN, HOANG, DINH, & HOANG, 2020, p. 222)

– **Credit Risk:** Therefore, credit risk is one of the key factors of bank profitability. It is measured by the ratio of loan loss provisions to total loans and advances. The loan loss provisions are reflected in the bank's income statement. And used as an indicator of the bank's capital risk and credit worthiness. Economists say that the profitability of banks depends on their ability to predict, avoid and control risks in order to make up for losses caused by emerging risks. When banks allocate resources for asset operations, they should consider asset risks. Many literatures show that higher credit risk is obviously related to lower bank profitability. (GEMECHU, 2016, p. 446)

– **Deposit Growth:** The deposit growth rate is obtained by dividing the current year's deposits by the previous year's deposits minus one. Deposits are considered to be the main source of bank financing and therefore should have a positive impact on profitability. A number of studies have shown that the impact of deposits on profitability depends on the ability of banks to convert them into income. When deposits are deposited in banks like good loans, they have a positive impact on profitability. When issued as non-performing loans, they may have a negative impact on profitability. (BLESSING, 2015, p. 84)

– **Bank Size:** Bank size is measured using the logarithm of total assets. The relationship between bank size and profitability is controversial. Generally, the larger the size, the higher the output. The reason is that the large size may lead in economies of scale that can reduce the cost of collecting and processing information, and economies of scale can make credit products more diversified and access capital markets that are not available to small banks. However, for extremely large banks, the size effect may be negative due to bureaucracy and other reasons. (KWADWO, 2018, p. 647)

### 2.3.2. Macroeconomic Factors

– **GDP:** Used as a macroeconomic indicator, in periods of unfavourable economic conditions the quality of the loan portfolio become worse, as a result this increase credit risk, the provisions, generating credit losses, subsequently reducing bank profitability. On the contrary, an improvement in economic conditions will improve the solvency of borrowers, increases loan request, with positive effects on the profitability of banks. Accordingly, the researcher expects a positive relationship between GDP and bank profitability. (ABOBAKR, 2018, p. 387)

– **Inflation:** The inflation rate measures the percentage increase in the consumer price index (CPI) of all goods and services. Inflation affects the actual value of costs and revenues.

Regarding the impact of inflation on bank profitability, there are different views in the literature. For example, some researchers believe that inflation can enhance the profitability of banks. They suggest that the positive relationship between inflation and bank profitability implies that bank income increases more with inflation than bank costs. High inflation rates are usually also related to high interest rates on loans, and therefore high incomes. Banks also obtain higher profits by withholding or delaying in crediting customer accounts in an inflationary environment. However, if inflation is not predictable and the bank will not adjust interest rates slowly then the bank's expenditure may grow faster than the bank's income, which will have a negative impact on the bank's profitability. (ZAWADI, 2014, p. 366)

### 3. METHODS AND MATERIALS

In this research we analyzed bank specific and macroeconomic variables that may have an effect on banks' profitability of the operating banks in Algeria, the study covered from (2012-2019) and analyzed a panel of nine (09) Commercial banks. Which are:

– ABC Bank (ABC), Exterior Bank of Algeria (BEA), Algeria National Bank (BNA), BNP Paribas (BNP), Al Baraka Bank, Society General (SGA), Trust Bank, Gulf Bank. Fransa Bank.

The data are gotten from the published annual reports of the banks concerning the bank specific variables while the macroeconomic variables data are gotten from the World Bank website. In addition, Stata 15.0 econometric software used for analyzing the data.

#### 3.1. Variables description.

**Table 1.** List of variables and their coding in the model

Variables	Description
<b>DEPENDENT VARIABLES</b>	
Return on Assets ( <b>ROA</b> )	Net Income / Total Assets
Return on Equity ( <b>ROE</b> )	Net Income After Tax / Total Equity
<b>INDEPENDENT VARIABLES</b>	
<b>Bank-Specific variables</b>	
Capital Adequacy ( <b>CAR</b> )	Total Equity / Total Assets
Liquidity ( <b>LR</b> )	Total Loans / Total Deposits
Efficiency ( <b>EFF</b> )	Operating Expenses / Net Income
Deposits Growth ( <b>DG</b> )	(current year's deposits/previous year's deposits) -1
Credit Risk ( <b>RIS</b> )	provision for loans losses / total loans
Bank size ( <b>BS</b> )	Ln total assets.
<b>Macroeconomic variables</b>	
Gross domestic product growth rates ( <b>GDP</b> )	Yearly change in GDP growth rate
Inflation ( <b>INF</b> )	Yearly change in inflation rate

**Source:** Prepared by the researchers.

#### 3.2. Model Specification

The multiple linear regression models are as follows:

##### ROA Model:

$$ROA_{i,t} = \beta_0 + \beta_1 CAR_{i,t} + \beta_2 LR_{i,t} + \beta_3 EFF_{i,t} + \beta_4 RIS_{i,t} + \beta_5 DG_{i,t} + \beta_6 BS_{i,t} + \beta_7 INF_{i,t} + \beta_8 GDP_{i,t} + ei - (1)$$

**ROE Model:**

$$ROE_{i,t} = \beta_0 + \beta_1 CAR_{i,t} + \beta_2 LR_{i,t} + \beta_3 EFF_{i,t} + \beta_4 RIS_{i,t} + \beta_5 DG_{i,t} + \beta_6 BS_{i,t} + \beta_7 INF_{i,t} + \beta_8 GDP_{i,t} + ei - (2)$$

**Where:**

- $ROA_{i,t}$  = Return on assets of bank i at time t.
- $ROE_{i,t}$  = Return on equity of bank i at time t.
- $CAR_{i,t}$  = capital adequacy of bank i at time t.
- $LR_{i,t}$  = Liquidity of bank i at time t.
- $EFF_{i,t}$  = Efficiency of bank i at time t.
- $RIS_{i,t}$  = Credit risk rate of bank i at time t.
- $BS_{i,t}$  = Bank size of bank i at time t.
- $DG_{i,t}$  = Growth of deposits of bank i at time t.
- $INF_{i,t}$  = inflation growth at time t.
- $GDP_{i,t}$  = Annual rate of change in GDP at time t.
- $ei$  = Error term.

**4. RESULTS AND DISCUSSION****4.1. Descriptive Statistics:**

Table (2) presents descriptive statistics relating to both dependent and independent variables that were used in regression analysis. Results indicate that, on average, the bank's mean value for ROA, ROE were 2.001, 15.88 respectively. ROE has the highest mean value of 15.88; this implies that banks net profit after tax represents 15.88% of shareholders equity in the Algerian bank system. The study reported that, among dependent variables, ROA has the lowest mean value of 2.001, which implies that banks, on average, are earning 2.001 DZD net income per 1 DZD of total assets, which is an unsatisfactory return.

**4.2. Multicollinearity Test :**

A multicollinearity test was performed by constructing a correlation matrix. From table (3) and table (4), the correlation matrix output in both models (ROA, ROE) insures that absents of multicollinearity between the independent variables.

**4.3. Regression analysis:****– ROA Model**

Table (5) shows the results of estimating the model of the impact of independent variables on the profitability of commercial banks, using: the pooled regression model, the fixed effects model and the random-effects model.

In the table (5), ROA is regressed against all, internal and external variables of Algerian banks using the pooled regression model (PRM) and the results are explained as follows: The R-squared statistics and the adjusted-R squared statistics of the model are 48.61% and 42.08% respectively.

The result indicates that the changes in the independent variables explain 48.61% of the changes in the dependent variable. That means variables included in the model are

collectively explaining 48.61% of the changes in ROA, While 51.39% is due to other factors. Consequently, these variables together, are good explanatory variables of the commercial bank's profitability in Algeria.

As shown in the table (5), all internal factors except Liquidity ratio, Deposits growth, Credit Risk, had a statistically significant effect on profitability. On the other hand, for external variables both of Gross domestic product growth rates and Inflation had an insignificant effect on profitability.

Between the significant variables, Capital Adequacy ratio, Efficiency ratio and Bank size, are significant at 5% significance level. Moreover, to identify determinants of banks profitability in the Algerian banks, a Random-effect model was applied in both regressions According to the Hausman test.

If we input variables shown in Random-effect model in Table (6) into equation (1), the prediction model becomes:

$$\text{ROA } i.t = 2.368 + 0.035 \text{ CAR } i.t + 0.0013 \text{ LR } i.t - 0.012 \text{ EFF } i.t + 0.024 \text{ RIS } i.t + 0.0023 \text{ DG } i.t + 0.033 \text{ BS } i.t + 0.044 \text{ INF } t - 0.11 \text{ GDP } t... (1)$$

The table (6) shows regressions between return on assets (ROA) and independent variables, where only Capital Adequacy Ratio, efficiency and Inflation was statistically significant at 5% and 10% level. In addition, results confirmed to theoretical expectations of (GIRMAY, 2011)(ABU HANIFA, CHOWDHURY, CHOWDHURY, & KABIR, 2015), and other studies.

(BEN NACEUR, 2003, p. 10), in this previous study the researcher analyzed the factors that affect the profitability of Tunisian banks, and he indicated that there was a significant positive effect between **capital adequacy** and profitability (ROA). And this is consistent with our results where there was a significant effect of capital adequacy on profitability (ROA). So we accept H1.

Where the coefficient of **Efficiency** is negative and statistically significant at 5% significance level. This indicates that reducing commercial bank's operating expenses would certainly increase the bank's performance in general and profitability in particular in the Algerian banks. Similar findings were drawn by (FADZLAN & CHONG, Determinants of bank profitability in a developing economy: empirical evidence from the Philippines, 2008, p. 104). Which means that H1 is accepted.

(FADZLAN, 2011, p. 62) Finds that increase in **inflation** is beneficial and that banks were anticipating changes in inflation such that they managed to capture such an effect in their interest rates, which affect profitability in a positive way, and this is consistent with our findings where there was a significant effect of inflation on profitability (ROA). So we accept H2.

For **Credit Risk** ratio, this variable has a negative and statistically insignificant effect on Algerian bank's profitability. This finding was inconsistent with the previous study of (GIRMAY, 2011, p. 32) so we reject H1.

**GDP** has an insignificant effect on (ROA) which is inconsistent with (ABU HANIFA, CHOWDHURY, CHOWDHURY, & KABIR, 2015, p. 295). That found a negative significant effect of (GDP) on (ROA). Therefore, the insignificant negative relation of (GDP) contradicts

the theory that economic growth improves profits and declines income. This result may be due to other reasons, including the preference of the customer or the decision to deposit excess funds and obtain a loan, or the lack of information about economic changes in the country. Which mean that H2 is rejected.

However, **Bank size** has an insignificant negative effect on profitability (ROA), this is inconsistent with what has been spotted in (SAIRA, JAMIL, ZAMAN, & ABDUL, 2011, p. 68), that there is a significant negative effect on ROA, which mean that larger banks achieve a lower profitability (ROA). Therefore, we reject H1.

For **Liquidity**, we found insignificant positive effect on (ROA), which is inconsistent with (MORAD & ZAIN EL DINE, 2014, p. 44), which found a statistically significant effect of liquidity on profitability, meaning that it is considered as a positive indicator of profitability and generates a higher return. So we reject H1. Where **Deposit growth** has an insignificant positive effect on profitability, while other studies findings that there is a positive significant effect of deposits growth on profitability (ROA), meaning that higher deposit growth ratio, contributes in increasing the granting of loans and thus benefit from the interest rate, by (YOUSFI, 2010, p. 277). Therefore, we reject H1.

#### – ROE Model

In the table (7), ROE is regressed against all bank-specific, internal and external variables of Algerian banks using the pooled regression model (PRM), and the results are explained as follows: The R-squared statistics and the adjusted-R squared statistics of the model is 51.53% and 45.38% respectively. The result indicates that the changes in the independent variables explaining 51.53% of the changes in the dependent variable. That means variables included in the model are collectively explain 51.53% of the changes in ROE. Consequently, these variables together, are good explanatory variables of the commercial bank's profitability in the Algerian banks.

As shown in table (7) regressions between return on equity (ROE) and independent variables, indicate that all variables had a significant effect at 5% level on profitability represented by (ROE) except, Liquidity Ratio, Credit Risk, deposits growth, bank size, inflation, and GDP. Moreover, to identify determinants of banks profitability in the Algerian banks, a Random-effect model was applied in both regressions According to Hausman test.

If we input variables shown in Table (8) into equation (2), the prediction model becomes:

$$\text{ROE } i.t = 17.07 - 0.244 \text{ CAR } i.t + 0.024 \text{ LR } i.t - 0.086 \text{ EFF } i.t - 0.60 \text{ RIS } i.t - 0.003 \text{ DG } i.t + 0.87 \text{ BS } i.t + 0.65 \text{ INF } t - 0.46 \text{ GDP } t \dots (2)$$

Where. Capital adequacy ratio shows a significant negative effect on ROE at 5% level, this clearly shows that a rise in Capital Adequacy diminishes the profitability of a bank, so a 1% change in capital adequacy leads to a decrease about -0.24% in profitability. These results are inconsistent with the study of (BLESSING, 2015, p. 86). Therefore, we accept H1.

In addition to that, **Efficiency** has a negative significant effect on profitability (ROE) at 5% level. Furthermore, a 1% change in total overheads to net income ratio triggering about 0.86 % change in profitability, which means that efficient banks tend to be more profitable



than inefficient ones in the Algerian banks. These results support the earlier finding of (ATHANASOGLU, BRISSIMIS, & DELIS, 2005, p. 23). That is mean H1 is accepted.

While the impact of **Inflation** is positively related to the Algerian banks' profitability, implying that during the period under study the levels of inflation were anticipated by the Algerian banks. This gave them the opportunity to adjust the interest rates accordingly and consequently to earn higher profits. This result is consistent with the findings of (FADZLAN, 2011, p. 62). That is mean H2 is accepted.

**Liquidity** ratio has an insignificant positive effect on ROE. Which is inconsistent with (MROSHEDUR, KOWSAR, & ABDUL, 2015, p. 144) that found a negative significant effect on ROE, which reveals that banks with a low level of liquidity earn less. Therefore, we reject H1.

Additionally, **Credit Risk** has a negative and statistically insignificant effect on Algerian bank's profitability (ROE). This result does not support the earlier finding of (GIRMAY, 2011, p. 32) that explained that an increase in credit risk reduces the profitability of a bank. Therefore, H1 is rejected.

**GDP** has an insignificant negative effect on (ROE) which is inconsistent with (ABU HANIFA, CHOWDHURY, CHOWDHURY, & KABIR, 2015, p. 295) that found a negative significant effect of GDP on ROE. Where the negative effect of gross domestic product (GDP) shows that high productivity is adverse for the profitability of commercial banks. (GDP) Imply that high economic growth improves the business environment and lowers bank entry barriers, which increases competition, and ultimately diminishing bank profitability (ROE). So, we reject H2. Apparently **deposit growth, bank size** appear to be not an important determinant of profitability represented by (ROE), because they did not have a statistically significant effect on the profitability of the Algerian banks. Which means that H1 is rejected.

## 5. CONCLUSION

This study specified an empirical framework to investigate the effect of (capital adequacy, liquidity, efficiency, credit risk, deposits growth and bank size) as bank specific factors, for each bank in addition to GDP and inflation as macroeconomics factors, on banks' profitability. In this study, two profitability measures are used: the return on assets (ROA) and the return on equity (ROE) ratios. To perform the analysis, the researchers depend on a sample contains nine banks operating in Algeria, during the period (2012 – 2019) using the Panel Data. The study reached the following results:

– For the ROA model, we found that there are only three independent variables. That has a statistically negative and positive significant effect, on the profitability of Banks operating in Algeria. Which are: Capital Adequacy ratio (CAR), Efficiency (EFF), and Inflation ratio (INF), these independent variables contribute to explain the changes in the dependent variable (ROA) by 69.50%.

– The analysis also revealed that there is an insignificant effect between liquidity (LR), credit risk (RIS), bank size (BS), deposits growth (DG) and Gross domestic product growth ratio (GDP), on profitability (ROA).

– For the ROE model, we found that there are only three independent variables. That has a

statistically negative and positive significant effect on the profitability of Banks operating in Algeria. Which are: capital adequacy (CAR), Efficiency (EFF), and Inflation (INF), these independent variables contribute to explaining the changes in profitability (ROE) by 54.18%. While liquidity (LR), credit risk (RIS), deposit growth (DEP), bank size (BS) and Gross domestic product growth ratio (GDP), have an insignificant effect on profitability (ROE).

–The most important thing revealed by this study is that capital adequacy is an important factor when it comes to the determination of profitability in Algeria. Which mean that adequate capital functioned in various ways such as providing a cushion against losses not covered by current earnings. It has also been a confidence booster to the depositors, public and the regulatory authority in Algeria.

–In addition to that, efficiency had a greater influence on all profitability measures. Moreover, efficiency has a negative significant effect on the profitability of the Banks operating in Algeria. Which indicates that reducing commercial banks operating expenses would certainly increase the bank's profitability.

–Inflation has a positive significant effect on banks' profitability, which mean that when inflation raises interest rates also raises. Increase in interest rates provide greater opportunity for banks to increase their profits.

–Interestingly, in the case of Algeria, profitability indicators are not affected by liquidity variables, which contradicts the results of previous studies in other countries and may indicate that the maintenance plan system is weak in increasing the profitability of banks. Another consequence banks do not make planned loan disbursement and have and adopted a minimum method to maximize the income of the balance sheet.

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## 7. Appendices

**Table 2. The Descriptive Statistics**

. summarize ROA ROE CAR LR EFF RIS DG BS INF GDP

Variable	Obs	Mean	Std. Dev.	Min	Max
ROA	72	2.001589	.7711704	.523438	4.437078
ROE	72	15.88953	8.312929	.610765	36.20898
CAR	72	16.24465	12.01723	3.884147	48.47492
LR	72	95.78134	27.90992	50.17528	259.835
EFF	72	102.0437	47.31653	18.85074	285.468
RIS	72	.5766522	.5118908	.011676	2.817361
DG	72	13.14463	17.90964	-21.64454	65.99804
BS	72	9.209598	1.492673	7.370823	12.51816
INF	72	4.6925	1.662988	2.92	8.19
GDP	72	3.17125	.4172577	2.63	3.8

The source: Prepared by the researcher using Stata 15.0  
**Table 3. Multicollinearity test (ROA)**

. correlate ROA CAR LR EFF RIS DG BS INF GDP  
 (obs=72)

	ROA	CAR	LR	EFF	RIS	DG	BS	INF	GDP
ROA	1.0000								
CAR	0.4727	1.0000							
LR	0.2577	0.4524	1.0000						
EFF	-0.2568	0.2658	0.0733	1.0000					
RIS	-0.2219	-0.1374	-0.1143	-0.1047	1.0000				
DG	0.3002	0.2739	-0.0218	0.0120	-0.1869	1.0000			
BS	-0.0773	-0.0367	-0.0824	-0.4178	0.1797	-0.2722	1.0000		
INF	0.1844	0.0552	-0.0390	-0.0916	0.0205	0.0598	-0.0433	1.0000	
GDP	-0.0000	0.1171	-0.0449	0.0199	-0.0327	-0.0120	-0.0316	0.1845	1.0000

The source: Prepared by the researcher using Stata 15.0  
**Table 4. Multicollinearity test (ROE)**

. correlate ROE CAR LR EFF RIS DG BS INF GDP  
 (obs=72)

	ROE	CAR	LR	EFF	RIS	DG	BS	INF	GDP
ROE	1.0000								
CAR	-0.6242	1.0000							
LR	-0.2881	0.4524	1.0000						
EFF	-0.4158	0.2658	0.0733	1.0000					
RIS	-0.0489	-0.1374	-0.1143	-0.1047	1.0000				
DG	-0.0948	0.2739	-0.0218	0.0120	-0.1869	1.0000			
BS	0.0056	-0.0367	-0.0824	-0.4178	0.1797	-0.2722	1.0000		
INF	0.1403	0.0552	-0.0390	-0.0916	0.0205	0.0598	-0.0433	1.0000	
GDP	-0.0578	0.1171	-0.0449	0.0199	-0.0327	-0.0120	-0.0316	0.1845	1.0000

The source: Prepared by the researcher using Stata 15.0

**Table 5. PRM (ROA) Model**

```
. regress ROA CAR LR EFF RIS DG BS INF GDP
```

Source	SS	df	MS	Number of obs	=	72
Model	20.5234295	8	2.56542869	F(8, 63)	=	7.45
Residual	21.7005373	63	.344452974	Prob > F	=	0.0000
				R-squared	=	0.4861
				Adj R-squared	=	0.4208
Total	42.2239668	71	.594703758	Root MSE	=	.5869

  

ROA	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
CAR	.0362145	.0075016	4.83	0.000	.0212237 .0512053
LR	.0001497	.0029334	0.05	0.959	-.0057123 .0060117
EFF	-.0082241	.001762	-4.67	0.000	-.0117452 -.004703
RIS	-.2282335	.1410781	-1.62	0.111	-.5101556 .0536886
DG	.0023707	.0044666	0.53	0.597	-.0065551 .0112966
BS	-.1150098	.0562435	-2.04	0.045	-.2274036 -.0026161
INF	.0526874	.0432274	1.22	0.227	-.0336956 .1390704
GDP	-.1628447	.17261	-0.94	0.349	-.5077784 .1820889
_cons	3.667004	.9533238	3.85	0.000	1.761938 5.572069

The source: Prepared by the researcher using Stata 15.0

**Table 6. REM (ROA) Model**

```
. xtreg ROA CAR LR EFF RIS DG BS INF GDP, re
```

Random-effects GLS regression

Group variable: BanksID

R-sq:

within	= 0.6950	min	= 8
between	= 0.0816	avg	= 8.0
overall	= 0.3184	max	= 8

Wald chi2(8) = 121.57

Prob > chi2 = 0.0000

corr(u\_i, X) = 0 (assumed)

ROA	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
CAR	.0352558	.0096969	3.64	0.000	.0162502 .0542614
LR	.0013572	.0019674	0.69	0.490	-.0024989 .0052132
EFF	-.0124532	.0013094	-9.51	0.000	-.0150195 -.0098869
RIS	.0247831	.1235122	0.20	0.841	-.2172964 .2668626
DG	.0023811	.0030025	0.79	0.428	-.0035038 .0082659
BS	.0332827	.0631654	0.53	0.598	-.0905191 .1570845
INF	.04473	.0269034	1.66	0.096	-.0079996 .0974597
GDP	-.1136948	.1110454	-1.02	0.306	-.3313398 .1039503
_cons	2.368196	.8220089	2.88	0.004	.7570884 3.979304

  

sigma_u	.59411236
sigma_e	.35707678
rho	.7346287 (fraction of variance due to u_i)

```
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```

	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fe	(B) re		
CAR	.0293652	.0352558	-.0058906	.0056427
LR	.0018704	.0013572	.0005132	.
EFF	-.0131126	-.0124532	-.0006594	.000147
RIS	.0652645	.0247831	.0404814	.0312312
DG	.0024192	.0023811	.0000382	.
BS	.0898183	.0332827	.0565356	.0247972
INF	.0462363	.04473	.0015063	.
GDP	-.0838768	-.1136948	.029818	.0110203

b = consistent under H<sub>0</sub> and H<sub>a</sub>; obtained from xtreg  
 B = inconsistent under H<sub>a</sub>, efficient under H<sub>0</sub>; obtained from xtreg

Test: H<sub>0</sub>: difference in coefficients not systematic

chi2(8) = (b-B)'[(V\_b-V\_B)<sup>-1</sup>](b-B)  
 = 11.00  
 Prob>chi2 = 0.2018  
 (V\_b-V\_B is not positive definite)

The source: Prepared by the researcher using Stata 15.0

Table 7. PRM (ROE) Model

```
. regress ROE CAR LR EFF RIS DG BS INF GDP
```

Source	SS	df	MS	Number of obs	=	72
Model	2528.34706	8	316.043383	F(8, 63)	=	8.37
Residual	2378.09235	63	37.7474976	Prob > F	=	0.0000
				R-squared	=	0.5153
				Adj R-squared	=	0.4538
Total	4906.43941	71	69.1047804	Root MSE	=	6.1439

  

ROE	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]
CAR	-.3788384	.0785298	-4.82	0.000	-.5357678 - .2219091
LR	-.0117666	.0307083	-0.38	0.703	-.0731323 .0495991
EFF	-.0562731	.0184453	-3.05	0.003	-.093133 - .0194131
RIS	-2.370692	1.476858	-1.61	0.113	-5.321957 .5805732
DG	-.0053007	.0467583	-0.11	0.910	-.0987398 .0881384
BS	-.684875	.5887781	-1.16	0.249	-1.861454 .4917041
INF	.7123431	.45252	1.57	0.120	-.191946 1.616632
GDP	-.481548	1.806946	-0.27	0.791	-4.092441 3.129345
_cons	34.84156	9.979747	3.49	0.001	14.89863 54.7845

The source: Prepared by the researcher using Stata 15.0

Table 8. REM (ROE) Mode

```
. xtreg ROE CAR LR EFF RIS DG BS INF GDP, re
```

Random-effects GLS regression  
Group variable: BanksID

Number of obs = 72  
Number of groups = 9

R-sq:  
within = 0.5418  
between = 0.2501  
overall = 0.3316

Obs per group:  
min = 8  
avg = 8.0  
max = 8

corr(u\_i, X) = 0 (assumed)

Wald chi2(8) = 68.16  
Prob > chi2 = 0.0000

ROE	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]
CAR	-.2444292	.1004094	-2.43	0.015	-.441228 - .0476303
LR	.0244629	.019738	1.24	0.215	-.0142229 .0631488
EFF	-.0866474	.0131676	-6.58	0.000	-.1124555 - .0608394
RIS	-.6083195	1.248446	-0.49	0.626	-3.055229 1.83859
DG	-.0037246	.0301231	-0.12	0.902	-.0627649 .0553156
BS	.8793204	.6445535	1.36	0.172	-.3839812 2.142622
INF	.6511877	.2694306	2.42	0.016	.1231135 1.179262
GDP	-.4643688	1.115715	-0.42	0.677	-2.65113 1.722392
_cons	17.07742	8.399234	2.03	0.042	.6152259 33.53962
sigma_u	7.0514138				
sigma_e	3.6598				
rho	.78778733	(fraction of variance due to u_i)			

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	Coefficients		(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
	(b) fe	(B) re		
CAR	-.2258296	-.2444292	.0185996	.0560398
LR	.0281463	.0244629	.0036833	.0036412
EFF	-.0899921	-.0866474	-.0033447	.002997
RIS	-.6291812	-.6083195	-.0208617	.3826159
DG	-.0004661	-.0037246	.0032585	.005579
BS	1.214352	.8793204	.3350314	.2612969
INF	.6486872	.6511877	-.0025005	.0394147
GDP	-.4679433	-.4643688	-.0035745	.2516057

b = consistent under Ho and Ha; obtained from xtreg  
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(8) = (b-B)'[{V\_b-V\_B}^{-1}](b-B)  
= 3.45  
Prob>chi2 = 0.9034

The source: Prepared by the researcher using Stata 15.0