Democratic and Popular Republic of Algeria
Ministry of Higher Education and scientific Research

Ecole Supérieure de Commerce
E.S.C.

Thesis
Submitted In Fulfillment of the Requirements for the Degree of Doctor in Management Sciences
***Option:* ACCOUNTING AND MANAGEMENT CONTROL**

Thesis Title :

The Impact of Risk Management and Economic Stability on the Financial Performance of Algerian Banks : Evidence from Economic and Bank Specific Variables Using VAR Model and Panel Data Analysis

Submitted by :

SAHRAOUI Fatma Zahra

Supervised by :

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DEDICATION

I Would Like To Dedicate This Work :

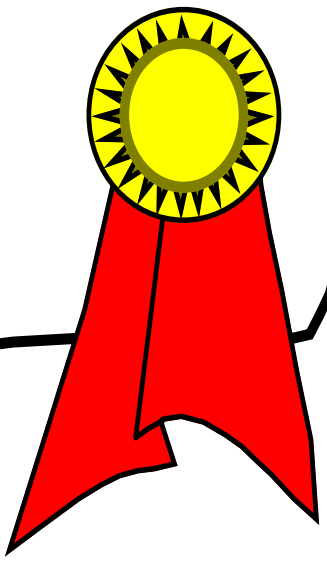
To My Loving Parents : Salah and Khadra .

To My Beloved Husband Fayçel .

To My Sweetheart Daughter Lilia .

To My Sisters and Brothers .

To My Precious Friends .



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Finally, I Could Not Have Completed This Thesis Without The Support Of My Husband, Who Provided Time And Availability To Support Me.

TITLE : The Impact of Risk Management and Economic Stability on the Financial Performance of Algerian Banks: Evidence from Economic and Bank Specific Variables Using VAR Model and Panel Data Analysis

Abstract :
This research aims to investigate the relationship between risk management, economic stability and the financial performance of Algerian banks. Therefore, we used a sample of eighteen (18) Algerian banks, during the period 2010-2019. During the study, we tried to detect the influence of several banking risk ratios and economic variables on the banking profitability in Algeria. To this end, we applied two econometric models, starting with a VAR model to identify the different variables that affect the Algerian economic stability, using a monthly data from December 2010 to March 2019. Than a Panel data analysis was applied composed of 180 observations. The results showed that banking risk management and the used economic evidence certainly influence the financial performance of Algerian banks, however, the impact level is dissimilar from variable to another. The study also revealed differences between state-owned banks and private banks. Moreover, the research proved that the economic stability in Algeria is defined by the variation of the following financial and economic variables: the Monetary Market Rate (MMR), the price of Brent-oil, the foreign exchange rate (USD/DZD), and the foreign exchange reserves. This work permitted us to identify the nature (negative or positive) of the influence of risk management, economic evidence and bank specific variables on the financial performance of the Algerian banking system.
Keywords: Risk Management, Economic Stability, Financial Performance, Algerian Banking System, VAR model, Panel Data.

TITRE : L'impact de la gestion des risques et de la stabilité économique sur la performance financière des banques algériennes : preuves à partir de variables économiques et spécifiques à la banque à l'aide d'un modèle VAR et d'une analyse de données de panel.

Résumé :
Cette thèse porte sur l'étude de la relation entre la gestion des risques, la stabilité économique et la performance financière des banques Algériennes. A partir d'un échantillon composé de 18 banques Algériennes, durant la période 2010-2019, nous essayons de détecter l'impact des différents ratios de risques bancaires et des variables économiques sur la profitabilité des banques Algériennes. A cette fin, nous avons appliqué deux modèles économétriques, le premier c'est un modèle VAR afin d'identifier les différentes variables qui influencent la stabilité économique Algérienne, en utilisant des données mensuelles de décembre 2013 à mars 2019. Le deuxième c'est une analyse des données de panel sur un panel équilibrer de 180 observations. Nos résultats montrent que la gestion de risques bancaire et les variables économique affectent certes la performance financière des banques Algériennes, mais avec des effets plutôt mitigés. Ils révèlent également des divergences entre les banques étatiques et les banques privées. Il apparait ainsi que la stabilité économique en Algérie est déterminée par la variations des variables financières et économiques : le taux du marché monétaire, le prix de pétrole (Brent-oil), le taux de change (USD/DZD) et les réserves de change. L'étude a abouti à l'identification des impacts de la gestion de risques, des variables économiques et des variables spécifiques aux banques sur la performance financière du système bancaire Algérien.
Mots Clés : La Gestion De Risque, Stabilité Economique, Performance Financière, Système Bancaire Algérienne, Modèle VAR, Données De Panel.

العنوان: تأثير إدارة المخاطر والاستقرار الاقتصادي على الأداء المالي للبنوك الجزائرية: شواهد من متغيرات اقتصادية ومصرفية محددة باستخدام نموذج VAR وتحليل لوحة البيانات

ملخص
ركزت الدراسة على بحث ومعالجة العلاقة بين إدارة المخاطر والاستقرار الاقتصادي والأداء المالي للبنوك الجزائرية. عن طريق استعمال عينة مكونة من 18 بنك جزائري، خلال الفترة 2010 - 2019 ، محاولين الكشف عن تأثير ادارة المخاطر المصرفية المختلفة والمتغيرات الاقتصادية على ربحية البنوك الجزائرية. لتحقيق هدف الدراسة، قمنا بتطبيق نموذجين للاقتصاد القياسي، لتحديد المتغيرات المختلفة التي تؤثر على الاستقرار الاقتصادي الجزائري استعملنا نموذج VAR ، وباستخدام معطيات شهرية من ديسمبر 2013 إلى مارس 2019 . ثانيا استعملنا تحليل لوحة بيانات مكونة من 180 عينة. تظهر نتائجنا أن إدارة المخاطر المصرفية والمتغيرات الاقتصادية تؤثر بالتأكيد على الأداء المالي للبنوك الجزائرية، ولكن مع تأثيرات مختلفة إلى حد ما. كما أنها تكشف عن اختلافات بين البنوك الحكومية والخاصة. إضافة لذلك يبدو أن الاستقرار الاقتصادي في الجزائر يتحدد من خلال المتغيرات المالية والاقتصادية التالية: سعر سوق المال، وسعر النفط,(نفط برنت)، وسعر الصرف (USD/DZD) واحتياطي الصرف. أسفرت الدراسة عن تحديد تأثيرات إدارة المخاطر والمتغيرات الاقتصادية والمتغيرات الخاصة بالبنك على الأداء المالي للنظام المصرفي الجزائري.
الكلمات المفتاحية: إدارة المخاطر، الاستقرار الاقتصادي، الأداء المالي، النظام المصرفي الجزائري، نموذج VAR، بيانات اللوحة.

Summary

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List of Abbreviations

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ACB	Algerian Central Bank
ADF	Augmented Dickey-Fuller Test
ALM	Assets Liabilities Management
AMA	Advanced Measurement Approach
BADR	Banque De L'Agriculture ET Du Developpement Rural
BBM	Banking Business Model
BCBS	Basel Committee On Banking Supervision
BDL	Banque De Development Local
BEA	Banque Extérieure D'algérie
BIA	Basic Indicator Approach
BNA	Banque Nationale D'algérie
CAD	Caisse Algerienne De Development
CMC	Currency And Credit Council
CNEP	Caisse National d'Epargne ET De Prévoyance
CPA	Crédit Populaire D'algérie
CPI	Consumer Price Index
CR	Credit Risk
CRR	Capital Requirements Regulation
CRR	Credit Risk Ratio
DEA	Data Envelopment Analysis
DP	Default Probability
DZD	Algerian Dinar
EAD	Exposure At Default
EBT	Earnings Before Taxes
EPS	Earnings Per Share
EUR	Euro
EVA	Economic Value Added
EWMAM	Exponentially Weighted Moving Average Model
FX	Foreign Exchange Market
GDP	Gross Domestic Product
GFC	Great Financial Crisis
GMM	Generalized Method Of Moments
GPM	Gross Profit Margin

List of Abbreviations

ICAAP	Internal Capital Adequacy Assessment Process
IMF	International Monetary Fund
IRR	Interest Rate Risk
IRSA	Interest Rate-Sensitive-Assets
IRSL	Interest Rate-Sensitive-Liabilities
IT	Information Technology
LCR	Liquidity Coverage Ratio
LGD	Loss Given Default
LMC	Law Of Money And Credit
LRR	Liquidity Risk Ratio
M2	Money Supply
MENA	Middle East North Africa
MMR	Money Market Rate
NII	Net Interest Income
NIM	Net Interest Margin
NPLs	Non-Performing Loans
NSFR	Net Stable Funding Ration
OECD	Organisation For Economic Cooperation And Development
OEM	Operating Expenditure Margin
OR	Operational Risk
ORM	Operational Risk Management
POB	Private Owned Banks
PVg	Global Position Variation
PVl	Long Currency Position
PVs	Short Currency Position
RAPM	Risk-Adjusted Performance Measures
RaRoC	Risk-Adjusted Return On Capital
RM	Risk Management
ROA	Return On Assets
ROE	Return On Equity
RPM	Risk Provisions Margin
RWAs	Risk Weighted Assets
RWCR	Risk Weighted Capital Requirements
S	Sensitivity

List of Abbreviations

SA	Standardized Approach
SCP	Structure-Conduct-Performance
SOB	State Owned Banks
SVA	Shareholders' Value Added
SWF	Sovereign Wealth Fund
US	United States Of America
USD	United States Dollar
V	Variation
VaR	Value-At-Risk
VAR	Vector Autoregressive
WB	World Bank
OSF	Oil Savings Fund

INTRODUCTION

INTRODUCTION

1. CONTEXT

The most recent research points to the presence of several deficiencies in the risk management methods in banking, which can be the dominant reason for the performance inefficiencies in the financial institutions, where the subprime crisis that affected the United States (US) mortgage industry in 2007 [1] emphasized this belief. In the same vein, Acharya et al (2009) accentuated in their research that strong and independent risk management is fundamental to effectively managing risk in banks. In addition, it should be noted the growing complexity of banking institutions and the ease with which their risk profiles could be modified. It is therefore very difficult for supervisors to regulate banking risks.

Risk management plays a determinant role in banking development all over the world. Particularly in financial crisis periods, it is generally known that one of the principal causes of the financial crisis is inefficient risk management policies and strategies. Thus, risk management in banking appears as a way to mitigate economic shocks.

Risk management practices seem to affect how banks will expand their business activities. Various large commercial banks have added more complex activities, such as securitization to their core business of financial intermediation activity. This encouraged them to take excessive risks, which amplified the systemic risk levels, increased financial difficulties, and instability, and triggered the 2008 financial crisis.

Since then, banks have been subject to stronger regulation and have had to abandon their securitization activities, which has had the side effect of increasing the volatility of financial products. As a result, these practices fixed the risk-taking levels in banks. Therefore, risk management incited researchers to highlight the multiplicity of banking risks to which the bank is exposed, namely the financial risks of which the credit risk is the most important[2].

Numerous explanations for crises have been formulated by different studies, which conclude that credit risk defined as the inability of the borrower to honor his obligations to repay the principal and the interest owed to the bank, is the fundamental cause of default in banking, which accumulated non-performing loans[3]. Moreover, the subprime crisis questioned the soundness of the banking systems that used to be considered efficient, dynamic, and innovative. In this context, the relative weight of non-performing loans is an essential component in judging the health of a country's banking sector. Credit risk is an indicator of financial stability on which the International

[1] Diamond. DW and Raghuram. G Rajan. *Fear of Fire Sales and the Credit Freeze*, University of Chicago Booth School working paper. 2009.
[2]Campbell, J. Y., *Bank insolvency and the problem of non-performing loans*. *Journal of Banking Regulation*, vol. 9, n° 1, 2007. PP. 25-45.
[3] Vazquez, F., Tabak, B.M. and Souto, M., *A macro stress test model of credit risk for the Brazilian banking sector*. *Journal of Financial Stability*, Vol. 8, Issue 2, 2012. PP. 69-83.

Monetary Fund (IMF) and the World Bank (WB) are based to assess the fragility of financial sectors.

Algeria is one of the countries that is affected by the global economic changes, especially those made by the hydrocarbon prices instability. Therefore, studying risk management in the Algerian context has its specificities, due to the fundamental role played by the banking system. Moreover, several banking experts comprehend that risk undertaking should be well evaluated if these financial institutions are pursuing to ameliorate their performance.

Algeria's banking system is a fundamental instrument of growth and a key financial sources provider to both public and private sectors, similar to the role of the banking system in other countries in the north of Africa such as Tunisia and Morocco. In Algeria, the financial authorities control the banking system using regulations and instructions made by the Algerian Central Bank (ACB) to manage the financial performance of the system and to guarantee its conformity with the established standards, guidelines, and regulations.

Even though the Algerian banking system has significantly progressed, however, it is not at the same level as other banks in the North African region (Tunisia and Morocco), also, the system suffers from several deficiencies that limit its progress in terms of laws and regulations[1], which restrain banks from determining independently their policies. Moreover, these limits can affect directly the economic growth of the country, as banks are known for their part in facilitating the transfer of goods and services by simplifying the payments and settlement systems, this vital position of banks in the economy exposes them to different risks, and jeopardize their existence.

2. PROBLEM STATEMENT

The financial crises faced by the international banking systems over the years, and especially the great financial crisis in 2008 underlined the shortages of banking risk management. Therefore, improved risk management techniques are required to assist in guarantying the safety and soundness of the financial institution and specific banks around the world. A fragile risk management system was widely recognized as a direct contributing factor to the financial crisis.

It should be notified that, in the present research, we also intend to carry out a comparison between the state-owned banks and private-owned banks to clarify their common points, their differences, and their respective contributions. This comparison would make it possible to perceive the possible link between the strategy implemented for banking risk management and the required financial performance.

The problem statement, which we would like to formulate for this research work, consists in identifying and analyzing the effective risk management methods within bank

[1] Aghrout, A., et al. *Restructuring and privatization in Algeria*. In Aghrout, A. (Ed.), Algeria in transition: Reforms and development prospects. London: RoutledgeCurzon. 2004. PP. 120-135.

institutions in Algeria. It also aims to define good risk management practices and analyze the relationship between these practices and the banking financial performance. In addition, we are planning to enlighten the influence of economic stability on the banking profitability in Algeria. From the upper-mentioned problems, arise the following research main question:

What is the impact of risk management practices and the economic instability on the financial performance of Algerian Banks?

From the fundamental question of the research arises the following hypotheses and questions:

3. SUB-QUESTIONS

SUB-QUESTION N°01: What are the risks that specifically identify the Algerian banking system?

Elements of answer are reviled using a quantitative study, where an econometric model studied the impact of the bank-specific risk ratios and their influence on the banking profitability.

SUB-QUESTION N°02: How can the ownership structure of the bank influence its financial performance indicators?

To answer this sub-question, we based on a comparison study between the two types of ownership structures that exist in the Algerian banking system, in the first section of the empirical analysis of this research.

SUB-QUESTION N°03: What are the fundamental factors that control the economic and financial stability of the Algerian-banking sector?

The response to this sub-question is provided by the establishment of a VAR model in section two of the empirical part. where we would test the fluctuations of the GDP levels caused by variation in the following variables: the inflation rate, the price of Brent oil, foreign exchange rate (USD/DZD, EUR/DZD), Foreign exchange reserves, money supply (M2), the money market rate (MMR), and the total credit to the economy (Loan).

SUB-QUESTION N°04: What are the essential internal and external variables that influence the banking profitability in Algeria?

Banks are characterized by high levels of risk, their future is ambiguous and related to many factors. To provide an answer to the sub-question 04, we theoretically investigated the bank's management, its business model, required capital, the Basel standards, and other numerous. Besides the empirical examination of the impact of bank-specific and economic variables on its profitability.

4. HYPOTHESES

HYPOTHESIS N°01: The Algerian economy has its distinctions from other countries in the region, high dependency on the hydrocarbon incomes, shortage of productive investment, and the dominance of the public sector.

The mentioned factors could influence the banking system and create risks that are specific to the Algerian financial environment.

HYPOTHESIS N°02: The Algerian state-owned banks dominate the banking activity, unlike the private-owned banks that are characterized by a lack of diffusion in the country.

The banking ownership structure is an essential characteristic that defines the profitability levels, therefore, we derived the following sub-questions:

HYPOTHESIS N°03: various factors affect the GDP levels in Algeria, these factors are mainly financial and economic

The banking financial performance determinants are essentially made of two categories: internal financial performance determinants such as the size of the bank and its capital level, on the other hand, the external determinants like the macro-economic factors.

HYPOTHESIS N°04: Risks in banking are mainly financial, as the high level of uncertainty related to the financial activity of the bank, moreover the bank's risk management could be influenced by their nature, internal, external, financial, or non-financial risks.

5. THEORETICAL FUNDAMENTALS OF THE RESEARCH

Banking risks can be distinguish to two categories[1]:

- Macro-management: on this level, there are three methods of risk management in banking: the assets portfolio diversification (loans, securities), the risk coverage using policies based on insurance, and finally the use of the bank's equity.
- Micro-management defines the asset selection procedures and the controlling procedures of the bank's operations.

Regarding the management of financial risks, which are the traditional risks of banking activity and related to its core activity, the management system has two dimensions: a technical dimension on one hand. Organizational and human dimensions, on the other hand, are combined to achieve maximum risk security.

[1] Lamarque, E. and Maurer, F., *Le risque Opérationnel Bancaire: Dispositif d'évaluation et système de pilotage*. Revue française de gestion, vol. 191, 2009. PP. 93-108.

The organizational and human risk management dimension is where the management has a key role. The last financial crisis has highlighted the importance of risk control at the highest possible levels to help ensure the soundness and the financial health of the financial institutions.

The financial performance in banking presents distinct characteristics from other types of firms. These financial institutions are distinguished by an important level of opacity caused by information asymmetry[1], high level of indebtedness[2], and level of normalization[3]. The mentioned features make its measures and determinants strenuous to control and evaluate.

Moreover, the banking profitability or financial performance mirrors the bank's overall results, as it reflects the profitability levels associated with the risks taken by the bank. In the conceptual framework of banking performance, it is measured through profitability and financial soundness indicators. Furthermore, the risk management efficiency is related and depends on bank profitability, where the analysis of risk features must be made using a three-direction relationship between the causes, consequences, and effects on the bank's financial performance[4].

Most of the large banks are operating in a complicated business climate, with dissimilar professions, including non-banking activities. Therefore, efficient risk management is fundamental for the bank’s sustainability, which acts and reacts in real-time, according to the different risk prerogatives.

This research aims to examine the influence of risk management practices and economic changes on financial performance. This, in the context of the Algerian banks with different structures, is to compare the performance levels between the state-owned banks and private-owned banks and identify the key factors that impact their profitability levels.

6. LITERATURE REVIEW

As follows, we will present several studies that tried to examine the relationship between risk management and economic stability on the financial performance in banking. The next literature review adopted several empirical methods in different contexts.

- **The Study of Ayman Abu Rumman et al (2020)**

This study examined the impact of risk management policy on the financial performance in Jordan. Moreover, the research applied a qualitative methodology by distributing

[1] Laeven, L. and Levine, R., *Bank governance, regulation, and risk-taking*. Journal of Financial Economics,vol. 93, 2009. PP. 259 275.
[2] Macey, J. R., and O'Hara, M., *The corporate governance of banks*. Economic Policy Review, vol. 9, n° 1, 2003. PP. 91-107.
[3] Prowse, S., *Corporate control in commercial banks*, Journal of Financial Research, Vol.20, 1997. PP.509-527.
[4] Lin, X., and Zhang, Y., 2009, *Bank Ownership Reform and Bank Performance in China*. Journal of Banking and Finance, Vol. 33, 2009. PP.. 20-29.

questionnaires and sampling the feedback of 123 participants. Then a regression analysis was conducted to prove the direct relationship between risk management and financial performance. The study findings showed a significant impact between credit, liquidity, market risk, and financial performance.

The results proved the existence of positive causality between risk management practices implemented in the workplace and the bank's profitability measured using ROE and ROA indicators.

- **The Study Of Jane Gathigia Muriithi Et al (2016)**

The study aimed to test the impact of credit risk on financial performance in Kenyan banks, using a sample of 43 commercial banks in Kenya, for the period between 2005-2014. Moreover, credit risk was measured using the ratio of capital to weighted assets, asset quality, loan loss provision, and advance ratio. On the other hand, the ROE ratio was applied to assess the banking financial performance. Furthermore, the study used panel data techniques (fixed effects estimation and generalized method).

The findings showed that credit risk has a significant and negative impact on the banking financial performance in Kenya, moreover, high non-performing loans to total assets ratio are associated with underprivileged bank performance in the long run as in the short run.

- **The Study Of Nicolae Petria Et al (2015)**

The study examined the factors that influence banking profitability in European Union (EU27) over the period 2004- to 2011. The research divided these factors into internal (bank-specific variables) and external factors (macroeconomic variables). In addition, the researchers used ROAA and ROAE as profitability proxies.

The results revealed that the risk management ratios used in the study (Credit and liquidity risk, management efficiency, the diversification of business, the market concentration/competition, and the economic growth) have an impact on the financial performance of the EU banks.

- **The study of Deger Alpera Adem Anbarb (2011)**

The researchers applied two types of variables (bank-specific and macroeconomic variables) to examine the determinants that affect the banking performance in Turkey from the period 2002-to 2010. Moreover, as profitability proxies, this study used ROE and ROA ratios and conducted a panel data analysis.

The outcomes of the research demonstrated the existence of a significant and positive impact of non-interest income and asset size on bank financial performance. Nevertheless, the findings ascertained that size of credit portfolio and loans have a negative and significant influence on bank profitability. Likewise, for the macroeconomic variables, only the real interest rate affects positively the banking profitability.

7. ACADEMIC AND PROFESSIONAL INTEREST

This research has principally two essential goals: on one hand, clarifying the path for economic and political decision-makers in terms of the different risks faced by the Algerian banks, their impact on the financial health of the system, and consequently, identifying the Algerian banks' variabilities towards economic changes and instability.

In addition, this work will capacitate the financial authorities in Algeria in recognizing the fundamental dissimilarities between State-Owned Banks (SOB) and the Private Owned Banks (POB) in terms of significant financial indicators.

Moreover, the research will test the impact of numerous economic factors on the banking profitability in Algeria, by the use of an econometric model that studies the nature of the relationship and its direction of causality between economic and bank-specific variables.

Furthermore, this study will capable the financial performance scholars to comprehend the diverse factors that influence the banking profitability in Algeria, by the use of a panel structure of eighteen (18) banks and over ten (10) years at the time of the study.

Finally, in the present scientific work, we will perform an analytical analysis of the outcome of the econometric results to understand the banking activity in Algeria, its determinants, and characteristics, assess their importance and prioritize them. The studied factors that have a direct and indirect impact on financial performance are part of the banking strategy that takes into account innovation in financial management, competition, and set objectives.

Although this research interest is in the Algerian banking sector, it can be generalized to similar banks that operate in the North African region, it also helps to draw the required measures to improve their banking sector and promote the stability of their economic-financial system.

8. ADOPTED WORKING PLAN

To respond to our main question, we structure our work into four chapters. The first chapter proposes to understand the specificities of banking management and sector in the Algerian context. For better comprehension of this variable, we sub-divided this chapter into three parts:

- Bank management in a changeable economic context;
- Bank performance measures and determinants;
- Algerian banking sector.

This chapter will focus on the review of the theoretical literature on the financial performance in banking, and especially in Algerian banks using an analytical study in the

final section that is interested in the financial performance indicators in the Algerian context.

The second chapter will try to clarify the different risks faced in the banking activity, the risk management, and finally the risks in the Algerian banking sector. This chapter includes an analytical study of the risks specifically faced by the Algerian banking sector.

In this chapter, we will first present the different risks to which a bank is exposed, to approach in the empirical part, and then we will present, based on various research works, the risk management in banking. Finally, we will carry out an analytical analysis of the existing risks that jeopardize the Algerian banking system.

The third chapter identifies the research paradigm, methodology, and mathematical tools. This chapter is also subdivided into three sections:

- Research paradigm and epistemology;
- The hypothetico-deductive method;
- Mathematical tools.

The third chapter defines the philosophical bases of our research, the methodology used and the mathematical tools applied.

The empirical chapter is the fourth, where we will carry out an empirical study, to find answers to our research problem. In this chapter, we would carry out a comparative study between the performance indicators of the state-owned and private-owned banks in the first section. In the second section, an econometric vector auto-regression model (VAR –model) would be established to identify the economic and financial stability causes in the Algerian banking sector.

Moreover, a panel regression analysis was conducted to examine the impact of risk ratios and economic variables on the financial performance of Algerian banks, in this empirical study, we used bank-specific variables such as the size of the bank and its deposits and economic variables as the GDP growth and inflation rate.

Finally, the Corona-Virus- Disease-2019 (COVID-19) has shade our life for the last two years, and its consequences were not just sanitary. Additionally, it influenced the world economy and paralyzed the different aspects of human life. However, this crisis was temporary, and its impact on several financial organs cannot be permanent. It can have an effect in the short term. Nevertheless, the economy would adjust to its post-crisis potential. Multiple scenarios are possible, and we cannot risk our research findings being limited in crisis times. Therefore, we excluded the 2020-2021 years, to save our research output from being biased due to emergency policies taken by the Algerian authorities in times of crisis.

Chapter one: Financial Performance in Banking

Introduction of the First Chapter

Banking financial performance reflects the sound use of the bank's assets, and its capacity to generate profit. The banking system in Algeria is the main component of the financial market. Therefore, this sector replicates the economic health of the country. As a result, evaluating the profitability of banking is essential to practitioners, scholars, and bank managers.

The evaluation, measurement, and management of the bank's profitability have vital importance to stakeholders, shareholders, and the economy as a whole. For the stakeholders, the financial health of a bank can be reflected in a better salary for its employees, better financial services and products for its clients, and influence positively the work environment as a unit. In addition, for shareholders, it is highly valuable the return on their investments and the financial sustainability of their business.

Due to the central role played by banks in financing most of the economic investments and businesses, academicians and professionals showed tremendous interest in studying bank profitability and financial performance, so consequentially, they will be able to improve the activities and functions of the bank as an organization. Therefore, several factors were studied to prove linkage to the financial performance in finance and management fields.

This chapter will contain three sections. The first theoretically investigated the bank management, its business model, its regulatory framework, and the banking financial and economic environment. The second will study the measurements of the bank profitability and its internal and external determinants. Finally, the financial performance in the Algerian context.

1. BANK MANAGEMENT IN A CHANGEABLE ECONOMIC CONTEXT

The international banking system witnessed several changes that affected its structure and its organization, where the actual universal economy knows several changing calamities, from the last financial crisis in 2007 to the dramatic drop in the oil prices in 2020. These negative events pushed the financial authorities in each country to have direct intervention in banking activities and regulations. Therefore, the changes that happened in the banking sector in the last decade has been influenced the way banking activities are carried on, probably one of the most important consequences of these changes is a persistent period of weak profitability in the banking sector. Since the lack of profitability in the banking sector jeopardize the collapse of the whole economy, most scholars and researchers have shown a tremendous interest in the strategic and operational decisions of banks, as a result, their organizational structure, business model, and their financial and economic stability.

1.1. BANKING BUSINESS MODEL

The banking sector has been experiencing fundamental changes, due to the great financial crisis, which lead to the failure of large banking groups, particularly, those distinguished with a highly risky business model. Aftermath, several radical changes, and regularities were undertaken to resuscitate the leftovers of the financial system and to maintain financial stability. To this end, a group of restrictions was followed by the banking system, as innovative procedures of financial implications for the future of the financial intermediation. In this modern economy characterized by changing context, growing market structures, and financial regulations, we found the banking business model as a policy means for a better understanding of the risk related to the banking intermediation activities.

1.1.1. Business model definition

The business model is a multidisciplinary notion, it is quite novel concept that might be not well defined in banks, however, analysts and researchers largely use this concept to assess the banking performance. In this subsection, we will try to identify what is a banking business model. A variety of scientific works concerned to identify and clarify the business model[1].

The business model as a research topic was developed in management and business discipline, more than it is well identified in the banking or financial field. Furthermore, academicians divided the definition of the business model according to two different ways[2]:

[1] Achtenhagen, L., et al. *Dynamics of business models – strategizing, critical capabilities and activities for sustained value creation.* Long Range Planning, 46(6), 2013. PP. 427–442.
[2] Roengpitya R., et al. Bank Business Models: Popularity and Performance, BIS Working Paper No. 682, December. 2017.

- A component approach: based on the idea of providing the elements that can define a business model.
- A concept approach: this second approach is based on the idea of providing the information that should be given by a business model.

In our trial to define the banking business model. We will divide the concept into three notions: the first what is a business model in the literature, then what is a bank, and at the end the definition of the banking business model. Therefore, according to Osterwalder et al (2005)[1]:"*a business model is a conceptual tool that contains a set of elements and their relationships and allows expressing the business logic of a specific firm. It is a description of the value a company offers to one or several segments of customers and of the architecture of the firm and its network of partners for creating, marketing and delivering this value and relationship capital, to generate profitable and sustainable revenue streams".* Therefore, a business model implemented by a firm is strategic planning to generate profits and revenue from operations, in the previous definition, the writer's objective was to explain that each firm has its business model that responds to a specific design and architecture of the value creation in the company.

The same author 2010 defined the business model through nine building blocks that show how a firm intends to generate profits[2]:

- ✓ Customer segments;
- ✓ Customer relationship;
- ✓ Value proposition;
- ✓ Channels;
- ✓ Revenue streams;
- ✓ Key resources;
- ✓ Key activities;
- ✓ Key partnership;
- ✓ Cost structure.

If we try to cluster the previous nine blocks into homogenous areas, we will have customer area, offer area, infrastructure and financial area. Other attempts were made related to the interconnection between business model and technology and how technology can be adapted by a company. On the other hand, Chesbrough (2010)[3] focused on the functions of a business model:

- ✓ Development of the value proposition;
- ✓ Determination of the appropriate market segment;
- ✓ Revenue generation mechanism;

[1] Osterwalder, A., et al. *Clarifying business models: Origins, present, and future of the concept*.Communications of the association for Information Systems. 2005.
[2] Osterwalder, A., & Pigneur, Y. *Business model generation: a handbook for visionaries, game changers, and challengers*. John Wiley & Sons. 2010. P14.
[3] Chesbrough, H. *Business model innovation: Opportunities and barriers.* Long Range Planning, 43(2–3), 2010. PP.354–363.

- ✓ Costs structure estimation;
- ✓ Assessment of the position of the firm in the value chain;
- ✓ Identification of complementary and competitors;
- ✓ Formulation of the competitive strategy.

The aforementioned academic works have one thing in common in term of the definition of a business model, where they had as a result, that it is the way an organization reach and achieves value creation by interacting with its suppliers and customers, and the approach adapted by a company on how to do business in the market. At this point, a deeper understanding of the business model in the banking sector is worth recalling the definition of a bank.

1.1.2. What is a bank ?

The bank is an intermediary entity that buys and sells financial products and services, furthermore; its activity is to transform and manage the risk of financial claims in a market economy[1]. In addition, the intermediary role of a bank is the collection of deposits from the public, granting loans to investors, the management of the payment system, and financial engineering. Among the other financial intermediaries, banks have a competitive advantage, which is information gathering. More precisely, banks are in a better position in terms of the management of information asymmetries between borrowers and savers. For a better understanding of the assessment and the way banks operate and how they perform is to rely on the approach applied to the banking sector with several ownership structures.

The massive changes and evolvements in the banking activities and funding strategies in the last decade have differentiated the image of a traditional bank and its role in the economy. Consequently, banks' intermediation role became more diversified in term of funding and investment in short and long term via equity, structured financial instruments and other more complicated financial structures. Additionally, in the financial system of an economy or in the financial markets, banks are essential players in both financial structures, banks have two appreciated roles[2]:

- ✓ The banks' interaction in the financial system in general and in financial markets in particular;
- ✓ The banks' contribution to risk accumulation in the system, and how and at which speed they contribute to systemic risk.

1.1.3. Banking business model

After defining the bank's mission and main roles, now we come to define a business model of banks by operating the definition that says the business model is the way of a

[1] Diamond, D. W., and P. H. Dybvig. *Bank runs, deposit insurance, and liquidity*. The Journal of Political Economy, 1983. PP. 401–419.
[2] Ayadi R. *Banking Business Models. Definition, Analytical Framework and Financial Stability Assessment*, Palgrave Macmillan. 2019. P26.

firm to generate profits interacting with its customers and suppliers to recognize that banks generate and create value. Although, it missed that this revenue probably would generate a tremendous amount of a systemic risk. Therefore, the business model of a bank need to consider both aspects; profit generation and systemic risk emphasizing.

According to Zott et al (2011)[1] "t*he business Models is created to emphasise a system-level, holistic approach to explaining how firms "do business*". Also for Osterwalder and Pigneur (2010)[2] define a business model as "*the rationale of how an organisation creates, delivers, and captures value*". From these two last definitions of the business model, the next observations can be made:

- ✓ Banks function in competitive atmosphere where other competitors are also establishing their strategies to create value;
- ✓ The banking sector is regulated by international entities or by the authorities of the country that the bank operates in, these regulation impacts the choice and the function of the banking activity;
- ✓ From the literature the bank's mission was defined as financial intermediation actor, risk manager, information collectors;
- ✓ Risk management created from the bank's main activity which is granting loans, also banks are called to manage risk created from collecting deposits and issuing short-term and long term liabilities;
- ✓ Banks create and distribute value in the process in risk undertaken and management of the liabilities and assets;

The business model in banking is a new field for researchers. Actually the interest of academicians and policy institutions took off after the great financial crisis, therefore academics tried to apply the business model concept in the banking sector in several different ways. The way banks managed their activities and funding is a pragmatic view of business mode, at the same time this activity generates risk that needs to be managed. Consequently, we can call a bank as a positive value creator, if the bank is able to manage the risk over time on the other hand, the banks will be a destructor of value if it take excessive risks.

The banking business model definition trials focused on the components of the balance sheet of banks, by distinguishing the activities on the assets side and funding on the liabilities side. The BBM provides a global vision of the way a bank performs in the banking sector while capturing funding and investing opportunities in the market. This method is imitated in the assets and liabilities of a bank and the way they interact with their competitors, where each bank is in obligation to interact with the other operators in the field through its structure of the balance sheet (assets and liabilities); this explains the complexity and the interconnection of the financial system.

[1] Zott, C., et al. *The business model: Recent developments and future research*, Journal of Management, 37(4), 2011. PP.1019–1042.
[2] Ibid. Osterwalder, A., & Pigneur,Y. 2010. PP.14-15.

1.2. BANKING REGULATURY FRAMEWORK

Any modern economy has the financial system as a fundamental component of its structure. Therefore, the main but not exclusive objective of the regulatory authorities is to maintain the stability of the sector's operators, where regulating the banking sector is no more questionable, but how much extensive regulations are?

The great depression crisis in the beginning of the last century is fresh in the memory of any regulator that had long term consequences on the international banking system; the justification of the huge amount of regulations established by the policymakers is the bankruptcy of Lehman Brothers in September 2008 and many other well-known banks in the world. These regulations was undertake to prevent and secure the international banking system, also to manage and to avoid the systemic risks created by the banking intermediaries insolvency. From that day on, a chain of regulatory measures was issued, although, definitely it has an influence the current banking regulation.

It seems that banking system did not really learn from its previous errors, where public authorities and investors were able to deceive themselves over time to cause wealth destruction[1]. Due to the technological evolvement and international interconnection, nowadays, it is quite difficult to avoid the financial crisis' waves, even if it was made by one not too big bank.

Those last ten (10) years, and just after the GFC, as a first stage the banking system received a wave of regulations, was made as precautions measures in emergency times, these large regulatory actions had an ultimate objective of strengthening the assets of credit institutions, in the belief that to limit the bank's risk undertaking, authorities need to guarantee a high endowment of own funds, also this measure would increase resistance in situations of sudden crises and safeguarded macroeconomic soundness. Additionally, the weakness of the international banking system can be determined by two main factors:

- ✓ An excessive level of leverage;
- ✓ Limited stable sources of funding.

1.2.1. Basel III key standards

The last updating in the Basel III regulations was in 2017 this version seeks to retrieve reliability in the calculation of risk weighted assets (RWAs) and develop the benchmark between banks' capital ratios. Where RWAs can be defined as an estimation of the minimum level of regulatory capital a bank must preserve to deal with unforeseen losses, this ratio is a fundamental component of the risk based capital framework[2].

[1] Reinhart C.M., Rogoff K.S. *This Time is Different*. Eight Centuries of Financial Folly, Princeton University Press. 2009.

[2] BCBS – Basel Committee on Banking Supervision, Basel III: Finalising post-crisis reforms, December. 2017. P2.

The emergency reforms undertaken by the Basel Committee on Banking Supervision (BCBS) after the end of the financial crises had mainly two objectives:

- ✓ The focus on increasing the size and quality of bank's capital assets;
- ✓ Strengthening risk weighted capital requirements (RWCR).

The following table shows the completed first phase of the Basel III key regulations in 2017, which led to a remarkable increase in the level of bank assets, consequently preventing new systemic crises and assuring the normal operation of the banking system.

Table N°01: Basel III key standards

Standard	adoption year	Requirement	Phase-in from year	full implementation year
Stage 1: Capital and liquidity				
Capital definition	2010	CET1; deductions	2013	2022
Minimum CET1 ratio	2010	4.5%	2013	2015
Capital conservation buffer	2010	2.5%	2016	2019
Countercyclical buffer	2010	0–2.5%	2016	2019
G-SIB capital surcharge	2010	0–3.5%	2016	2019
Leverage ratio (LR)	2010	3%	2016	2019
Securitization framework	2014	Revised Framework		2018
Market risk framework	2016	Revised framework		2022
Liquidity coverage ratio	2010	100%	2015	2019
Net stable funding ratio	2010	100%		2018
Stage 2: Tackling RWA variability				
Output floor	2017	72.5%	2022	2027
LR revisions/G-SIB surcharge	2017	50% scaling factor		2022
Credit risk framework	2017	Revised framework		2022
Operational risk framework	2017	Revised framework		2022

Source: BORRONI.M. and ROSSI.S. *Banking in Europe the Quest for Profitability after the Great Financial Crisis*. Palgrave Macmillan Studies in Banking and Financial Institutions. 2019. P8.

The Basel framework has three main pillars[1]:

- Minimum capital requirements;
- Supervisory review;
- Market discipline, based on standardized disclosures and complementary reforms.

The Basel III standards was divided into two stages, the first was focusing on capital and liquidity, and the second was centred on the benchmark and the consistency of the internal methods to calculate RWCRs, which enable the banks to measure their own risk.

Furthermore, the above mentioned principals was gradually introduced to simplify the adjustment in banking sector, this process was extended progressively over a time line, as declared before, the requirements of first stage in the Basel III standards are now applicable worldwide, and generally before the deadlines set-up by the committee.

To this end, banks found themselves under the pressure to adjust their balance sheets to fit the new standards, so they would be in harmony with the market expectations, so the respect of the Basel requirements is now the fundamental component of benchmark for investors and credit institutions that usually struggles with negative market valuations.

Moreover, the early responds of banks to the recommendations proposed by the Basel committee was in reality an obligation created from the increasing use of stress tests by the supervisory authorities to measure, and assess the resistance level of the banking system to unexpected systemic crises[2].

1.2.2. The impact of Basel III

The requirements of the Basel III recommended banks to preserve a minimum capital amount of 7% that would make the bank face profitability issues, therefore, in general banks will capture a higher capital reserve to cover themselves against the market pressure, to this end, and banks can limit the loans granted to its costumers.

At this case, banks will be required to hold more capital than assets, which will reduce the size of their balance sheets.

[1] BIS – Bank for International Settlements, Annual Economic Report.2018.
[2] CGFS – Committee on the Global Financial System. Structural changes in banking after the crisis, CGFS Papers No. 60, January. 2018.

The next table presents the key principles and requirements of the Basel III accord.

Table N°02: The Key principles of Basel III

Basel III principles	**Requirements**
Minimum Capital Requirements	- The Basel III accord raised the minimum capital requirements for banks from 2% in Basel II to 4.5% of common equity. - An additional 2.5% buffer capital requirement that brings the total minimum requirement to 7%. (Banks can use the buffer when faced with financial stress).
Leverage Ratio	- Banks are required to hold a leverage ratio in excess of 3%.
Liquidity Requirements	Basel III introduced the usage of two liquidity ratios: - The Liquidity Coverage Ratio: This ratio requires banks to hold sufficient highly liquid assets that can withstand a 30-day stressed funding scenario as specified by the supervisors. - The Net Stable Funding Ratio: this ratio requires banks to maintain stable funding above the required amount of stable funding for a period of one year of extended stress.

Source: ibid. BCBS – Basel Committee on Banking Supervision, December. 2017. P7.

An effect of -0.05% to -0.15% on the GDP annually due to the Basel III standards, this was the results of a research established by the Organisation for Economic Cooperation and Development (OECD) in 2011. To stay in the game, banks need to adopt an emergency strategy of increasing their lending spreads and they rely on their costumers to pass the surplus costs[1]. The Basel III introduced innovative liquidity requirements, principally the Net Stable Funding Ratio (NSFR) and the Liquidity Coverage Ratio (LCR); these requirements will influence the function of the bond market.

Due to the LCR that prefer banks holding government, bonds and covered bonds (liquid bonds) demand on lower quality corporate bonds will decrease. Consequently, banks will try to reduce maturity divergence and sustain a minimum NSFR by holding more liquid assets and increase the amount of long-term debts. At the same time, banks will try to minimize the activities that generate liquidity risks.

The implementation of Basel III requirements will need a time frame to be completely applied; the application of the Basel III standards will change the function of derivatives markets, where the operation cost will be higher for clearing brokers and lead them to exit the market most of the time. The second Basel III requirement interested on minimum capital to reduce the counterparty risk, this standard's application depends on the bank trades through a central clearing counterparty of though a dealer. In the case where the

[1] Constancio V. *Challenges for the European banking industry, conference* "*European Banking Industry: what's next*?", University of Navarra, 7 July. 2016. P8.

banks trades in derivatives markets through trader or a dealer, that cause a high capital charge for the trade regulated by the Basel III capital standards[1].

On the other hand, if a bank use a central clearing counterparty this results only a 2% cost, which is an attraction factor for banks. The departure of dealers would combine risk between a limited numbers of members, therefore, the systemic risk will be indirectly increased due to the difficulties faced by the banks to transfer trades from one bank to another.

Since the last great financial crisis (GFC) more than a decade has passed, in term of regulation a considerable advancement has been made, although the regulation-banking list is far from fulfilment. A numerous innovative international standards, more developed guidelines and better practices are now achieved. However, meanwhile the banking sector is witnessing the emergence of new risks and a specific legislative weariness, related to constant and pressing variations in the regulator scope that will be able to limit the prosperity made in this recent years in term of evolving the sustainability of credit institutions.

It should be well established in mind that even the most perfect and complete regulatory framework will not be able to eliminate the probability of a crisis appearance, the risk underestimation leads to economic and financial crisis, where this can be happening in positive periods due to the good performance of the economy. Therefore, the regulatory framework is far from complete, so the regulatory updates will continue to appear and burden the banks with its cost of adaptation, and shrink its profit margin for the long time to come.

1.3. BANKING FINANCIAL AND ECONOMIC ENVIRONMENT

More than ten years ago, the international banking system has witnessed the most profitability crisis ever. However, the effect of the financial crisis was different from one country to another and from one bank to another.

Also the ramifications of the GFC remained unchanged for a number of years, and harmed many operators of the banking sector. This dramatic profitability reduction was caused by the extended period of the crisis, and the dissimilarity of the crisis intensity that overwhelmed the world economy.

1.3.1. The factors effecting bank profitability reduction during the GFC

The GFC had an influence over the banking modern management, where this phenomenon had geopolitical factors and weak economic growth, furthermore a real recession blow caused very low level of inflation, low interest rates and unconventional monetary policy designed to provide the needed liquidity for the normal function of the economy.

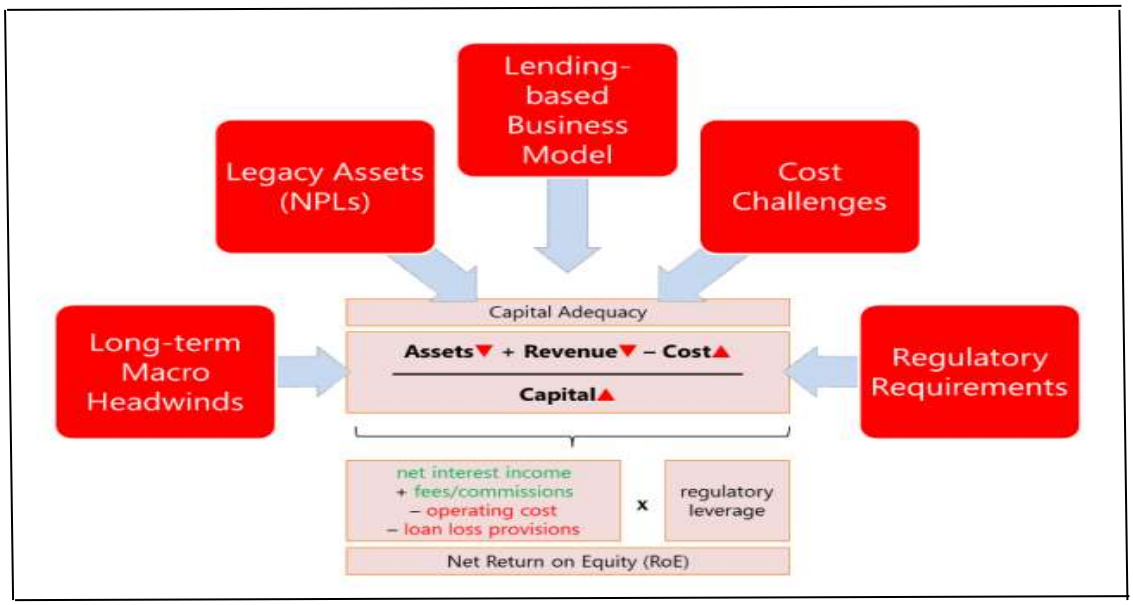
[1]Bonaccorsi. E., Gobbi, G. *The changing structure of local credit markets: Are small business special?*, Journal of Banking and Finance, 25: 2001. PP. 2209–2237.

As aforementioned, the situation was more aggravated by the beginning of the sovereign debt crisis, mainly in the countries where high levels of public debt extensively held by international credit institutions and they have problems in term of repayment, that have negative impact over the performance of the banking system.

To determine and identify all the factors that have been a part of the sudden drop in banking profitability is challenging. Additionally, an accurate level of interaction among the previous mentioned factors is highly depends on national specifications. Undeniably, it should be mentioned that the epidemic effect of the crisis was mostly caused by the group of countries, which have a single currency. On the other hand, they have different rules and controls on credit institutions.

The next figure identifies the main elements that have determined the sharp decline in profitability:

Figure N°01: Main factors effecting bank profitability



Source: Jobst A., Weber A. *Profitability and Balance Sheet Repair of Italian Banks*, IMF Working Paper, WP/16/175. 2016. P3.

The previous figure presented the essential factors that explain the dramatic reduction of banking profitability, with some differences according to the national contexts. Taking for example, the regulations in term of non-performing loans were different in each country, which makes it hard to harmonize their identification, measurement and control[1].

[1] FSI – Financial Stability Institute. *The identification and measurement of non-performing assets: a cross-country comparison*, FSI Insights on policy implementation, Bank of International Settlements, No. 7, April. 2018.

The banking sector has struggled with performance issues like all the other operators in the economy, which was characterized by macroeconomic weaknesses. Furthermore, the economy characterized with poor growth potentials may inhibits investment.

Consequently, banks will limit the granted loans, and this loan distribution reduction will lower interest income, this volume loss can be the cause for banks to assume a greater degree of risk, however, due to borrower's insolvency this can cause loans deterioration (NPLs), and as a result, credit loss provisions, also all the related costs[1].

The aforementioned phenomenon is more accentuated in the economy that depends on banking system as a source of financial resources development, in such economy the reliance was on bank credit, more specified by small-and medium-sized enterprises, a numerous credit institutions had economic and financial complications due to the predominance in many banking systems of a lending-based business model.

These issues drove to solvency crises, the previous problem was resolved through the injections of public capital, in other cases, it was the bank itself by the regulatory authorities[2].

The fundamental source of income in traditional commercial banks is bank profit margins, more particularly the net interest margin, therefore banks have strongly affected by the last GFC, result from:

- ✓ Lower revenues caused by reduced lending activity;
- ✓ An increase in funding costs needed to assure the adequate level of liquidity and to regulatory requirements.

Credit institutions faced the increase of higher risk premium demanded from institutional investors due to the growing climate of distrust; on the other hand, account holders shrink their contribution in the shape of deposits, where they usually do not receive interest rates.

The interventions of the supervisory authorities in the financial system, must me be added to this complex framework. Additionally, a considerable increase in the banks' capital base is required to ensure the system's solvency, through enormous recapitalization procedures with an objective to stringent capital necessities and the needed buffers to ensure the normal function of the banking system in unforeseen critical situations.

1.3.2. Cost efficiency and credit quality

As mentioned previously, the banking system had a troubled period over the last decade; a number of interconnected factors distinguished this period. The banking managerial

[1] ECB Banking Supervision. *SSM thematic review on profitability and business model*. Report on the outcome of the assessment, September.2018.
[2] ESRB – European Systemic Risk Board. *A new database for financial crises in European countries*. Occasional Paper Series, No 13/July. 2017.

domain was affected by the macroeconomic characteristics of the period, which made banks to refurbish their adopted strategies.

Back in the history, the banking system witnessed several banking crises, however, most of the time the crises were caused by poor management or mistakes of misbehaviour by the directors, but in some situation systemic crisis can be the reason, although it was related to a particular type of banks, and in specific area[1].

The banking sector was always predictable, and these predictions were most of the time positive and right, regardless of the fact that in the last years the world economy was facing some difficulties also banks were influenced by the instable conditions and regulations of the sector, however the banking system's performance was generally positive.

The international markets are recording a tremendous development and increasing financing of the economy, which guaranteed the profitability of the banking sector by the high volumes of transactions, also the evolvement of the transactions' quality, justified the raise of the brokerage commissions by the huge number of banking customers.

Even though the banking sector did not reach the performance of other sectors such as the Information Technology (IT) sector[2]. However, the profitability of the banking sector never been doubted or its important role of ensuring the normal functions of the economy. Investors have always included shares of listed banks to their portfolio for the upper-mentioned reasons. In fact, profits in banking sector is considered as guaranteed.

Therefore, the banking management are established based on two objectives; generating revenues and guarantying activity volumes, which facilitate the accompaniment of management costs to growth.

The banking system has one possible element of concern that is developing the level of competitiveness; back in 1980s was the emerging period of the banking system, due to outstanding assured returns. Furthermore, developing the competitiveness level was encouraged by the monetary authorities, by removing the structural regulatory limitations, and lowering the entrance barriers that facilitate the appearance of new operators in the financial and banking market.

The previous strategy adopted by the regulatory authorities had an objective of minimizing the costs for the final costumers, from the authority's point of view, the increasing level of competitively will reduce the charges and commissions for end users, which leads banks to generate more revenue from the volumes of the transactions, therefore more attention was given to costs incurred.

[1] Logan A. *The United Kingdom's small banks' crisis of the early 1990s: what were the leading indicators of failure?*, Bank of England Working Paper.2001. P.139.
[2] Preissl B.et al. *E-Life after the Dot Com Bus*t, Springer.2004. PP. 39-61.

Actually, beside the areas characterised with high number of population where competitiveness was accentuated and banks were able to have numerous branches, on the other hand, some obstacle appeared such as sociodemographic characteristics and the rarity of branches in rural areas.

Among the several challenges in the banking sector, the most important was the arrival of the banking services digitalization, this technological innovation made the presence of the costumer at the branch unnecessary and also it helps in reducing the time needed to make a transaction, at the same time it helped limiting errors.

Regardless of the tremendous investment required to implement this new IT structures and assure a high level of security to transactions and depositors accounts, costumers demanded decreases in commissions and charges for their different services; the perception of the clients of lower transaction costs was fed from the faster transactions and a lack of the human intervention.

Therefore banks were under the obligation to review their structural strategies and to reconsider their activity.

The evolvement of the digitalization, the increasing of sophistication and the safety of online banking services coincided with the great financial crisis, which made the branches most of the time useless because of the reduced volume of transactions.

Unquestionably, the branches maintain their economic value, but it is challenging to require the soft information at a distance or through completely automated operations, and it is more delicate to provide the required security.

However, this type of banking services required a high cost to maintain it. In addition, the banks were facing the consequences of the last financial crisis (more stringent regulations, losses on loans), encouraged banks to gather the data and other information and transforming them into "hard" information, where the access to this category of data is possible only for high levels of staff.

Granting loans is the operation the most affected by these changes, mainly by the regulations of Basel III, where banks are obliged to assign a rating to each borrower based on documented and objective factors. Different capital requirement for the bank is applied in case of the attribution to a certain class of risk, and it can reach the maximum in case of absence or non-allocation of rating[1].

The importance given to rating as key element in evaluating the costumer's solvency, and as result on the interest rate applied to the credit, this process surely made the evaluation more objective, however it does not provide a complete appreciation of soft information that cannot be treated by evaluation metrics.

[1] BCBS – Basel Committee on Banking Supervision. International Convergence of Capital Measurement and Capital Standards. A Revised Framework. Comprehensive Version, June. 2006.

Regardless the important implementation costs of an internal rating-based model[1], and the required approval of the regulatory authorities for its effective activation and its constant maintenance, several banks, specifically larger ones, have recognize this process as a fundamental component in its decisional procedure in term of granting credits to their clients.

The implementation of the Basel II standards back in 2004 and the occurrence of the GFC starting from 2007 were too close in time to permit an objective evaluation of the internal models 'effectiveness on the credit quality deterioration.

Nonetheless, it is obvious that the reliance only on digitalized data may not apprehend some, usually very important, components of evaluation, but these objective processes radically decreased the subjective aspects in credit-granting process, by which, in some situations caused significant solvency problems.

In this multifaceted context, the banking management faced significant challenges; one of the most important is cleaning the balance sheet that still affected by remarkable volume of non-performing loans, also identifies progression in the efficiency organizational structures, precisely in the area of transactional banking; the urgent definition of operational strategies within the fin-tech area. If not banks will face a remarkable decreasing of the profit margins, and progressive marginalization on the market.

Additionally, another factor makes a banker's choices difficult, the regulatory changes, where the regulators stated that the current regulations are far from complete. The new risks emergence and the brittleness of the loan-granting system necessitate a periodic review of the rules, however risk and ambiguous calamities added uncertainties and weighting on banks' profits for a long time.

[1] BCBS – Basel Committee on Banking Supervision. Basel III: Finalising post-crisis reforms, December. 2017.

2. BANK PERFORMANCE MEASURES AND DETERMINENTS

The Banking system is the centre of the modern economy. Therefore, the compliance of banks to international regulations established by the Bale agreements, and to guarantee positive profitability and performance ratios. After the financial crisis in 2007, the global banking system was affected by several factors that destabilised its financial equilibrium stress. Surely, the financial crisis did not only caused bank bankruptcies, also quasi-bankruptcies, nationalisations and a decline of large financial institutions[1]. Coming further, the subsections concerning determinants of bank performance, which is divided to internal and external determinants, And finally the banking performance analysis using CAMEL model.

2.1. BANK PERFORMANCE MEASURES: ROE, ROA, NIM

Financial and economic literature was able to define the banking performance, through several aspects that guarantee sustainable banking profitability. In this subsection, we will try to understand the internal determinants of banks performance, which can be determined as the performance indicators influenced by the bank's management decisions and policy objectives. The management effects are the outcomes of the dissimilarities in bank management policies, objectives, and actions mirrored in the differences in bank operating results, including financial performance and profitability. According to **Zimmerman (1996)** the fundamental factor in bank performance in management decisions especially, in term of loan portfolio concentration[2]. Several studies related bank performance to management quality, and management sound decisions, which can be financially measured and assessed through the use of traditional financial indicators: return on equity (ROE), return on assets (ROA), and net interest margin (NIM).

2.1.1. Return On Equity (ROE)

Return on equity of banks is a common factor of profitability, and it is a creamy topic of debates between banks and regulators. The ROE is defined as[3]:

ROE = (Net Income / Book value of equity)

Therefore, this indicator in banking sector can be increased or decreased in two ways: by a variation in net income, or by movements in the equities. Just before the last financial crisis, regulators drove banks to increase their ROE, by boosting income and maintaining the operating capital or with small capital buffers, as a consequence, the ROE of many banks excessed of 15%. Once the financial crisis hit, several banks found themselves in trouble caused by the adapted strategy to increase the ROE, which basically involves more risk taking. In that moment, banks that were operating with less equity were failing

[1] FERROUHI, El Mehdi. *Moroccan Banks analysis using camel model*. International Journal of Economics and Financial Issues, 43: 2014. PP.622-627.
[2] Zimmerman, G. *Factors influencing community bank performance in California*. Federal Reserve Bank of San Francisco 1. 1996. PP.26-41.
[3] Berger, A.N. and C.H.S. Bouwman. *How does capital affect bank performance during financial crises?* Journal of Financial Economics 109. 2013. PP. 146-176.

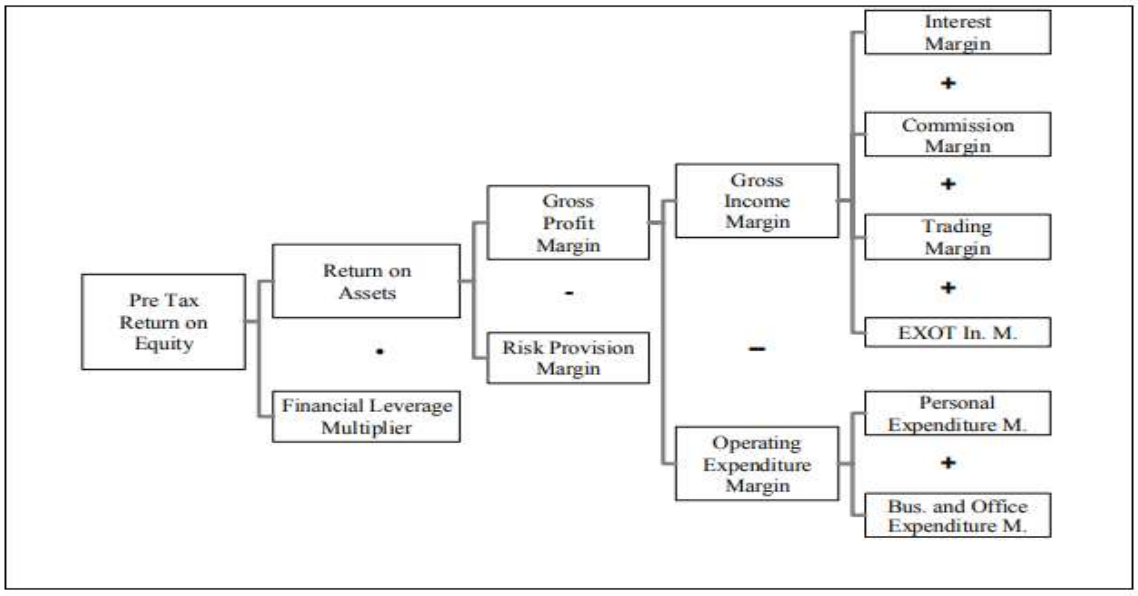
and needed the state assistance, since then, regulators tried to prevent this from happening again with increasing the required capital over the years.

In contrary with corporation that focus on Earnings Per Share (EPS), banks accentuate ROE, where investors define it as a key indicator to assess the market value and growth of a bank. This differentiates banks from conventional enterprises, where bank can offer interest on the collected financial resources that is a part of its capital. Banks are more motivate on managing capital to maximize shareholder value than growing earnings[1].

On the other hand, the international banking regulators such as Basel committee, in Basel III defined the minimum capital requirements, so it increased the banking working capital, which caused the shrinking of the ROE. Consequently, the level of banking ROE have been decreasing as recommended in the passage of 2009 reform. After issuing the Basel III recommendations, banking ROE has recorded an average around 5% to 10%.

The ROE ratio is a tool to measure the financial performance of a bank, and it is simply applicable using the data of the financial statements, the simplicity of this ratio is an advantage to facilitate the analysis phase. Cole (1972) proposed data separation based on the diversity between expenses and income, this suggestion uses the key sources of income: Net interest income; Commission income; Trading and other income. The following figure provides the ROE scheme for banks:

Figure N°02: ROE scheme for banks



Source: Christian Kalhoefer and Rania Salem, Profitability analysis in Egyptian banking sector. Faculty of Management Technology. GUC. Working Paper No. 7. 2008. P10.

[1] Investopedia, https://www.investopedia.com/ask/answers/040815/what-level-return-equity-common-company-banking-sector.asp, visited the 17/04/2020.

The previous figure would be clearer after understanding the expenditure scheme, as the following table present the different type of general expenditures, administrative expenditures and depreciation, with its result over the bank income statement:

Table N°03: Bank income statement

Gross Interest Income **– Interest Expenditures**
= Net Interest Income **+ Commission Income** **± Trading Income** **± Other Income**
=Total Operating Income **– Total Operating Expenditure** **(1) Personnel Expenditure** **(2) Occupancy Expenditure**
= Gross Operating Profit **– Provisions for Loan and Lease Losses**
= Net Operating Profit **± Extraordinary Profit/Loss**
= Net pretax Profit **– Applicable Taxes**
= Net after-tax Profit

Source: Ibid, Christian Kalhoefer and Rania Salem. 2008. P13.

The income statement can be distinguished from bank to another, according to its accounting rules, and as clarified in figure 02, ROE scheme is organized as follow:

- ✓ Income components decomposition;

Table N°04: Bank Income decomposition

IM = Interest Margin = IM =Net Interest Income / Total Assets
CM = Commission Margin = CM = Net Commission Income / Total Assets
TM = Trading Margin = TM = Net Trading Income / Total Assets
EXOT = Extraordinary and Other Income Margin = Net Extraordinary and Other Income / Total Assets

Source: Own computation

The aforementioned income ratios their sum result the Gross Income Margin, if:

- ✓ **Operating Expenditure Margin (OEM) = Operating Expenditure / Total assets**;

From the previous equation, we can deduct the GPM:

- ✓ **Gross Profit Margin (GPM) = Gross profit / total assets**;

At this stage, we can subtract RPM:

- ✓ **Risk Provisions Margin = Risk Provisions of the year / Total Assets;**

We concluded that:

- ✓ **Return On Assets (ROA) = Net Profit / Total Assets;**

If we replace the denominator from Total Assets to Shareholder's Equity, the result will be as follow:

- ✓ **Return on Equity before tax (ROE bt) = Net profit / Shareholder's Equity.**

The outcome of the ROE-scheme offers general understanding of the profitability structure in banks.

2.1.2. Return On Assets (ROA)

Usually, Return on Assets (ROA) as performance indicator is more reliable than (ROE), concerning efficiency performance, as ROA is adjusted for leverage (ROA = ROE / leverage). Furthermore, ROA as a performance measurement give the investor an image of how profitable a bank is relative to its total assets[1].

[1] Beyond ROE – how to measure bank performance, European central bank report, 2011.

Basically, ROA is the capacity of a bank's management to make profits from the bank's assets, although due to off-balanced-sheet activities it can be biased. ROA is frequently denoted as the bank's equity multiplier that evaluates the financial leverage. The banks that report higher ROA, they have lower leverage, consequently higher equity and lower ROE. ROA appears to be the key ratio for banking performance measurement[1].

The return on assets formula as previously mentioned is:

- **ROA = Net Income / average Total Assets**
- **ROA = Profit Margin / Total Assets turnover**

The first equation use average total assets as denominator, this is due to the fluctuation of the assets owned by the bank through the time, also it can be due to the seasonality of the banks revenue, and by using the average assets over time eliminate those issues.

The after-tax income is used to determine the return on assets of a bank, and to evaluate the profitability of every monetary unit in the assets that it owns. The return on assets is generally applied to test the bank's return to shareholders.

The ROA is a benchmark ratio, and to compare the profitability of a bank to another, this indicator can be useful if only it was applied and compared between operators of the same sector, as it is will be used in this these in the banking sector, that is because dissimilar sectors require different amount of capital and assets to generate profits. Furthermore, ROA would be optimally useful if we compare the ROA ratio of the same bank over time, which mean, to compare it to different stages in the bank life cycle.

2.1.3. Net interest Margin NIM

The third traditional performance measure is Net Interest Margin (NIM), this indicator determine the bank profitability, it is the return of the bank intermediation activity, which is collecting deposits and granting loans, and the intermediation between those who have financial resources surplus, and those needs it. More precisely, this indicator is conducted by[2]:

NIM = Net Interest Income / Interest-Earning Assets

Where Net Interest Income is calculated as follow:

Net Interest Income = Interest Income – Interest Expenses

Where Interest Income is conducted from the bank's granting loans activity and Interest Expenses is the sum of interest paid to those who put their saving in a particular bank looking for interest income by the end of the deposition period.

[1] Panayiotis P. Athanasoglou. And al. *Bank-specific, industry-specific and macroeconomic determinants of bank profitability*. Int. Fin. Markets, Inst. and Money (18). 2008 .PP. 121–136.
[2] Rubi Ahmad and Bolaji Tunde Matemilola. Determinants of Bank Profits and Net Interest Margins. Researchgate. 2014. PP. 229-248. https://www.researchgate.net/publication/257811193.

Different from the aforementioned performance indicators, Net Interest Margin has this essential reason, that it uses information of the revenues and costs acquired from the traditional activity of a bank to calculate this indicator, but not other type of revenue and cost. This can be consider as a limitation of this indicator, because of abandoning several revenues originating from the bank's income statement, precisely, the NIM index emphasis a narrow bunch but very important budget items, which permits us to determine the financial performance of the bank's core business.

The other profitability indicators such as ROE and ROA can be influenced by the numerator of the NIM indicator, which is net interest income, as one of the most important elements in the net income of a bank. In case of the shrinking in net interest income the bank activity must be reinforced with strengthening of business lines, or by limiting the operating costs, or also by non-recurring incomes. All the proposed offset strategies come with several types of risks that need to be well examined and managed[1].

The NIM index has continuously been a debate territory between professionals and academicians, just after the international financial crisis, the NIM indicator has developed a high importance in bank performance analysis. Since 2007 banks was presenting severe deterioration in loan portfolios, non-performing credits increased immensely, bank operating with customers that generate high risk and with a high share of credits over total assets were facing disciplinary action from the financial authorities.

The banks that were the most effected by the crisis are small and local banks, which have limited financial portfolio, and concentrated on the traditional intermediation bank activity, however, large and foreign banks also witnessed critical problems. Several monetary and economic policies were adapted by the monetary authorities to prevent the rapid spread of the financial crisis to the economy, the policy was to lower the short-term interest rates, also in developed countries it was complemented with sharp decreasing in long-term interest rates, as a result the yield curve was flatten.

The previous two components of the monetary policy had an impact over the banking NIM indicator the effect was over the denominator and numerator (Net Interest Income, and Interest-Earning Assets) of the indicator. Consequently, the progression of the NIM index led to the role of presenting the way banks can change their liabilities and assets management according to the economic context changes, also showed the interest of keep the track of performance indicator in crisis period[2].

Beside the importance of the NIM index in analysing banking performance, also it has several boundaries. As mentioned heretofore, the nature of the NIM indicator is to only concentrate on net interest income, and this performance measure abandon other incomes that the bank may generate with annex activities. During the last few contacts, banking

[1] Abreu M., Mendes V. *Commercial bank interest margins and profitability: evidence for Some EU Countries*, Proceedings of the Pan-European Conference Jointly organized by the IEFS-UK & University of Macedonia Economic and Social Sciences, Thessaloniki, Greece, 17–20 May.2001.
[2] Beltratti A., Stulz R.M. *The credit crisis around the globe: Why did some banks perform better?*, Journal of Financial Economics, 2012. P 105.

system witnessed enormous development and diversification in term of financial products that generate significant revenue flows, referring to the different financial products authorised and promoted by the monetary authorities.

Even though, net interest income is at the heart of the financial performance of a bank, only 30% to 40% of the bank operating revenue is from non-interest income, for this reason, NIM jeopardies offering an ambiguous image of a bank's capability to generate income[1].

Another limitation of the NIM indicator is its incapability in term of calculating the net interest income that it cannot separate between interest income and interest costs. If the NIM numerator is increasing, that might me from two different reasons, it can be from healthy assets profitability, or as it can be from cheaper funding sources, so each situation have a precise risk causes.

The amelioration of interest income levels might be caused by granting loans to riskier customers that are ready to pay extra to cover their risk of insolvent. However, decreasing interest rate on savings might fade away customer loyalty, or cause cash withdrawal[2].

At the end, the Net Interest Margin indicator neglects the importance of efficiency that distinguishes the bank from other operators in the sector. Dissimilar to ROA and ROE previously mentioned, the NIM index does not take into consideration any signs about the operating costs, and it is restricted in interest costs as a component of the bank expenditures. As the efficiency is a significant problem in the banking sector, this NIM limitation may be crucial in term of this indicator uses[3].

Subsequently to the previous section, where we tried to explain the main bank performance measures, the next subsection is deducted to an important bank performance aspect, which is the bank performance determinants, this feature can be divided to internal and external determinants.

This division usually in empirical research is based on two factors: in one hand the organizational, competitive and financial decisions by top management and on the other hand to external factors as inflation, business cycle and regulation.

2.2. INTERNAL DETERMINENTS OF BANK PERFORMANCE

The financial performance or profitability in a traditional enterprise is generally linked and determined by managerial decisions and choices in term of strategy, production and organization, the managerial choices are made as a respond to the external imitations, to ameliorate the efficiency of the enterprise and prediction of the competitors' moves.

[1] Calmès C., Theoret R.*The Impact of Off-Balance-Sheet Activities on Banks Returns: An Application of the ARCH-M to Canadian Data,* Journal of Banking and Finance. 2010. P. 34.
[2] Carbo Valverde S., Rodriguez Fernandez F. *The determinants of bank margins in European banking*, Journal of Banking and Finance,2007. P. 31.
[3] Stiroh K.J. *A Portfolio View of Banking with Interest and Noninterest Activities*, Journal of Money, Credit, and Banking, 2006. P.38.

At this stage it is suitable to sustain the theory that it does existed a direct relation between managerial decisions and the profitability of a bank, and for the first instance, it is ideally to link the serious problems in the financial aspect of a bank to a bad management.

The last prediction is due to the reality that a wide range of profitability elements are controlled and affected by the top management decisions, therefore the stability and the risks faced by a company is in their hands, these elements can be grouped under the headline: internal determinants of bank profitability[1].

Several empirical researches had extensively studied the effect of the internal determinants over the bank financial performance, these researches recorded contradictory results. However, this problem of the bank financial determinants is always interesting and motivating to professionals and academicians.

2.2.1. The size of a bank

One of the most prudently discovered factors between the determinants of bank performance is the size of a bank. In traditional companies, the size of a company was tremendously examined and well-known subject not only the financial aspect. On the other hand the financial determinants have several effects on the bank performance, for Shehzad (2013)[2]**:** the size of a bank as factor in the bank profitability can be linked to creation of economies of scale.

In contrary, the large size banks can have particular understanding of some subjects, different ways of issues treatment, and several methods to control their demeanor and financial outcomes. The study of bank size is present practically in all empirical works as a control variable, where the differentiation in term of size is essential to ensure that the research findings are valid, and especially if the research sample is wide so this discrimination becomes fundamental.

Furthermore, in international market we find a small banks operating simultaneous with mega banks in the same market, granting loans and collecting deposits on a global scale, in such situation, taking into consideration the size of a bank is critical and should be studied judiciously[3].

Nevertheless, the empirical researches that studied the impact of size over bank profitability provided conflicting findings. The economies of scale in the banking sector is controvertible, generally, some researches such as the study of Tregenna (2009) [4] found

[1] Rasiah D. *Review of Literature and Theories on Determinants of Commercial Bank Profitability*, Journal of Performance Management, 2010. P. 23.
[2] Shehzad C.T., et al. *The relationship between size, growth and profitability of commercial banks*, Applied Economics, 2013 .P.45.
[3] Goddard J., et al. *Dynamics of Growth and Profitability in Banking*, Journal of Money, Credit and Banking. 2004. P. 36.
[4] Tregenna F. *The fat years: the structure and profitability of the US banking sector in the pre-crisis period*, Cambridge Journal of Economics. 2009. P. 33.

the existence of inverse relationship between the size and the profitability indicators in a bank, where the advantages related to size decrease as the size increases.

The previous mentioned results have logic in its folds, since the size generate negative as positive aspects to the business, where it generates a range of beneficial scale effects, however at the same time, it engenders some diseconomies related the size itself as the organizational costs.

Therefore, if the negative impact is greater than the positive one, it becomes a damaging feature for bank performance. Although, for small banks the opposing may happen, where this type of entities may benefit the economies generated from competitive advantages, such as the non-necessity for extremely qualified skills, or to be geographically widely present. For this end, it is fair to state that there is a relationship between the size and the profitability of a bank; however the sign of this link is not yet certainly determined.

2.2.2. The business model of a bank

The business model of bank is an essential component of the internal performance determinants, where this factor profoundly conditions the strategic decisions in term of market positioning and its return-risk profile[1]. The researchers in this subject allocated enormous empirical resources just after the international financial crisis in 2007, the amount of researches in the topic is indirectly proves the position of the business model choice in bank's income and financial results.

Due to precise factors, the orientation of a bank to a particular business model can be determined, that the top management declared the strategic choice, or on the other hand, by factors that tend to apprehended précised and important connotations of the bank's activity. Among these, we can derivative two variables, which are the balance sheet and the income statement of a bank, respectively, the credit share over the total assets and the interest income.

The loan portfolio's share over the total assets in a bank define its strategy in term of the intermediation role of granting credits and collecting financial resources, in a particular situations, where the opportunity to carry out deeper analysis is possible by the availability of the adequate data for the study, in this case, it is doable to concentrate on precise type of credits, like those granted to retail customers.

For the bank, it is more rational to distinguish margin profiles from retail and wholesale operations, the differentiation is also valid for the liabilities side, in term of explain the capability of the bank to collect deposits from retail clients[2].

In the last decade, the international banking systems witnessed financial turbulences that shown how a strategic choice of the bank toward lending activity have a direct influence

[1] Gambacorta L., van Rixtel A. *Structural bank regulation initiatives: approaches and implications*, BIS Working Papers. 2013. P. 412.
[2] Demirgüç-Kunt A., Huizinga H. *Financial Structure and Bank Profitability*, World Bank Policy Research Working Paper, no. 2430, August. 2000.

on the bank financial performance, where the latter is dependent on the features of the economic cycle. Through the same period, the banking system knew a huge evolvement, where loans (especially mortgages) was the main share in bank revenues, the loan market was progressing, and the interest rates were tremendously getting high.

This phenomenon did not last so long. it crushed down, then the model fragility of development was shown. In addition, this incident proved the non-stability of the bank revenues. In 2013, Goddard[1] conducted a study concentrating on the part of credits over the total assets and its contribution on the financial performance in a bank, where he had as result that in certain period such as during the financial crisis, the part of loans out of total assets have a negative contribution over the bank profitability.

The interest income as the second variable of the business model is validating the considerations made with reference to the loan share, furthermore, researchers found a positive relationship between the two variables[2]. The quality and quantity of the loans granted by the bank defines the amount of interest income in the financial statements, other factors need to be taken into consideration in term of the loans quality will be further discussed.

However, banks that operate on traditional retail commercial activities tends to have an important part of share of interest income out of operating revenues, in time of market prosperity this makes the bank very profitable, on the other hand, in times of market turbulence this makes the bank very fragile [3].

The aforementioned aspects are related to the business model choice of a bank. However, usually they are treated disjointedly, on one hand, the focus on one source of income exposes the bank to tremendous risks, there for, revenue diversification is fundamental.

Large banking groups now are heading for revenue diversification, changing from consulting to asset management, and from lending to trading, today banking activities have a large of sources of revenue. The theory of "do not put all your eggs in one basket" is valid for bank revenue diversification as in portfolio theory, where the concept is simple strategy in term of banking risk management.

Although, the strategy of diversification can be applied in traditional companies with low costs, but in banking sector the strategy is expensive and difficult to carry out. In banking world, the revenue diversification requires several investments; the implantation of organisational process, technological investments, and acquisition of skills for employees

[1] Goddard J.,et al. *Do Bank Profits Converge?*, European Financial Management, 2013. P. 19.
[2] Kok C., Móré C., Pancaro C. *Bank Profitability Challenges in Euro Area Banks: The Role of Cyclical and Structural Factors*, Financial Stability Review, Volume 1, European Central Bank. 2015.
[3] Stiroh K.J. *A Portfolio View of Banking with Interest and Noninterest Activities*, Journal of Money, Credit, and Banking, 2006. P.38.

assigned to the innovative roles. These changes necessitate a massive investments and it is an immense cost for the bank if it did not come to manage and to bear it down[1].

The adoption of revenue diversification strategy cannot be achieved in short time regarding its requirements, and the necessity for appropriate adaptation time for the different organs in the bank, the same for financial stock selection.

This strategy can fire back, where the cost of diversification can be high caused by the volatility made from the new sources of revenue, which can be greater than the positive effect of the strategy itself that would lead to a loss of the bank deriving from the low correlation between the several activities carried out. Stiroh and Rumble (2006)[2] in their famous article introduced this phenomenon by calling it "dark side of revenue diversification, although, there is no empirical evidence linked the impact of the revenue diversification on the bank financial stability and profitability.

On the other hand, the credits and interest rate income subject can be affected by the possibility of loans market deterioration, as in the last international financial crisis. The literatures in this subject are several, in term of the part of non-performing credits over the total credits, concerning credits that necessitate particular attention over the total credits, or loan provisions injected in income statement of a bank. There is empirical evidence concerning these different aspects, where they have negative impact over the profitability of a bank[3].

2.2.3. Capital level

Another internal determinant of financial profitability in a bank is the role played by a bank regulatory capital level, in the subsection dedicated to bank performance measures, we presented the consequence of having low level of intermediaries equity can provide tremendously high level of ROE. Although, the fragility recorded the last decade of the banks categorized by high level of capital ratio is now limited by the prudential regulation proposed by international market authorities[4].

View the importance of the financial leverage, empirical researches have proved that there is a positive relationship between financial leverage and risk default of a bank, which a lower level of capital ratio walk hand in hand with lower level of risk default for the bank, consequently, the bank will be more flexible financially in term of market deterioration. These concepts should participate to decrease the expectations of stakeholders 'returns, by facilitating the creation of value. Although, the analysis using ROE as dependent

[1] Sanya S., Wolfe S. *Can Banks in Emerging Economies Benefit from Revenue Diversification?*, Journal of Financial Services Research, 2011. P.40.
[2] Stiroh K.J., Rumble A.*The Dark Side of Diversification: The Case of U.S.* Financial Holding Companies, Journal of Banking and Finance, 2006. P.30.
[3] Chronopoulos D.K.,et al. *The dynamics of US bank profitability*, The European Journal of Finance, 2015. P.21.
[4] Dietrich A., Wanzenried G.*The determinants of commercial banking profitability in low-, middle, and high-income countries*, The Quarterly Review of Economics and Finance, 2014. P.54.

variable will have a negative influence from capital ratio, because of the equity presence in denominator of the ROE indicator, and in the leverage numerator[1].

The international banking sector witnessed in modern economy a serious decrease in interest rates, but an increase in competition level. In these circumstances, among banks there is gap of profitability levels, this specific factor is the efficiency level of each bank, this efficiency is the capability of banks to cover the costs when incomes become narrower. Additionally, the fixed costs of bank make the bank's income and revenue more volatile. However, in the literature another ratio is used called the cost income ratio[2]:

Cost income ratio = Operating costs / Operating income

This indicator highlights the ability of a bank to balance recurring costs and revenues. However, there are banks can operate with very low fixed costs, due to their particular structure. Generally, banks that have traditional intermediation activity and able to keep their fixed costs low tend to have greater profitability than others.

Keeping the cost income ratio under an acceptable level needs a great care from the bank's management itself, also in term to establish effective benchmarking activities among competitors. In this concern, it should be illustrated that the significance of the cost income ratio related to the bank's ability to benchmark between its costs and revenues, and not only to provide a demonstration of the costs incurred. The cost income ratio can be managed through achieving an increase in revenues at the same time to reduce the costs, so the relationship between the numerator and the dominator of this ratio that is significant. But also there is indirect relationship between cost reduction and revenue deterioration, where the banks that tend for policy of cost reduction are more likely facing costumer's dissatisfaction with the received services than consequently reduction in future revenues of the bank.

The cost income ratio is one of the most important indicators that show the ability of the bank's management to interfere in its performance. At the end of this subsection, there are other internal determinants related to the governance characteristics in a bank that can affect the bank profitability and performance: the organizational structure of the bank, its nature (cooperative banks), its governance (membership), and several researches concentrated on these aspects in different timing and contexts[3].

2.3. EXTERNAL DETERMINENTS OF BANK PERFORMANCE

The banking system is essential for the functioning of financial markets. Also the whole economy, their intermediation activities based on their role of risk and asset management lead the banking system to be a fundamental structure in the economy of any country, the

[1] IMF – International Monetary Fund. Spain: Financial Sector Assessment Report; Technical Note: Determinants of Bank Profitability, IMF Country Report No. 17/339, Washington, DC. 2017

[2] Molyneux P., Thornton J. *Determinants of European bank profitability: A note*, Journal of Banking and Finance,1992. P. 16.

[3] Iannotta G.,et al. *Ownership structure, risk and performance in the European banking industry*, Journal of Banking and Finance,2007. P.31.

bank is a direct relationship of intermediation between the bank and its environment; enterprises, public administrations, families and households. To this end, the banking sector is in a strong relationship with its environment.

Furthermore, these environmental factors have an effect over the sustainability of the bank and its profitability. In previous researches, the external determinants of bank performance are usually grouped in three types: competitive factors, regulatory factors and macroeconomic factors. The external elements that are the most that affect the bank performance are economic cycle, inflation and the level of market interest rates.

2.3.1. Macro-economic factors

The economic or business cycle is generally estimated by the variation and the volatility of the Gross Domestic Product (GDP), precisely, the bank performance is predicted to trail a pro-cyclical trend[1]. Economic recession or GDP reduction lead to bank income shrinking, on the other hand, GDP growth therefore stimulate bank's revenues, this positive relation is due to the effect of GDP variation over the customer default, consequently the increase and decrease of the non-performing loans of a bank.

The GDP growth as variable is present in several empirical researches, among this academicians we found Goddard et al. (2004)[2], Demirgüc-Kunt and Huizinga (1999)[3], Arpa et al. (2001)[4], Bikker and Hu (2002)[5], Schwaiger and Liebig (2008)[6] and Dietrich and Wanzenried (2014)[7]. These previous researches have reached a positive relationship between the GDP growth as the variable that measures the development of economic activity over the bank performance, where a period of prosperity and growth lead to increase the investments and households consumption, consequently raise the loans and as a result affect positively the bank performance.

Several studies interested in the impact of inflation and interest rates as external profitability determinants in the banking sector, where interest rate reduction proved to be the cause for the shrinking in the bank's margins[8]. However, the inflation as macroeconomic external factor was demonstrated in most of the empirical studies to have a negative relationship with the bank performance, where the focus is on the bank's

[1] Kanas A., Vasiliou D., Eriotis N. *Revisiting bank profitability: A semi-parametric approach*, Journal of International Financial Markets, Institutions & Money, 2012. P. 22.
[2] Goddard, J., et al. *The profitability of European banks: a cross-sectional and dynamic panel analysis*. Manchester School, 72(3), 2004. PP.363-381.
[3] Demirgüç-Knut, A., Huizinga H. *Financial structure and bank profitability*, World Bank Policy Research Working Paper, n 2430, August. 1999.
[4] Arpa, M., et al. *The influence of macroeconomic developments on Austrian banks: implications for banking supervision*. BIS Papers, 1, 2001. PP. 91-116.
[5] Bikker, J.A., Hu, H. *Cyclical patterns in profits, provisioning and lending of banks procyclicality of the new Basel capital requirements.* BNL Quarterly Review, 221, 2002. PP.143-175.
[6] Schwaiger, M.S., Liebig, D. *Determinants of bank interest margins in Central and Eastern Europe.* Financial Stability Report, 14, 2008. PP. 68-87.
[7] Dietrich, A., Wanzenried, G. *The determinants of commercial banking profitability in low-, middle-, and high-income countries*. The Quarterly Review of Economics and Finance, 22, 2014. PP. 1-18.
[8] Claessens S.,et al. *Low-for-long Interest Rates and Net Interest Margins of Banks in Advanced Foreign Economies*, IFDP Notes, Board of Governors of the Federal Reserve Board, Washington, DC. 2016.

capability to stabilise an adequate level of marginality by passing on price increase through the rates offered and charged to clients[1].

2.3.2. Competitive factors

In imperfectly competitive markets, the banks were able to benefit from the market imperfection (monopolistic or oligopolistic returns). Nowadays, using proxies such as Herfindal Hirschman index or the market share for the top 3,5,10 banks, market competition is a control variable in bank performance[2]. Among the traditional theories that deal with the impact of market competition on the firm profitability that was applied in the banking sector are[3]: Structure-Conduct-Performance (SCP), the Efficient- Structure hypothesis, the Expense Preference hypothesis and the Galbraith-Caves Risk avoidance hypotheses. The conducted results showed that an oligopolistic rent is generally caused by a high level of market concentration related with collusive behaviours. Although, the effect of competition on the bank performance still ambiguous and uncertain, due to the results of the previously mentioned researches, which illustrate that the final outcome can be the compression of the bank's margins and reduction of the overall profitability in case of harsh competition between intermediaries.

2.3.3. Regulatory factors

The last factor that can explain the bank's ability to generate profits and to be financially profitable is the regulation factors, as the regulations can control the activity of the bank, by prohibiting certain activities, or on the other hand, obliges the bank to play certain role. Over all, the banking regulation have a purpose to affect the income opportunities of the operators in the banking sector, the study of the effect of the this factor on the financial performance should take into consideration the different regulation found in each country, therefore, the necessity to harmonize the process of the study. Due to the dissimilarities among countries it is quite difficult to include regulatory differences in a single study[4].

This subsection makes clear conclusion. That bank performance measures and determinants have a particular process of selecting the most suitable financial indicators. Also that the evolvement of the evaluation process, and financial statement reclassification has generated a proliferation of financial ratios, therefore, the researcher found himself under the obligation to make particular selections, and to adopt indicators with a significant interpretative content.

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[1] Beltratti A., Stulz R.M. *The credit crisis around the globe: Why did some banks perform better?*, Journal of Financial Economics, 2012. P.105.

[2] Mirzaei A., et al. *Does market structure matter on banks' profitability and stability? Emerging vs. advanced economies*, Journal of Banking and Finance, 2013. P.37.

[3] Rasiah D. *Review of Literature and Theories on Determinants of Commercial Bank Profitability*, Journal of Performance Management, 2010. P.23.

[4] Barth J. R., et al. Bank regulation and supervision: what works best?, Journal of Financial Intermediation. 2004. P.13.

3. ALGERIAN BANKING SECTOR

The Algerian banking system knew several changes, starting from the French colonial stage, to the liberalisation phase, these changes created a numerous of barriers in the face of developing a healthy system as planned by the Algerian authorities. Subsequently, the Algerian banking system was ruled and controlled by the public authorities to emerge an industrial sector that distinguished by an intensive capital production technology.

3.1. THE EVOLUTION OF THE ALGERIAN BANKING SECTOR

In 1986 the Algerian government was pushed by the economic crisis to adopt massive economic reforms in which this reform was shaped in improving the Algerian banking system. Measures as focusing on the correction of the macro-economic imbalances, stimulate the foreign direct investment, and open the Algerian economy to the international competition were needed to smooth the transition from the centrally-planned economy to the market economy[1].

3.1.1. Historical background of the Algerian banking system

The Algerian banking system went through several stages, more precisely it is characterized with five phases; colonial, sovereignty, nationalization and socialization, restricting, and liberalization phase.

During the colonial phase, the Algerian banks had an objective of financing the colonial economic activities and providing currency exchange services. The Algerian banking system was presented by the Bank of Algeria, which was an annex of the French Bank.

Additionally, the Algerian banking system was established with branches and subsidiaries of French banks, therefore, the French authorities created the Algerian council of credit that have a mission to regulate the development of the banking system. In general, the Algerian banking system were implanted around the large cities, also they were specialized in financing the colonist agriculture activities, foreign trade, petrol and mining exploitation[2]. Post-colonial stage, the Algerian authorities found itself in the obligation to create an independent economy from the French government, since 1962 the political ideology of the Algerian government was a socialist economy controlled by the state in order to ameliorate the living conditions of the Algerian citizens.

As result to the new orientations of the Algerian government several colonial banks stopped their activities, also the liberal banks remained refused to finance the Algerian development programs, or deal with companies owned by the state, using as an argument that these activities is in contradiction with their liberal commercial objectives. Therefore the Algerian government found itself in the necessity to create its own banking system that is ready the finance the government program. The creation of the Central Bank of

[1] Ruppert, E. *The Algerian Retrenchment System: a financial and economic evaluation*. The World Bank Economic Review, 13(1), 1999.PP.155-183.
[2] Latrach, T.Z. *Banking techniques*. Algeria: University Publications Offices. 2001.

Algeria (CBA) was followed by the creation of the "Caisse Algerienne de Development" (CAD) to provide medium and long term loans. Then the establishment of the "Caisse National d'Epargne ET de Prévoyance" (CNEP) in order to collect savings and to finance the Algerian housing programs[1].

The third stage of the Algerian banking system historical background was the nationalization and socialization phase during this stage three banks owned by the state were created, which are: Banque Nationale d'Algérie (BNA), Crédit Populaire d'Algérie (CPA) and Banque Extérieure d'Algérie (BAE).

This period was distinguished by the domination of the Algerian authorities over the economy and the banking system to finance the planned program of development, therefore the role of the banking system was passive and restricted in financing the investment programs. This period the fundamental financial institution is the treasury that managed the government financial resources; on the other hand, the banking system was just a channel that allocates capital according to the Algerian authorities 'plans[2].

Early in the eighties, the Algerian banking system was boosted by the creation of two commercial banks: "La Banque de L'Agriculture ET du Developpement Rural" (BADR), and "La Banque de Development Local" (BDL).

Moreover, this stage has as distinctive point the restructuring of the companies owned by the Algerian authorities to improve their profitability. Also these enterprises had to benefit from treasury fund to get rid of their debts.

The last change witnessed by the Algerian banking system was to liberate the economy, after a severe chain of crisis back in the 1986 the Algerian economy was seriously harmed by the dramatic fall in oil prices. The mentioned unfavourable events caused the collapse of the currency reserve and increased the level of the external debt[3]. Furthermore, the necessity to make serious reforms to the economic sectors including the banking sector was fundamental.

The Algerian banking system during this period straggled with insolvency problems, caused by the enterprises owned by the state; they were unable to attain their objectives and also damaged the banks financial situation. Consequently, in 1986 the law of bank and credit was issued, this law has an objective to make essential changes to the banking sector. On the other hand, the Algerian government used this law to determine the legal framework that describes the activities of the financial institutions.

The banking sector had the autonomy needed to established their own dependent objectives from the Algerian authorities, so banks were allowed to collect financial

[1] El-hassar, C. *Réformes et opportunités d'investissements dans le secteur bancaire Algerien*. Média Bank, 48, 2000. PP.4-8.
[2] BenHalima, A. *Le Système Bancaire Algérien: Textes et Réalités.* Algiers: Dahlab.1996.
[3] Meliani, H., Aghrout, A., and Ammari, A. *Economic reforms and foreign direct investment in Algeria*. In Aghrout, A., and Bougherira, R.M. (Eds.), *Algeria in transition: Reforms and development prospects*. London: Routledge.2004. PP. 87-101.

resources despite their forms and duration, also offered loans for the short and long terms, and to be able managing their own credit risk. But, the autonomy provided to the banks emphasized its responsibility to allocate financial resources to finance the investment programs, and reduce the burden and limit the role of the treasury.

The Central Bank of Algeria restored its conventional role of being the bank of banks, and being responsible to identify the monetary policy also the distribution of loans. Banks and credit law furthermore shaped the relationship of the bank and its customers, also created a new control and advisory institutions.

The law of 1986 allowed the Algerian authorities to straighten the mission of a bank, so the bank will be able to fix its strategy based on economic objectives rather than social objectives. Regardless of how the law autonomies the banking system it did not have a huge effect on the banking sector, because of the enterprises controlled by the state and managed by centralised system[1]. In 1988 an improved version of the banks and credit law was issued in order to supply the needed autonomy to the economic public enterprises with the financial institutions included. Political, social and economic crisis were witnessed by Algeria, at the end of the eighties, these crisis affected the production system, aggravated the external debts, and limited the importation.

The Algerian citizens were influenced, and living standards were deteriorating, as consequence Algerians called the authorities to make serious reforms. As the Algerian authorities applied what people demand the socialist era was finished, and replaced by a market-oriented system following the recommendations proposed by the International Monetary fund (IMF)[2]. The change from socialist system to market-oriented system required reforms, which help the economy establishing solid macroeconomic environment. Accordingly, programs that provide economic stability were created.

The new economic reforms had as objectives to correct the macroeconomic imbalances, attracting foreign direct investment, encouraging privatization[3]. To complete the reform, a sound banking system was obligatory, so the economy would have an effective monetary policy. Nevertheless, in low-income country as Algeria was in this period are distinguished with concentrated banking system and poor institutional environment, they were known also with the effectiveness of the monetary policy for the macroeconomic stabilization.

The study of Mishra, Montiel, Pedroni, and Spilimbergo (2014) proved that an aggressive monetary policy in such environment would worsen the macroeconomic stability[4].

[1] Hadj-Nacer, A.R. *Les Cies de la réforme*. Algiers: E.N.A.G.1990.
[2] Oufriha, F.Z. *La difficile transformation du système bancaire en Algerie*. In Chenntouf, T. (Ed.), *L'Algérie face à la mondialisation.* Dakar: CODESRIA. 2008. PP.115-163.
[3] Saad, M., Meliani, H., and Benosman, M. *The Tortuous and Uncompleted Privatisation Process in Algeria*. In Majumdar, A.M., and Saad, M. (Eds.), *Transition and development in Algeria: economic, social and cultural challenges* . London, UK: Intellect Ltd.2005. PP.17-27.
[4] Mishra, P., Montiel, P., Pedroni, P., and Spilimbergo, A. *Monetary policy and bank lending rates in low-income countries: Heterogeneous panel estimates*. Journal of Development Economics, 111(C), 2014. PP.117-131.

Therefore, to complete the economic reforms, it is fundamental to make essential financial reforms also. To achieve this objective, in 1990 the law of Money and Credit (LMC) was issued. The previously mentioned law has as objective to accompany the system changes from socialist to market-economy system, by moving to market-determined credit banks, and encouraging the competitions and modernisation in the banking sector. For this end, the Algerian authorities slowly withdrawal the mission of financing the state owned enterprises from the treasury to the banking system. Also the CBA was no more responsible for financing the treasury deficit.

The LMC has as an objective to break down the involvement of the state into the banks' decisions, so they can liberalize the banking system activity from the centralized management. The banks' decisions were represented by the administrative determination of interest rate and orientations of loans allocation[1]. Furthermore, the LMC limited the possibility of offering preferable interest rates for the public sector by the treasury, and make the lending interest rates unified for both private and public sectors.

The following table summarized the historical background of the Algerian banking system:

Table N°05: Historical background of the Algerian banking system

Phase	Period	Bank owned by the state	Characteristics
Colonial phase	**1851-1962**	Banque de l'Algérie (Annexe de la banque de France)	The Algerian banks were just an extension of the French banking system; they were created to guarantee the financial needs of the colonial economy.
Sovereignty phase	**1962-1966**	Central Bank of Algeria CBA - Caisse Algérienne de Developpement (CAD) -Caisse National d'Epargne et de Prévoyance (CNEP) -	The Algerian authorities during this period have planned set of development programs that had economic-social objectives.
Nationalization and socialization phase	**1966-1982**	Banque Nationale d'Algérie (BNA) - Crédit Populaire d'Algérie (CPA) - Banque Extérieure d'Algérie (BEA)	The Algerian authorities have emphasized on the principle of the centralization of the resource allocation to ensure orienting resources according to the state objectives without taking into consideration the banks' objectives.
Restricting phase	**1982-1986**	La Banque de L'Agriculture et du Developpement Rural (BADR) - La Banque de Development Local (BDL)	The main characteristic of this period is restructuring the state-owned enterprises in order to improve their profitability.
Liberalization phase	**1986-nowadays**	-	The Algerian authorities switched the national economy from system highly dominated by state (socialist) to the market-oriented system.

Source: Ishaq HACINI, Khadra DAHOU. *The Evolution of the Algerian Banking System.* Management Dynamics in the Knowledge Economy Vol.6 (2018) no.1, 2018. PP.145-166.

[1] Benachenhou, M. *Réformes économiques : dette et démocratie*. Algiers: Echrifa. 1993.

The previous table shows that the Algerian banking sector has developed remarkably over time. In term of laws and regulations, the Algerian bank system went through different reforms and regulations to attain the objective of the market-oriented system, which is to liberalise the banks activities and to have the autonomy needed to establish their strategy independently from the authorities.

Also, the private and foreign investments were able to enter after liberating the Algerian market. The aforementioned reforms had a positive impact on the performance of the Algerian banking system, illustrated by the development of the banks' assets, its ability to collect the deposits, and providing more credit to finance the economic development.

3.1.2. Evolution of the Algerian banking regulation

The main text of the Algerian banking regulation is the law of 90-10, but this law was replaced by the law of 03-11, and modified by the law of 10-04.

3.1.2.1. The law of 90-10:

The law of 90-10 was issued in 14 April 1990, the law related to the money and credit; it introduced tangible changes in term of organization, function, and management of the Algerian banking sector[1].

The first point of the law was enshrined to the autonomy required to the Central Bank, which was named "Bank of Algeria". One of the most important organs in the Algerian financial system was created due to this law, which is the "Currency and Credit Council" (CMC), this council has the authority to control the money issuing, money coverage, exchange regulations, and the prudential standards, as well as the authorization of banks and financial institutions.

The "banking commission" as a control organ was created, which has ethical and jurisdictional power. It ensures the respect of banks and financial institutions to the laws and regulations.

The promulgation of the 90-10 law caused several changes related to money and credit, concerns the Creation of banks using private national capital, the installation of banks (mixed, foreign), the restructuring and modernisation of state owned banks.

Furthermore, the Algerian banking system found itself under the obligation to reorganize its institutions, to establish modern and more efficient means in term of communication, and the function of the banking and financial operations, hand in hand with allocating a qualified human capital, in order to comply with requirements of the market competition

3.1.2.2. Promulgation of Ordinance No. 03-11 of 08/26/2003

The year 2003 witnessed the promulgation of the ordinance n°0-11 of August 26, 2003 (ordnance repealing the law of 90-10) related to money and credit, which traits the

[1]Loi 90/10 du 14/04/1990 relative à la monnaie et au crédit.

supervision and the control of banks and financial institutions, also insisting on the liquidity and solvency of the system.

Thus, the obligation of banks to adhere to the "central of risks", which is responsible for the data collection in term of the names of beneficiaries from bank loans, the guarantees taken for each credit.

3.1.2.3. Ordinance No. 10-04 of 08/26/2006

This ordnance was created for the conditions of implantation for the foreign investors on the Algerian market under the partnership system. In addition, it aims to identify the institutional framework and the control of banks and financial institutions.

3.2. GENERAL INDICATORS ON ALGERIAN BANKING SYSTEM

At the present time, we notice that the banks owned by the state (public banks) are always predominant in term of branches network comparing to the agency network of the private banks. In addition, the performance indicators are in public banks' favour.

3.2.1. Banks ownership and branches network

This subsection will be dedicated to actual situation of the Algerian banking sector by focusing on the following indicators: The banks active in Algeria, number of agency per bank.

The following table illustrate the active banks in Algeria and their ownership:

Table N°06: List of banks in Algeria

Name	**BNA**	**CNEP**	**CPA**	**BDL**	**BEA**	**BADR**	**Fransabank El Djazaïr**	**Credit Agricole Corporate Et Investissement Bank-Algerie**	**Al Salam Bank-Algeria**	**H.S.B.C Algeria**
Ownership	Public	Public	Public	Public	Public	Public	Private Foreign	Private Foreign	Private Foreign	Private Foreign
Name	**Al Baraka Algérie**	**ABC-Algerie**	**Natixis Banque**	**Société Générale Algérie**	**City Bank Algeria**	**Arab Bank**	**B.N.P Paribas El Djazair**	**Trust Bank Algeria**	**Gulf Bank Algeria**	**The Housing Bank For Trade And Finance-Algeria**
Ownership	private (Mixed)	Private Foreign	Private Foreign	Private Foreign	Private Foreign	Private Foreign	Private Foreign	Private Foreign	Private Foreign	Private Foreign

Source: Central bank of Algeria, 2019.

The present banking system is radically different from what it used to be before the process of the reforms, the system witnessed a change from closed-central system to market-oriented system.

In 2019, the Algerian banking system contains six (06) banks owned by the state, which are: BEA, BNA, BADR, CNEP, BDL, and CPA. For the private banks, they are fourteen (14).

This Following table represent the agency network per bank in Algeria:

Table N°07: Agency number per bank

Bank	**BADR**	**CNEP**	**BNA**	**BDL**	**CPA**	**BEA**	**Société générale**	**BNP Paribas**	**AGB**
Agency number	342	227	214	169	127	100	82	72	54
Bank	**Al Baraka**	**Trust Bank**	**Natixis**	**ABC bank**	**Al Salam Bank**	**Arab Bank**	**Housing Bank**	**Fransabank**	**HSBC**
Agency number	29	27	26	24	9	8	7	6	3

Source: Central bank of Algeria, 2019.

The public banks in Algeria control the majority of the banking activity, despite the fact of superiority in term of numbers to the private banks.

For the agency network, the public banks cover all the Algerian territory, on the other hand, the private banks operates only in the large cities and in the north of the country.

From 2018 statistics[1], the agencies' number operating for the public banks represent 1426 agency, facing 347 agencies for the private banking sector.

3.2.2. Credit and liquidity soundness

The banking system plays its mediation role of absorbing financial surpluses from the depositors and put to the use of investors.

The banks activity is surrounded with risk and problems, one of the main bank risks is liquidity risk, where the bank is under the obligation to meet its costumer's demands of withdrawing their savings at any time.

[1] Bulletin annuel de la banque d'Algérie 2018.

The Following table illustrate the monetary situation of the Algerian banks during 2015 to 2019.

Table N°08: Monetary situation of the Algerian banking system (2015-2019)

In Millions of DA	2015	2016	2017	2018	2019
MONEY et QUASI MONEY	13 704 511	13 816 309	14 974 578	15 678 893	16 506 600
MONEY	9 261 136	9 406 972	10 266 060	10 755 175	10 975 200
QUASI MONEY	4 443 375	4 409 337	4 708 518	4 923 718	5 531 400

Source: Annual report of CBA, 2020.

During the period 2015- 2019, the Algerian banking system seems to have a sound situation in term of the monetary security, where the money represents twice the amount of quasi money in the total of money and quasi money.

In 2019, the Central bank of Algeria initiated a monetary policy to absorb the liquidity from the economy, which called "open market" operation, as a result to this policy the banking liquidity reached more than 1500 billions of Algerian dinars.

The Following table illustrate the liquid assets in the Algerian banks during 2009 to 2017.

Table N°09: Liquid assets in the Algerian banking sector (2009-2019)

Ratio	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Liquid assets/ total assets	51,8	53	50,2	45,9	40,5	38	27,2	23,5	23,7	19,84	17,5
Liquid assets/ short term credit	114,5	114,3	103,7	107,5	93,5	82,1	61,6	58,4	53,9	47,45	-

Source: Annual report of CBA, 2020.

We noticed from the previous table that the liquidity in the Algerian banking system is in deterioration reached the half in 2019, due to the economic situation of the country during the period of oil prices crisis in 2014.

Therefore, the liquidity must be managed by the banks, by maximising its profits, and at the same time to be able to meet the financial requirements of its depositors by holding a sufficient amount of liquidity, in order to achieve a balance between the profitability and liquidity.

The Following table shows the deposit structure in the Algerian banks system during 2015 to 2019.

Table N°10: Deposit structure in the Algerian banking system (2015- 2019)

In millions of AD	2015	2016	2017	2018	2019
Current deposit	5 153 064	4 909 772	5 549 155	5 969 857	5 537 600
Bank deposit	3 891 680	3 732 175	4 498 982	4 500 243	4 351 200
Deposit BCA	16 795	13 219	14 353	23 536	-
Deposit treasury	537 197	404 986	261 307	607 157	273 300
Deposit CCP	707 392	759 392	774 513	838 920	913 100

Source: Annual report of CBA, 2020.

The financial resources collected by the Algerian banks records a genuine progress during the period 2015-2019. Also the table above shows that the essential type of the financial resources is the current deposit.

The next table represents the nature of credit in the Algerian banks between 2015 and 2019.

Table N°11: Nature of credit in the Algerian banks (2015- 2019)

In millions of AD	2015	2016	2017	2018	2019
Short term credit	1 710 642	1 914 230	2 298 014	2 420 202	3001667
Medium term credit	1 641 809	1 810 828	1 844 394	1 851 084	7831667
Long term credit	3 924 794	4 184 823	4 737 622	4 781 899	

Source: Annual report of CBA, 2020.

The structure of credit by maturity indicates the predominance of long term loans, mainly loans offered to enterprises owned by the state and active in the energy sector. Thus, the share of short term loans increased from 2015 to 2019 similarly to the other types of loans.

The following table shows that the hydrocarbon sector does not resort to the bank loans, figures from the ratio of Credit to the economy/ GDP (NIOR), which mean that the credits offered to resident represent more than the fifty percent 50% of the GDP Not Including Oil Revenue:

Table N°12: Credit to the economy relative to GDP not including oil revenue

Ratio	2014	2015	2016	2017	2018	2019	2020
Credit to the economy/ GDP	38.3	44.0	46.0	47.4	47.4	47.6	47.8
Credit to the economy/ GDP (NIOR)	52.5	54.2	55.7	58.5	59.8	58.7	58.0
Credit to the private sector/ GDP (NIOR)	25.2	26.7	27.9	30.1	31.3	30.8	30.1

Source: Annual report of CBA, 2020.

This subsection illustrates the improvement of the banking intermediation gradually, in parallel with banking network development, in term of credits distribution or deposits collect.

However, the progress level remains below the levels reached in certain Mediterranean countries. On the other hand, the banking performance is relatively insufficient in term of a basic services provided to their customers, also in term of credit offered to small and medium-size enterprises.

Furthermore, the credit granted to the economy as a percentage of GDP passed from 38% to 48%. The inability of the banking sector to grant more credit to the economy might be caused by the opposition of the Algerian householders to count on borrowing in term to finance their activity, in the developed countries the main borrowers are the householders.

Nevertheless, for the Algerian people the refraining of borrowing is due to religious considerations. However, the banking sector in Algeria failed in transforming efficiently the short-term savings into long-term assets by investing into successful projects.

Undeniably, the only financial source that helps the economic units in the Algerian banking sector, taking into consideration that the financial institutions and the financial market are inactive, which give the domination to the commercial banks over the financial system, as it is the case in the MENA countries[1].

It is fundamental to know that banks owned by the state rule the loans market in Algeria. More than 75% of the credit granted to the economy is offered by the state owned banks, due to their dominance over financing the public sector, on the other hand, the private banks dominate less than 25%.

Nevertheless, economies such as the Algerian economy, which is centrally-planned economy, are distinguished with high market power[2].

[1] Olson, D., and Zoubi, T.A. *Efficiency and bank profitability in MENA countries*. Emerging markets review, 12(2), 2011. PP.94-110.
[2] Delis, M.D. *Bank competition, financial reform, and institutions: The importance of being developed*. Journal of Development Economics, 97(2). 2012. PP.450-465.

However, the private banking sector is important according their short experience in the Algerian market, also it is notable that the private banks' share is increasing from a year to another, for this reason, the private banks' existence will boost the competition and contribute the improvement of the public banks' services.

It existed a different theory about the dominance of the public banks, one of these theories is that the public banks sector is empowered by the Algerian authorities to enhance the financial and economic development regardless the low quality of these institutions.

Which create barriers for the private banks' performance and According to Andrianova, Panicos, and Anja (2012)[1]**:** the confidence in private banks might be increased by the quality of institutions, and the appearance of opportunistic tendencies is prevented from happening in less developed banking system.

3.3. ALGERIAN BANKING PERFORMANCE

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[2].

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.

3.3.1. Financial sector development

Algeria over the past decade was able to modernise its banking system, despite the social trouble, and the excess of liquidity created by the hydrocarbon sector. But, loan market dominated by the state-owned banks is in general directed to public entities; also public banks dominate financial intermediation, same for the inactive financial markets.

The financial system might be recognize as stable for the first sight, however, this fake stability carries high costs, and distorts risk appears and governance[3].

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[1] Andrianova, S., Demetriades, P., and Shortland, A. *Government ownership of banks, institutions and economic growth.* Economica, 79(315), 2012. PP.449-469.

[2] CBA (2013). *Banques et établissement financiers*. Retrieved on April the 11, 2019, from: http://www.bank-of-algeria.dz/html/banque.htm

[3] World Bank. *Financial Sector Assessment : Algeria*. Washington, DC. © World Bank. 2004. https://openknowledge.worldbank.org/handle/10986/15942 License: CC BY 3.0 IGO.

To this end, the Algerian authorities need to adopt a several radical changes. To privatize all the state-owned banks over the medium term, to improve the banking system in term of cutting the intermediation costs, to establish a strong institutional framework, to regulate the hydrocarbon-induced liquidity and loan cycles, that restrict banks' risk taking, on the other hand, different reforms to develop the non-bank financial sector.

The Algerian financial system stability and prosperity have strong rely on the public sector, and on the wisdom of the Algerian authorities in term of free the system from the dependence on the oil prices and its effects on bank liquidity and credit risks.

- **Reforms that would boost the role of the financial sector in the Algerian economic development**

The following table presents several reforms proposed by the IMF and its development aspects:

Table N°13: Reforms recommended by the IMF for the Algerian economic development

Reforms	Development aspects
Leverage hydrocarbon wealth to develop financial sector	Reduce volatility in the financial sector, • Reduce the Dutch disease effect (appreciated exchange rate reduces competitiveness), • Carve out a greater role for government securities in deepening financial markets.
Phase out exchange controls and base monetary policy on interest rates	• Identify the appropriate monetary and FX frameworks; • Gradually liberalize the FX market , • Liberalization of forward contracts , • Limitation to underlying trade liabilities, receivables and selected capital transactions.
Transform the role of the state into facilitator	• Create the conditions for stronger creditor rights, • Enhance efficiency in the economy, and financial intermediation, • Ensure a more level playing field and strengthen competition.

Source: Report of the FMI Financial Stability Assessment No. 14/161, Algeria, 2014.

Algeria as several other countries, that have the oil curse, which mean that a country have natural resources and potential of development, however, it does not reach its goals of

prosperity and development. Different explanation might be taken into consideration, such as[1]:

- The Dutch disease: this phenomenon is created by the export revenues (hydrocarbon for Algeria) that appreciate the real exchange rate, and cause the tradable sector less competitive in world markets;
- The volatility of the government revenue: it is caused by the fluctuation in world prices, which can cause interruption in the government planning, enhancing investment in projects with lack of potentials in good times and result pro-cyclical budget adjustments during bad times;
- Problematic institutional development: the problematic reside in the resources allocation, particularly in corrupt authorities, the development plans are made based on favouritism than on growth-oriented economic policies.

Beside the Hydrocarbon curse, the Algerian economy and financial development is also held back because of several factors[2]:

- The excess of liquidity, so the financial resources availability of funding reduces the demand for finance;
- Entrepreneurial tendencies are driven towards rent seeking, and less to start new productive firms, that would necessitate capital;
- The lack of investment in institutional frameworks that stand for private property rights, straightening of contracts and transparency, has negative impact on the long term over the institutional set up needed to enhance finance in the longer run.
- Raw commodities prices booms are generally consequence busts that make lending riskier.

The Algerian authorities established fiscal rules to deal with oil prices fluctuations, this strategy seems to be inefficient. And as plan to save for the future generations a part of the oil revenue, the Algerian government created oil savings fund (FRR).

One of the measures that should be taken from the Algerian government is the creation of Sovereign Wealth Fund (SWF), this fund would prevent the Algerian economy from oil and hydrocarbon crisis, and also to provide a higher rate of return on investment, this fund helped other similar countries in numerous ways[3]:

- The management of the domestic expenditure, as consequence the reduction of the Dutch disease;

[1] Das, and al, *Economics of Sovereign Wealth Funds: Issues for Policymakers*.Washington: International Monetary Fund. 2010.
[2] Bouchetara Mehdi, *Financial stability and Solvency of Algerian banks, application of stress tests from 2012 to 2016*. Financial Markets, Institutions and Risks, Volume 2, Issue 4. 2018. PP. 57-67.
[3] https://www.researchgate.net/publication/276268740, consulted on the 12/04/2020.

- The transformation to the SWF would limit the revenue accessible for the instantaneous consumption, and enhance savings with higher returns and for the long term;
- The fund can also smooth the resources cycles, by funding counter-cyclical policy;
- The control over the liquidity variation related to resources revenue, would facilitated the execution of the monetary policy.

3.3.2. Banking soundness development

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[1]. 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.

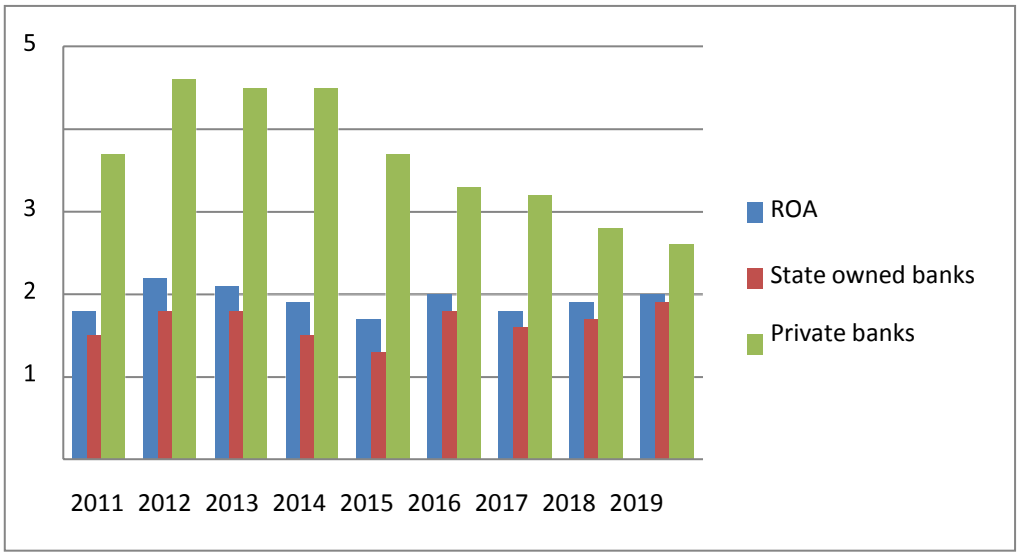
Aforementioned, the Algerian banks are liquid, back in 2015, the Algerian banks had 48% of their assets liquid, it is a fact that this liquidity is due to oil export operations[2].

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 Graphics highlight the development potential in terms of financial inclusion and the development of financial intermediation in Algeria.

[1] FMI's Report No. 14/161. Financial System Stability Assessment. 2014.
[2] Ibid. Bouchetara Mehdi. 2018. PP. 57-67.

Graphic N°01: Return on Assets (ROA) of the Algerian banks (2011-2019)



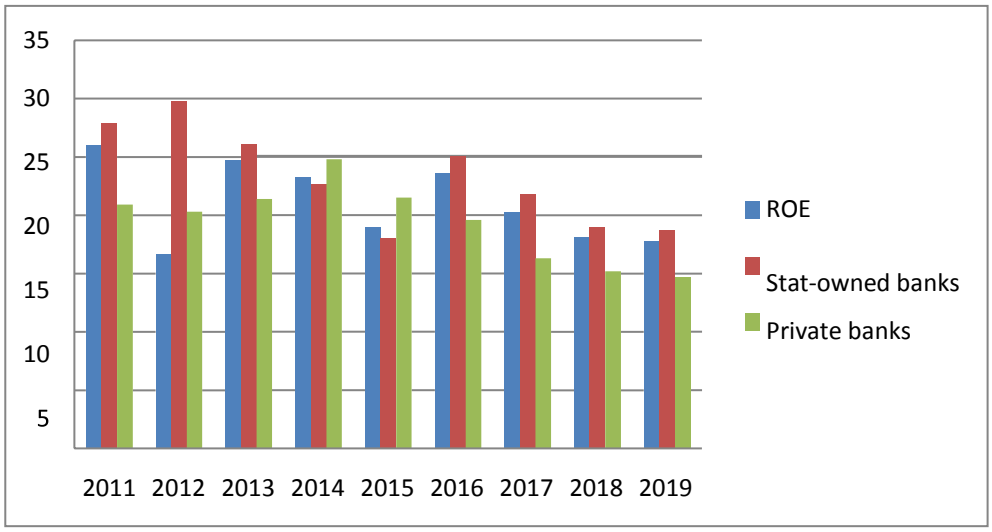
Source: Central bank of Algeria, 2019.

From the previous table it is clear that the profitability of Algerian banks has increased between 2011- 2019, 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 graphic present the evolution of ROE ratio over 2011-2019

Graphic N°02: Return on Equity (ROE) of the Algerian banks (2011-2019)



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 2011 to 17.8% in 2019 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.

In addition 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[1].

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 practices.

In addition, the Algerian banks need to obtain effective risk management tools and financial rules according to the international standards.

[1] Abed, G.T., and Davoodi, H.R. *Challenges of growth and globalization in the Middle East and North Africa.* Washington, DC: International Monetary Fund.2003.

Conclusion of the First Chapter

This theoretical study presented conceptual framework of the dependent variable of our empirical approach, where we will use the financial performance measures to find the relationships that influence its fluctuations. As previously mentioned the chapter was divided into three section. We started with understanding the specificities of bank management in the actual changeable economy, where we studied the bank business model, we reached as a result that business model is the manner or the strategy applied by the organization to generate profit in interaction between its clients and suppliers. Than the regulatory framework of the bank that it is in constant change and revision in consistency with the economic situation and cause adaptation cost for the bank.

The second subsection presented the financial performance measure ROE, ROA and NIM. We concluded that Net Interest Margin is less reliable than ROE and ROA, for the deficiency of neglecting other operating costs and focusing on interest costs only. Then, we studied the financial performance determinants. Where we divided the determinants into internal factors that can be effected by the managerial decisions and the bank strategy. However, the economic or regulatory environment of the bank can cause the external determinants.

Finally, we inspected the financial performance evolution in Algerian banking system. Starting with the historical progress the banking system, the different stages of bank modernization in Algeria, and its regulatory evolution. Then general indicators of the system was presented, beside the performance ratios. From this subsection, we concluded that although the huge progress made by the financial authorities in improving banking system, still there are marvelous opportunities of growth in the sector.

The present chapter offered key indicators of the Algerian banking sector, and its key financial performance efficiencies and deficiencies. The information provided by this chapter would be the background of our empirical approach. As it illustrates the specificities of the research's field in term of bank management, financial performance and the Algerian banking evolutions and indicators.

Chapter two:
Banking Risks, Banking Risk Management and Algerian Banking Risks

CHAPTER II: Banking Risks, Banking Risk Management, And Algerian Banking Risks

Introduction of the Second Chapter

In the ancient business management philosophy, risk was comprehend as threats or losses. Nowadays, risk means new business opportunities. Therefore, risk have different aspects, and it is challenging to define, to assess, to manage and to control. As the essential stage is identification in any management process, in the present chapter, we will try to define risk in banking, its different possible categories, and the potential types of risk that it can be faced in banking risk management.

Banks are the most critical businesses to run, its activity is based on collecting funds, granting loans and financial engineering. Therefore, risk management is a fundamental process to guarantee the bank's sustainability in changeable environment. Moreover, the bank's internal and external environment can create hindrances in the way of attainment of certain objectives. The exposure to this environment require the bank to take some proactive measures, to identify the possible risk categories that can create undesirable outcomes. Furthermore, in the literature, risk management is the application of different measures to identify, analyse, and control the defined risks, as the bank survival depends heavily on its capabilities to anticipate and prepare for the changes. Additionally, the bank specificities need to be take into consideration during the implementation of risk management procedures in banking.

The Algerian banks are no exception, and the bank's environment in Algeria is critical economically, politically or socially, which make the bank's activity more challenging. Therefore, risk management should actually be bank specific and country specific dictated by bank specific determinants, political complexities and economic evidences.

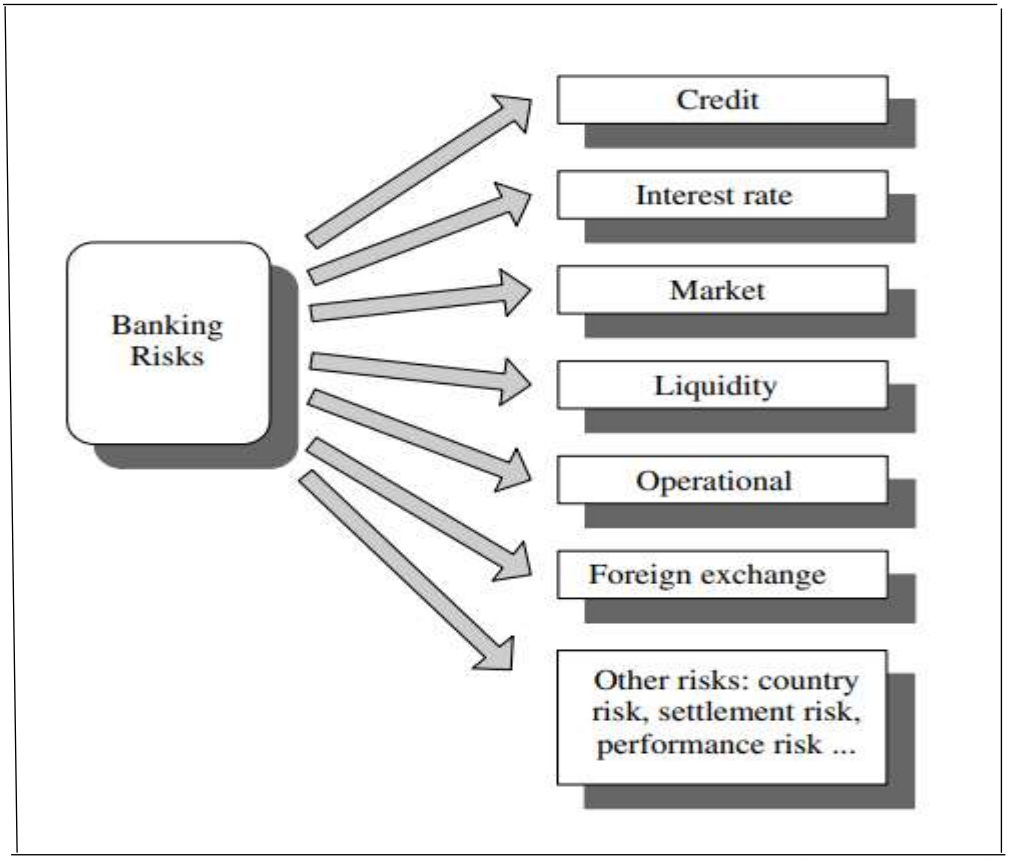
In the current chapter, we will identify banking risks, risk management in banking and risks in Algerian banks. To provide a conceptual framework concerning the risk management variable, to complete the required theoretical concepts background, beside financial performance notion presented in chapter one.

The present chapter will be divided into three sections. We will start by introducing the different risks faced by a bank. Then banking risk management would be treated in the second section. Finally, a data analysis of the risks in Algerian banking system.

1. BANKING RISKS

The banking world is facing several changes and uncertain events, as previously defined 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, this evolvement is cause from two main factors: the risk practices development and regulatory incentives. Furthermore, the quantitative risk measurements require a sound base of the different risk definitions. Therefore, risk definition is getting more precise over the years. The capital requirements imposed by the regulatory authorities helped the process of risk management. This imposing capital charges implies modeling the value of risk. This section will be focusing on three essential banking risks: interest rate risk, market risk and credit risk. Where several source of uncertainty maybe the cause of banking risks that have adverse impacts on the bank profitability. The risk management necessitates defining the source of the uncertainty and the limit its effect on the banking performance. The following figure represents the different types of banking risks:

Figure N°03: Banking Risks



Source: Bessis.J. *RISK MANAGEMENT IN BANKING*. John Wiley & Sons Ltd, Baffins Lane, Chichester, West Sussex, PO19 1UD, England .2001. P12.

In this study, we will focus on financial risks, or the risks created from economic variation or market changes. Due to the important volume of prices observations, the market risk is relatively easy to quantify. On the other hand, credit risk is related to the bank's activity. The technological innovation changed the previous comprehension of risks. Nowadays, credit risk is the main risk in the banking sector, therefore, the regulatory authorities dictated on banking operators to improve its measurement in term of the amount of capital that banks should hold. Beside the credit risk there is the operational risk that focuses on organizational malfunctions[1].

1.1. CREDIT RISK DEFINITION AND COMPONENTS

Credit risk is created from the uncertainty related to the obligator's ability to meet its obligations. This risk is associated to the borrower's capability to make the required payments in time. As result of this risk occurrence, the bank will face a potential loss of the credit principal, plus the related interest and collection charges. In case of the bank was able to restore a portion of the granted loan the loss may be limited to a fraction of the amount due. However, the situation might be more aggravated in case of the credit quality of counterparty deteriorates[2].

Banks use to accentuate in credit analysis on the company's ability to honour its financial engagements, by investigating the financial solvency of the potential borrower to repay the loan, beside other considerations such as: the company's financial books for the last three years at least, its management record, the object of the credit, the provided guarantees and other environmental factors. Furthermore, the last decade witnessed a large range of regulations in term of risk management and measurement in banking, also the credit derivatives development, therefore, credit risk now can be quantified and model. At facility level and portfolio level sound risk measurement practices should be established to identify the amount of capital that the bank requires to maintain cautiously against uncertain losses. The new concept of credit risk modelling consist on the analytical due diligence a bank completes to measure the risk of borrowers.

We will try in the following subsections to understand more credit risk, by introducing the breakdown of credit risk into: credit risk components, CR modelling and loss distribution for credit risk.

The credit risk components terminology was introduced in the Basel II accord of 2006 that stands for the factors that incidence on the potential loss from credit risk[3].

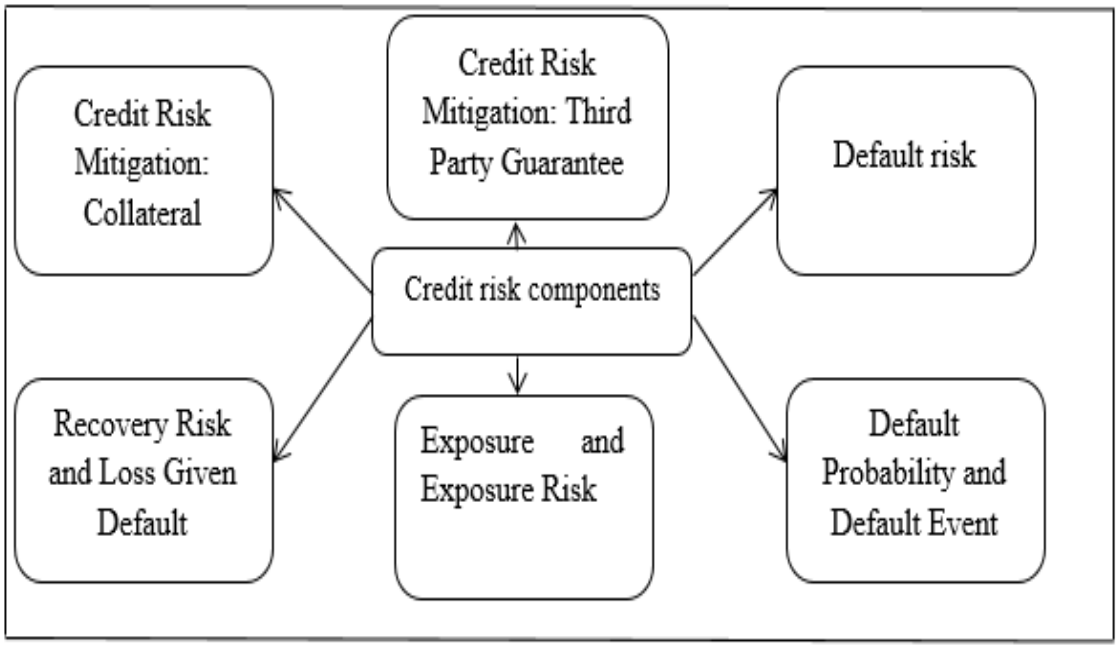
[1] The Basel Accord of January 2001 requires a capital charge against operational risk.

[2] Gregory, J. *Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets*, John Wiley & Sons. 2012. PP.21-40.

[3] Basel Committee on Banking Supervision. International convergence of capital measurement and capital standards: A revised framework – Comprehensive version, Bank for International Settlements, BCBS publications. 2006.

The next figure illustrates the different components of the credit risk:

Figure N°04: Credit risk components



Source: Own computation

1.1.1. Default Risk

Default risk is defined as the created from the inability of the borrowers to honor their financial engagements; several events may cause the default risk[1]:

- ✓ Payments delay for a certain period or indefinitely;
- ✓ The debt obligations might be restructured due to the deterioration of the credit standing of the borrower;
- ✓ Bankruptcies.

Default and restructing are almost the same if it created from the lack of capacity of the borrower to honor payments obligations only if the lender changed the structure of the debt. Defaults are temporary if they are adjusted within a short period as the borrower settles liquidity problems.

The default definition is based on rules, where the default is created from the first dollar payment delay from the point of view of the rating agencies. On the other hand, regulators consider the default occurs if the borrower was not able to repay within 90 days. However, if the payment delays less than 90 days then the default is temporary.

[1]Jorion P, etal.*Informational Effects of RegulationFD: Evidencefrom RatingAgencies*. Journal of Financia l Economics76. 2005. PP. 309-330.

1.1.2. Default Probability And Default Event

The default probability is the likelihood of the borrower's default. The Basel accord requires the usage of annual default probabilities (DPs), in case of stable credit state, the DP increases with credit horizon and the DP fluctuates as the credit standing migrates[1].

For a particular credit state, the DPs rely on the dominant economic circumstances. The likelihood of default augments in period of economic recession where the economic conditions deteriorate.

Default probability estimation is a challenging mission. Statistics are allowed due to the large volumes of borrowers, which make the default events countable, and its frequency traceable over different periods. Retail banks and rating agencies use this method for the entire enterprises of different rating categories. In case of restricted volume of clients, this method is not valid, because the statistics are not significant.

Generally, there are a several methodologies and data sources, which banks can use to map DPs to internal grades. In addition, the broad approaches are three: based on the bank's own default experience, the mapping of internal defaults to external data and the usage of default models[2].

1.1.3. Exposure And Exposure Risk

The exposure represents the scope of the amount at risk related to a borrower. In other terms, the randomness of the risk size is the exposure. The Exposure At Default (EAD) is an estimate of the possible size under default, which in the current date is unknown.

The repayment schedule of a borrower derives the creation of the contractual exposure for loans. Concerning the long-term credit attached with amortization schedule, this schedule is pre-identified. Furthermore, an effective amortization schedule is different from the contractual schedule, in other cases, the loan's repayment is characterized with stochastic cash flows, floating rating loans, and interest rated related to market changes. Where the cash flows are driven by the costumer's behaviour as in the credit card loans. In the case of enterprises, at the initiative of the borrower the bank offers facilities as commitments of the bank. However, the bank has an obligation to lend to maximum amount to a contractual maturity under committed lines of loans, the liquidity effectively borrowed is the amount drawn, and the undrawn amount is the residual portion of the engaged line of credit, which is on off-balance sheet commitment[3].

[1]Kiefer K M. *Default Estimation, Correlated Defaults, andExpert Information*. Journal of Applied Econometrics 26. 2011. PP.173-192.

[2] Kealhofer, S. *Quantifying credit risk I: Default prediction*, Financial Analysts Journal, 3, 2003. PP.30–44.

[3] Crook, J.N., et al. *Recent developments in consumer credit risk assessment*, European Journal of Operational Research, 183 (3). 2007. PP.1447–1465.

1.1.4. Recovery Risk And Loss Given Default

The Loss Given Default (LGD) is the part of the exposure at risk that is really lost under default, after recoveries from the guarantees. Where the percentage of exposure covered after a default is the recovery rate, also it is complement to one of the LGDs expressed in percentage of exposure. Additionally, in post-default stage, the LGD is a fundamental cause of credit losses and the capital charge for credit risk is proportional to the final losses. Due to the uncertainty related to LGD, Basel committee imposed percentages under particular approaches[1]:

- ✓ 45% LGDs are assigned in case of senior claims on corporates, sovereigns and banks not secured by recognized collateral;
- ✓ 75% LGDs are assigned for all subordinated claims on corporates, sovereigns and banks.

1.1.5. Credit Risk Mitigation: Collateral

The essential practices in credit risk mitigation or reduction is posting guarantees and collateral of third parties. The fact of using assets as guarantee for credit transforms the credit risk exposure into asset risk. Default related to credit exposure can be moderated by the involvement of a third party to guarantee the obligor against the risk of non-payment.

In the case of default the assets pledged are sold and used to recover the total or fraction of the repayment. It is qualified as good quality collateral is the guarantee made of assets that are can easily liquidated without causing harm to their real value due to market movements. In case of financial assets are pledged, the bank can recover its repayments and can liquidate the assets if the borrower was not able to honour his payment obligation. Guarantees include cash or securities, usually bonds of good credit quality[2].

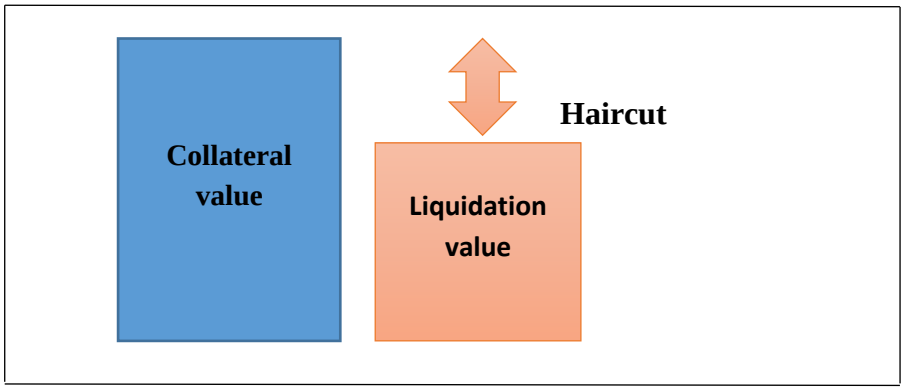
At the time of default the liquidation value is unknown if the transaction was collateralized from the beginning. In case of collateral made of securities its value is determined according to market factors, such as interest rate variation for bonds. The payments recover from the sale assets also relay on the assets liquidity at the time of sale. The result is that the credit risk of the guaranteed portion of the credit is transformed into an assets price risk.

Due to the uncertainty related to the value of the assets pledged and its liquidation possibilities, the identified value of the collateral is lower than its real value. The difference is the haircut.

[1] Altman, E.I., Sabato, G. *Modelling credit risk for SMEs: Evidence from the US market*, Abacus, 43 (3). 2007. PP. 332–357.
[2] Gordy,M.B. *Acomparative anatomy of credit riskmodels*, Journal ofBanking&Finance, 24 (1–2), 2000.PP.119–149.

Additionally, the haircut is a guarantee against the variation in term of value of the securities pledged, also against the value loss in the process of assets liquidation. The following figure illustrate the haircut notion:

Figure N05: Haircut



Source: Bessis.J. Risk management in banking. John Wiley & Sons, Ltd. 2015. PP. 202.

1.1.6. Credit Risk Mitigation: Third Party Guarantee

In case of default payments, the bank has a claim to the third party that provides guarantee for the borrower. When the direct borrower is unable to honour the debt payment obligation, the third party is obliged to pay the fraction or the total of the credit, same to the insurance provided by the guarantor to the lender. If the borrower defaults its obligation the bank uses credit derivatives that are instruments to recover then lender in case of loss under default. The instrument is based on the insured debt. The dissimilarity with the usual insurance contract is that the derivatives can be traded, where their prices fluctuates according to the market variation and a function of the credit risk of the underlying debt[1].

1.2. MARKET RISK

The market risk is related to market uncertainty movements, where the market value cannot be certain in the normal circumstances. The market risk is associated generally to trading portfolio.

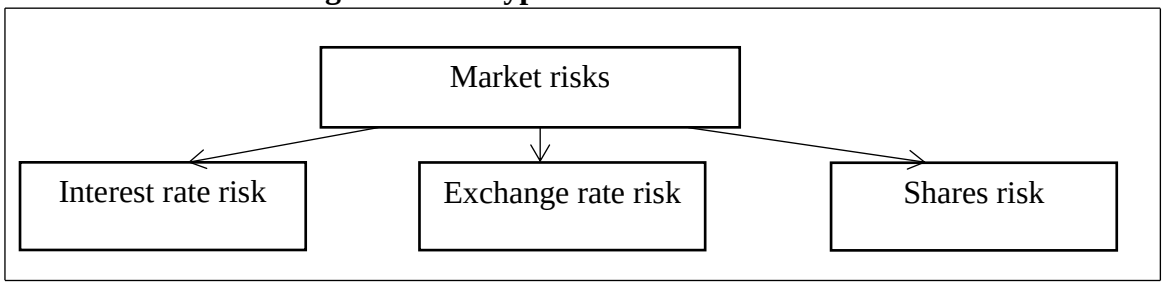
The market risk in banking is more present, since the market liberalization, where globalization had its effect on the monetary, financial and international exchange rates. The previous mentioned effects of market capitalization created new financial products (derivatives) that nowadays are a fundamental part of the banking activity[2].

[1] Brigo, D., et al. *Counterparty Credit Risk, Collateral and Funding: With Pricing Cases for All Asset Classes*, John Wiley & Sons. 2013. P7.

[2] Ernst & Young. IFRS 7 in the Banking Industry, available at:www.ey.com/Publication.vw/LUAssets/Industry_Banking_and_Capital_Markets_IFRS7_in_banking_industry/$FILE/Industry_Banking_and_Capital_Markets_IFRS7_in_banking_industry.pdf (accessed 18 June 2009).2008. P24.

The bank might be exposed to market risk because of speculative position (the bank is own trading account), also it may be caused of the market creator activities for the banks 'costumers. The market conditions are continuously modified that effect the bank through the essential three dependent but distinctly managed transmission channels. These are the fluctuation of the interest rates, the variation of the foreign currency exchange rate, and as a result the variation of market value of the bonds and shares issued by the bank. Furthermore, the usage of financial products derivatives induces additional risks to the banking activity. The next figure represents the different components of market risk:

Figure N°06: Types of market risks



Source: Own computation

1.2.1. Interest Rate Risk

In the banking activity both lenders and borrowers are exposed to interest rate risk, whether they were adopting fixed or variable rates. Although, if the bank and its costumer agreed to use fixed rate this will reduce the uncertainty related to interest rate fluctuation, however fixed rate adaptation does not eliminate interest rate risk.

The bank faces interest rate risk at a fixed rate in case of the interest increases, where the bank bears what called the opportunity-cost, the cost of not lending at a higher rate. In contrary, the costumer in case of interest rate increases at a fixed rate, he would be cover under a lower rate. It is notable that the prediction of future exposure to interest rate risk is the same for both cases fixed or variable[1].

1.2.1.1. Interest Rate Risk For Lenders And Borrowers

Lenders and borrowers have one only choice which is the type of exposure they want to have. This choice is driven by both sides' perception of interest rate fluctuation by using fixed income derivatives.

Corporates and financial institutions use such derivatives as an instrument to face this risk. It is hard to change directly the variable or fixed interest rate of a certain type of credit or a debt. As a substitute, derivatives are used. Derivatives do not modify the

[1] Black, F.,et al. *A One-Factor Model of Interest Rates and its Application to Treasury BondOptions*, Financial Analysts Journal, 46 (1), 1990. PP.33–39.

original debt or loan but are new contracts. The following table presents the interest rate exposure by the lender and the borrower:

Table N°14: Interest Rate Exposure by the Lender and the Borrower

Rate	Change of rates	Lender	Borrower
Floating rate	Rate **+**	Gain	Loss
	Rate **-**	loss	Gain
Fixed rate	Rate **+**	loss	Gain
	Rate **-**	Gain	Loss
Future exposures	Rate **+**	Gain	Loss
	Rate **-**	loss	Gain

Source: Bessis.J. Risk management in banking. John Wiley & Sons, Ltd. 2011. P82.

1.2.1.2. Interest Rate And The Yield Curve

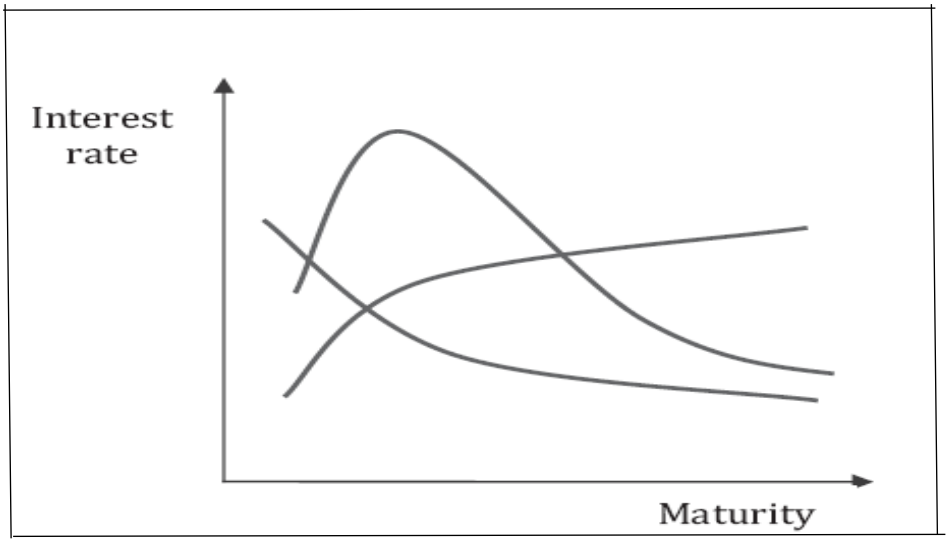
Market term structure of interest rates gives the different market rates for all maturities. For debts issuing in non-governmental institutions there are several categories of interest rates: risky rates and risk-free rates. In addition, interest rates are defined in several ways: the return of a bond kept until maturity is determined by the yield to maturity, the bond characterized with one flow of coupon received at maturity applies the zero-coupon rates without any intermittent cash flows such as coupons. Furthermore, the stripping process is the replication of the zero-coupon bond, which is liquid. The idea is determining the value of coupon bond minus the current value of the coupons, applying the rates linked to their dates[1].

For all types of borrowers: risk-free borrowers, risky borrowers and government exists the yield curve. For risky borrowers the rates paid are added to it a spread above the risk-free rate. The spread calculating depends on several factors, between these factors the default risk for the risky debts, in this case it is called credit-spread. Furthermore, the spread is linked to the credit ratings, industry and maturity. As a result to market interest rate variation, the yield curve can be shaped in different ways[2]: upward sloping, downward sloping or approximately flat.

[1] Golub, B.W., Tilman L.M. *Measuring yield curve risk using principal components, analysis, value at risk, and key rate durations*, The Journal of Portfolio Management, 23 (4), 1997. PP. 72–84.
[2] Nelson, C.R., Siegel, A.F.*Parsimonious modeling of yield curves*, Journal of Business, 60, 1987. PP. 473–489.

The following figure illustrates the several ways of the yield curve's shape:

Figure N°07: The different shapes of the yield curve



Source: Idem. Bessis.J. 2011. P83.

This previous figure explains the different possibilities of the yield curve related to the existence of several and instable market interest rates. As a result, interest rate risk management is a fundamental problem for corporates in term of liabilities management objectives, and for assets liabilities management in banks, as they are exposed to this risk in both sides of the balance sheet. Different studies concerning the relationship between interest rates and maturity shows that the most stable rates are long-term rate, in contrary the short-term rates are the most volatile[1].

1.2.2. Foreign Exchange Risk

The price of a foreign currency compared to the home currency is the definition of foreign exchange rates. For example if the home currency is the DZD (Algerian dinar), if we want to sell the US dollars (USD) to have home currency (DZD) then the operation is selling USD/DZD, automatically that's mean to buy DZD/USD.

Take for example that EUR/USD exchange rate is 0.8, which equals 1.25 USD/EUR. The foreign exchange risk happens due to variations of the foreign exchange rates. If we assume that, an exporter closed a deal of 1 million USD (foreign currency) that will be received in EUR (home currency). In this case, the exporter will change the 1 million USD into EURs, where each USD equals 0.8 EUR. Therefore, he will receive 800,000 EUR.

One of the foreign exchange risk management measures is the Forward exchange rate, where the rate is set-up today for a future date. Those who would instantly benefit from

[1]Brigo, D., Mercurio, F. *Interest Rate Models – Theory and Practice: With Smile, Inflation and Credit*, Springer.2007. PP.1-22.

the situation are the hedgers. The forward rates determine the future exchange rate as of today, but the forward rates have an essential condition, which is selling or buying using forward rates necessitate the expiration of the contract. The forwards are applied in the contract that expecting a future inflow or outflow in foreign currency[1].

Furthermore, there are the currency swaps exchange two debts of its principal and interests, made of two currencies in a define rate at the current time. It consists of swapping the currency of a debt issue, which means to borrow in one currency and change it into another currency. Additionally, the foreign exchange swaps buy and sell currencies at a specified horizon at a specified rate as of today. In addition, it can be seen as a sequence of forward contracts for every cash flow to be exchanges in the forthcoming horizon[2].

The application of the swaps for hedging purposes is understandable. The hedging strategies are based on the forward prices. For more illustration, if an exporting corporation receives foreign currency, in this case, the corporation is long in the foreign currency and facing the risk of home currency increases against the foreign currency.

1.2.3. Shares Risk

The third type of market risk is shares risk, which is the likelihood that a bank will have financial losses or not reaches the estimated revenues, due to unforeseen changes of the owned financial assets prices on the market. The shares risk is having a particular position in the trading register, this position are linked to shares with similar changing behaviour also their derivatives (futures and swaps).

Additionally, the risk associated to shares is identified for the particular risk that is related with ownership of an equity or bond, also for the position on the market in general. Furthermore, the derivatives risk is assessed, and managed, by exchanging it into the home currency value of shares of the original instrument. The settle of the market based on the rate among the demand and supply achieves the prices equilibrium. If the latter is unbalanced, the financial assets will witness a significant fluctuation that is known as prices volatility. Concerning the diversified portfolio of financial assets, the impact of market variation of a fraction of the portfolio can be compensated; as a result, the bank's fundamental objective is to manage its assets and liabilities efficiently to avoid profitability deterioration, and leads to financial performance[3].

[1] Danielsson, J.*The Value at Risk Reference: Key Issues in the Implementation of Market Risk*, Risk Publications, London.2007. PP.1-9.
[2] Wetmore, J. L., & Brick, J. R. *Commercial bank risk: market, interest rate, and foreign exchange*. Journal of Financial Research, 17(4), 1994. PP.585–596.
[3] Canabarro, E., Duffie, D. *Measuring and marking counterparty risk, in Asset/Liability Management for Financial Institutions*, Institutional Investor Books, 2003. PP.122–134.

Consequently, we may conclude that the market risk is created due to price fluctuation of several financial products of the bank, such as: the financial portfolio, own capital instruments, and the interest spread of foreign currencies exchange rate.

As a result, the main element of risk market is the shares position, the risk associated to goods, the risk of the interest rate and foreign currency exchange rate risk.

1.3. OPERATIONAL RISK IN BANKS

In the last decades, banking industry lived several transformations, scandals and collapses, which accelerated the appearance of the operational risk. This new risk has drawn the attention of professionals, academicians and banking supervisory authorities. Operational risk appearance can be related to various factors of change, like the size of banks that goes larger with time, their organizational complexity, also the arrival of new banking financial products, and the IT development that create the e-banking, similarly the intense competitiveness of the global financial market. The latest factor was the great financial crisis in 2007 that introduced new source of operational risk.

1.3.1. Operational Risk Definition And Classification

The regulatory authorities in the last years have determine the operational risk as a significant risk that spread into the entire banking industry. Years ago operational risk appeared into the surface of the banking industry, however, the OR recognition and identification were made only after the high losses of many banking crises due to several types of risk exposure, as a result, the OR was treated inappropriately, underrated or not addressed at all.

In the 90s numerous factors that introduced OR in banking was revealed, these factors nowadays are well-known, and the most important are[1]:

- These days banks are characterized with their growing size that goes with progressively complex organization, and the changing of the banking business model;
- The growing amount of human errors and system faults due to the technological evolvement that concealed different types of OR;
- The banking exposure to external frauds caused by the development of e-commerce and e-banking, issues of security and cybercrime;
- Segregation of duties problems due to outsourcing of production processes;
- The mitigation instruments of credit and market risk (such as derivatives, and securitization) are widely used, accompanied by the amplified presence of particular ORs.

[1] Ellis, B.,et al. *Driving value from postcrisis operational risk management*, McKinsey Working Paper, no. 34. 2012. PP.1-8.

OR gained more attention because of the awareness of the catastrophic nature that OR can lead to. The last past years, dramatic results was caused by operational failures, for some cases it even caused the collapse of the intermediary[1]. Back to the same period, banks and financial institutions witnessed more than 100 operational loss events, where each exceeded 100 million USD[2].

The significant financial crises have revealed a number of causal factors: deceptive employee behaviour, inappropriate business practices, internal control system malfunctioning, rarity of transparency in caring out investment services, inaccurate reward systems, and imprecise reporting lines. These factors highlighted the requirement for more intense control over OR, precisely in the financial concern, also the need to track the key indicators for controlling the tendencies of risk exposure.

1.3.2. Regulatory Framework Of The Operational Risk

The present regulatory framework defines operational risk as a major risk confronted by banks and needs important attention and coverage. Operational risk management needs provisions for three alternative approaches for calculating operational risk capital requirements, these approaches are[3]:

- ✓ The Basic Indicator Approach (BIA);
- ✓ The Standardized Approach (SA);
- ✓ The Advanced Measurement Approach (AMA).

Before analysing the essential features of all the previously mentioned approaches, in this subsection we will try to describe the last proposals of the Basel Committee in term of operational risk in banks.

The regulation of the operational risk was treated for the first time under Basel 2 in 2006[4]. Certainly, this prudential treatment of OR was adopted after a deep review of many proposals and international consultation process, Basel 2 defined the rules for the identification of OR capital requirements (first pillar) and for the supervisory review process and market discipline in Pillar 2 and Pillar3.

Afterwards, referring to the economic and financial changes at international level, the Basel III[5] accords in 2011 and 2013 announced fundamental changes to the capital requirements for banks. However, this announcement did not change the core of the

[1] Cope, E.W., Carrivick, L. *Effects of the financial crisis on banking operational losses*. Journal of Operational Risk, 8 (3). 2013. PP.3–29.
[2] Fontnouvelle, P, et al. *Using loss data to quantify operational risk*, Federal Reserve, April, 2003. PP.1–32.
[3] BCBS (Basel Committee on Banking Supervision). Review of the Pillar 3 disclosure requirements, June 2014.
[4] BCBS (Basel Committee on Banking and Supervision). Basel II: International convergence of capital measurement and capital standards: A revised framework, Comprehensive version, June.2006.
[5] BCBS (Basel Committee on Banking and Supervision). Basel III: The liquidity coverage ratio and liquidity risk monitoring tools, January. 2013.

prudential treatment of the operational risk. Identically to the latest regulatory framework, Basel III kept the articulation into three Pillars:

- ✓ Pillar 01: Minimum capital requirements (CRR- Regulation N°575/2013 of the European parliament and the Council of 26 June 2013 on the prudential requirements for credit institutions and investment firms);
- ✓ Pillar 02: Supervisory review process;
- ✓ Pillar 03: Market discipline.

The Capital Requirements Regulation (CRR) identified the OR as an important risk confronted by financial institutions and need coverage by own funds. These requirements introduced provisions for three substitute approaches for calculating OR capital requirements, the previously mentioned approaches includes several levels of risk sensitivity needing several degrees of sophistication. As a result, the CRR enhance banks and financial institutions to change towards more risk-sensitive approaches (Recital 52-CRR 575/2013).

The emergence of various methods for calculating capital requirements intend to accomplish several objectives[1]:

- ✓ Guarantee interconnection among the level of refinement of the approach to the degree of an intermediary's risk exposure;
- ✓ Limit the weight of regulation on identical banks;
- ✓ Properly acknowledge at supervisory level the ameliorations implemented by banks in OR management practices.

The provisions introduced in Pillar 1 do not provide a complete explanation for the operational risk management; however, it must be seen as integrating provisions in Pillar 2 and 3. With specific orientation to the Internal Capital Adequacy Assessment Process (ICAAP), financial institutions should develop a suitable governance logic related to the encouragement of a proper risk culture.

Precisely, financial institutions and banks must developed a robust process for assessing and controlling operational damages associated to credit and financial products[2], taking for granted that their inadequate management may influence the intermediary's capital adequacy, like it was observed in some of the crisis events. Furthermore, when determining the bank's strategy in term of OR management it should take into consideration several factors:

- ✓ The operational risk definition and risk sources identification;
- ✓ The risk's profile identification;

[1] Birindelli.G and Ferretti.P. Operational Risk Management in Banks: Regulatory, Organizational and Strategic Issues. Palgrave Macmillan Studies in Banking and Financial Institutions, Springer. 2017.P39.
[2] Krosner, S. Risk management and Basel II, speech at the Federal Reserve Bank of Boston, AMA Conference, Boston, May 14. 2008.

- ✓ The operational risk appetite definition using tools and measures comprehendible to management;
- ✓ The identification of means and models used in operational risk management (ORM);
- ✓ The integration of operational risk management into the whole process of risk management.

1.4. LIQUIDITY RISK

The last financial crisis was caused by a shortage of liquidity in international banking system due to strategy adopted by banks of raising cash at a higher cost than habitual conditions. Furthermore, liquidity is defined as the capability of a bank to increase the cash necessary to finance loan-granting activity and face deposit withdrawals in equitable period at an equitable cost.

The bank has two possible ways to increase liquidity: by collecting households' savings or increasing financial debt. As a result, the liquidity risk is the uncertainty related to the availability of liquidity or to the high cost of obtaining this liquidity[1].

1.4.1. Liquidity Gaps Definition

The imbalance between the assets and liabilities of bank is the liquidity gap, in other terms, is the probable inequality of financial sources and uses of funds. The decisions associated to funding or investing are made based on the information provide from the gap reports. Additionally, the gap management is procedures made to prevent and control the mismatches between assets and liabilities[2].

At future dates, the banking portfolio may record differences between the projected balances of assets and liabilities to create the liquidity gap. Assets and liabilities are gradually amortized over time, and their time profiles are declining. Forecasts are stable over time, if they ignore new credits, new deposits or debts at upcoming dates.

Depending on how assets and liabilities run off liquidity gap can be static in term of their time profile in the future. The liquidity gap can be defined mathematically from the difference between the projected balances of existing assets and liabilities at a future date (t). Over the planning horizon, there are as many gaps as there are time points.

For each future date t, we have the algebraic equation of liquidity gap[3]:

[1] Acharya V.V., Viswanathan S. *Leverage, moral hazard, and liquidity*, Journal of Finance, 66. 2011. PP.91–138.
[2] Adrian, T., Shin, H-S. *Liquidity and leverage*, Journal of Financial Intermediation, 19, 2010. PP. 418–437.
[3] Brunnermeier, M.K. Deciphering the liquidity and credit crunch 2007–2008, Journal of Economic Perspectives, 23 (1), 2009. PP.77–100.

Liquidity gap (t) = Assets (t) - Liabilities (t)

1.4.2. Liquidity Gaps Types

Different types of liquidity gaps can recognized, such as static, dynamic or marginal gaps. Static gap is the most common type, due to the runoff of existing assets and liabilities only. In addition, it is dynamic gap if it includes loans and debts. The marginal type consists of the differential fluctuation between two adjacent time points of assets and liabilities.

The variances of projected future balances of existing assets and liabilities are the static liquidity gaps. On the other hand, marginal gaps are the dissimilarities in differences between two adjacent time points. Although, both simple and marginal gaps can be easily calculated. The gap between the present outstanding balances of assets and liabilities is the cumulated value over time of the marginal gaps[1].

The new funds needed, or the new surplus funds of the period available for investing are the marginal gaps. The implicit assumption, and for a given management horizon, all the preceding gaps have been financed.

Additionally, the new financing needed or the new investment of granting loans needed represents a new marginal gap required to close the liquidity gaps from earlier contracted borrowing/lending in the past and remain in place[2].

Due to the existing assets and liabilities, the static liquidity gaps is been created. However, the dynamic liquidity gaps add new deposits and new loans to the amortization profiles of the current assets.

The liquidity gaps can be change due to new assets and liabilities created at forthcoming dates that are additional to the present assets and liabilities. The totality of assets and liabilities, currents and new ones, have a tendency to increase usually, rather than amortize.

Dynamic gap is the new gap time profile. To project the liquidity excesses or deficits gaps for all the current and future assets and liabilities are required. Overall, for budgeting objectives balance sheet projections are applied, rather than for liquidity risk management purposes[3].

[1] Brunnermeier, M.K., Pedersen, L.H. *Market liquidity and funding liquidity*, Review of Financial Studies, 22. 2009. PP.2201–2238.
[2] Diamond, D.W. *Banks and liquidity creation: A simple exposition of the Diamond-Dybvig model*, Fed Res Bank Richmond Economic Quarterly, 93 (2). 2007. PP.189–200.
[3] Diamond, D., Rajan, R.G. (2011) Fear of fire sales, illiquidity seeking and the credit freeze, Quarterly Journal of Economics,126 (2). 2011. PP. 557–591.

2. BANKING RISK MANAGEMENT

Over the past decade, risk management has been change, due to several external and internal factors that affected the traditional activity of the bank. However, the previous changes in risk management would not be the last, professionals and practitioners anticipate that the next ten (10) years will witness change that is even more extensive.

2.1. MODELING BANKING RISK MANAGEMENT

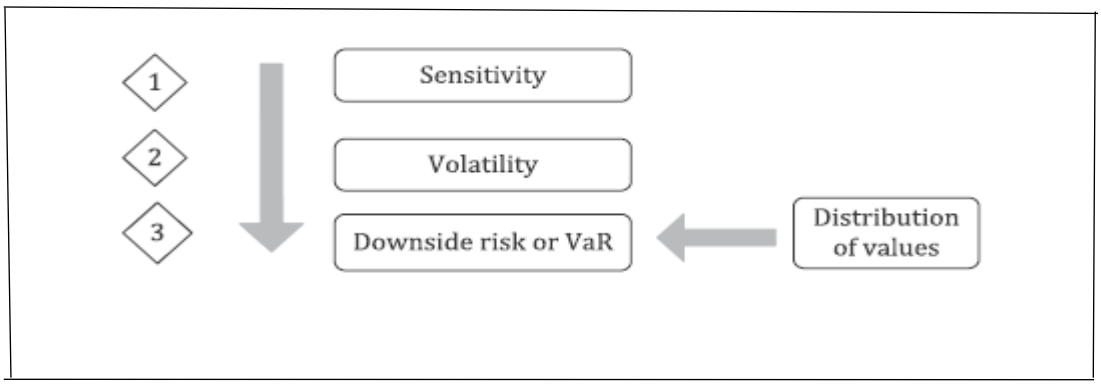
Different variables are use in risk modeling[1]:

- ✓ The first is the sensitivity which is a measure of the reaction of an asset value to a shock on the primary market factors usually called risk factors;
- ✓ The second is the volatility or more precisely risk factors-volatility that measures the immensity of the fluctuations of an asset value;
- ✓ Value-at-risk or the downside risk is the third variable of risk modeling that modeled value of possible losses in monetary value that recapitulate all risk metrics in one possible loss figure.

One of the most important fundamentals of risk models is value-at-risk (VaR). Sensitivity and volatilities are prerequisites for modeling VaR. the objective from defining VaR is to determine a value of possible losses that will not be surpass only with a small part from all different possible scenarios. The VaR is generally ground on a value, or loss, percentile, if depending on value or loss distributions. Furthermore, a distribution percentage is a value determined by the potential that the random values are equal or lower to that value.

The following figure illustrates the order and the sequence used to model VaR:

Figure N°08: Variables sequence to model the VaR



Source: Danielsson, J.*The Value at Risk Reference: Key Issues in the Implementation of Market Risk*, Risk Publications, London. 2007.

[1] Frye, J. *Principals of Risk: Finding VaR through Factor-Based Interest Rate Scenarios*, in VaR: Understanding and Applying Value at Risk. Risk Publications, London.1997. PP.275-288.

2.1.1. Sensitivity

Quantitative measures of risks are the backbone of risk management. In this approach several risk metrics exists. For each market' parameter movement there is a response from the target variable, which represents the sensitivities measure, for instance, an interest rate fluctuate of 1%. The sensitivities measures are the inputs of the market value at risk calculations for linear instruments. Generally, market parameters or risk factors are the determinants of assets values.

For different scenarios, sensitivities can be determine from closed-form equation that identify the value of an asset, for example, the Black-Scholes equation for options. In different cases, sensitivities can be define in approximation using the Taylor expansion formula, which treats the value fluctuation as a function of the variations of its arguments multiplied by the first-order partial derivatives with respect to each risk factor[1]. Additionally, sensitivities can be calculate mathematically by using a shock on one risk factor and tracking the response variation of value of the studied asset.

2.1.1.1.Sensitivity definition

The reactions and responses of a particular variable to change of risk factors is the definition of a sensitivity. Furthermore, changes of value can be present in monetary units or in percentage of the original value. Sensitivities represented in percentage are ratio between the changes of value related to a shock on the causal parameter. For illustration, we use the sensitivity of bond value with respect to a unit interest fluctuation of 1% equal to 5. The previous result means that a 1% interest rate changes produce a relative value variation of the bond of 5×1% = 5%.

The sensitivity can be identify in monetary units as the variation of the price of an instrument for a given variation in the causal parameter. For example, when the bond value equals 1000€, its value change is 5%×1000€ = 50€.

When V is the market value of an instrument. This value rely on one or different market parameters, m, that can be percentages (for example interest rates) or prices (such as indexes). By definition sensitivity (S) equals[2]:

$$\mathbf{S\ (Value)} = \Delta V / \Delta m$$

$$\mathbf{s\ (\%\ variation\ of\ value)} = (\Delta V / V) / \Delta m$$

The previous equations present that there is a simple relationship between the sensitivity value and the percentage sensitivity where:

[1] Shashidhar, M. *Market-implied risk-neutral probabilities, actual probabilities, credit risk and news*, IIMB Management Review, 23 (3). 2011. PP.140–150.
[2] Becker, B., & Ivashina, V. *Reaching for yield in the bond market*. The Journal of Finance, 70(5), 2015. PP.1863- 1902.

$$\text{s (\% variation of value)} \times V = \Delta V / \Delta m = S \text{ (value)}$$

For a small variation in the causal parameter, sensitivity provides only an approximation to the value change as a response. Due to its dependency on the present value of the asset and the market parameter sensitivity is consider as a local measure. When asset value and market parameter value change, both S and s change too.

Generally, assets value variation depends on different risk factors, and this value fluctuation is a function of several market parameters m_k[1], where *k* represents the market parameters, and it variate from 1 to K:

$$\Delta V = \sum_{(1 to k)} S_{iK} \Delta m_k$$

2.1.1.2.Sensitivity and risk controlling

Risk controlling necessitate controlling sensitivity to risk by balancing positions to the identical risk elements. In term of hedging, its position relies on the relative sensitivities of the hedging and hedged instruments. However, in term of controlling market risk, a widespread risk metric is the sensitivity of a market position or the sensitivity of a portfolio of several positions. Sensitivities assesse and control the fluctuation of value created by standard shocks on market parameters like equity indexes, interest rates and foreign exchange rates.

Several positions on different instruments are sensitive to probably to numerous risk factors. All risk factors have response sensitivities that risk management implies to it, on the hand individual instruments are sensitive only to certain risk factors.

The sensitivity of interest rates refers to the variation of earnings due to shocks applied on interest rates. The mismatches of the interest rate sensitivities is one of the factors of interest rate risk arising added to the misleading estimation of interest rates maturities. Interest rate gaps assess the Net Interest Income (NII) sensitivity to interest rate variation. If the variation of interest rate gap is positive than the volume of assets that are sensitive to interest rate is greater than the volume of liabilities sensitive to the same factor. Appling a positive shock of interest rate the NII increases due to the greater positive response of the interest revenue than the interest costs.

When the interest rate-sensitive-assets is represent as IRSA and to liabilities as IRSL, also Δi is the change of the variate rates, the variation of NII from the floatation of interest rates Δi is[2]:

[1] Poon, S-H., Granger, C. *Forecasting volatility in financial markets: A review*, Journal of Economic Literature, XLI, 2003.PP.78–539.

[2] Black, F., Derman, E., Toy, W. *A one-factor model of interest rates and its application to Treasury bond options*, Financial Analysts Journal, 46 (1), January–February, 1990. PP. 33–39.

$$\Delta \text{ NII} = (\text{IRSA- IRSL}) \Delta i$$

The fundamental equation that relate the variable-rate gap to NII is:

$$\Delta \text{ NII} = (\text{IRSA- IRSL}) \Delta i = (\text{interest rate gap}) \Delta i$$

2.1.2. Volatility

The volatility can be measure using historical data and it is the standard deviation of a market variable. Furthermore, risk models depend on realized or observed volatilities. Several types of volatility exist, such as the implied volatility that is define as the volatility fixed in the value of options, and by definition the implicit volatilities are very unstable and reliant on the specific demand and supply of certain options.

Historical volatility measuring using long periods can provide the unconditional volatility, or long-term estimation of volatility. The volatility by definition is time varying, as a result, the representability of long-term volatility is questionable because it does not reflect the current conditions, and otherwise short-term volatility would do. For different periods, the reliance of time series of the values of a market return is on the time by which the observations were collect, the occurrence and the frequency of observations. In the case where the distribution of returns were stable over time, than the frequency would be the factor that volatility depends on, however, not on the look-back period[1].

As volatility varies over time, several techniques are implement to measure it; the most unpretentious technique is applying a moving window of observations. The Exponentially Weighted Average technique associate more weight to the closest in term of timing observations. However, a more sophisticated technique as Garch family of models that depend on modeling the stochastic process of the volatility. This subsection provides explanation of the different technique possible to estimate time-varying volatilities.

2.1.2.1.Exponentially Weighted Moving Average Model (EWMA)

The present technique allocates to the most recent observations higher weights. Moreover, old observations less weights, additionally, the EWMA technique allowed smoothing the abrupt changes and variations. JP Morgan[2] introduced the EWMA technique:

When λ variate within *0* and *1*, also the horizon *t* move back from *t* to date 0:

$$\sigma_t^2 = (1 r_{t-1}^2 + \lambda r_{t-2}^2 + \lambda^2 r_{t-3}^2 + \ldots + \lambda^{t-1} r_0^2) / (1 + \lambda + \lambda^2 + \ldots + \lambda^{t-2})$$

With:

$$(1 + \lambda + \lambda^2 + \ldots + \lambda^{t-2}) = 1/(1-\lambda)$$

[1] Poon, S-H., Granger, C. *Forecasting volatility in financial markets: A review*, Journal of Economic Literature, XLI. 2003. PP. 78–539.

[2] Zumbach, G. The RiskMetrics 2006 Methodology, RiskMetrics Group. 2007. P139.

So :

$$\sigma_t^2 = (1\, r_{t-1}^2 + \lambda\, r_{t-2}^2 + \lambda\, r_{t-3}^2 + \ldots\ldots + \lambda\, r_0^2)\,(1-\lambda)$$

2.1.2.2.Garch models

The GARCH models tend to model the time behavior of volatility. This technique aims to capture the patterns of following a mean-reverting process, so that high level of volatility tend to smooth out after a while. Moreover, the variance captured in a t period related and depends on the variance as of t-1, on a similar horizon, plus on the more recent available observations.

The EWMA and the GARCH models are dissimilar, that the EWMA technique gather a long-term variance rate with the current estimation of return and variance. GARCH (1, 1) means that the model is based on the last estimate observation of the variance rate and on the present squared return, deprived of other lagged terms. Using the same lag of one period for variance estimation and squared return is the (1, 1) GARCH model. To generalize the model it can be added more lagged observations of variance estimation and squared return, however, the (1, 1) GARCH model is the most used, its equation is as follow[1]:

$$\sigma_t^2 = \gamma\sigma_L^2 + \beta\sigma_{t-1}^2 + \alpha r_{t-1}^2$$

2.1.2.3. Maximum Likelihood Methodology

The maximum likelihood methodology consist of using parameters that maximize the probability of observing the data. Accept that we can associate probabilities to each observation and assign the probability of observing the global set of data. For more illustration, if the observations are independent, the chances of spotting k values is established from the chances of observing each one. This technique capture the factors or parameters of the probability distribution that match the data set. Furthermore, the maximum likelihood methodology can be explained for capturing the maximum likelihood estimate of a stable variance, as an intermediate phase[2].

2.1.3. Value at Risk (VaR)

The downside risk or the value at risk (VaR) is the amplitude of a possible loss for a specified horizon and for a particular portfolio of financial assets, and defined probability. The VaR necessitate modeling the distribution of the random asset value over time. Due

[1] Poon, S-H., Granger, C. *Forecasting volatility in financial markets: A review*, Journal of Economic Literature, XLI, 2003. PP. 78–539.
[2] Poon, S-H., Granger, C. *Practical issues in forecasting volatility*, Financial Analysts Journal, 61 (1). 2003. PP. 45–56.

to the fluctuation of the prices level according to the original value, the random shocks are measured. In regular market model, the value of the asset in the future depends on a sequence of random returns.

The value at risk is identify as a quantified distribution of the value fluctuation. The quantified distribution is a threshold value of the random variable like the possibility of observing lower values is given[1].

2.1.3.1. VaR General Equation

For a given asset or portfolio, the value at risk is popular measure to predict the risk over a fixed period. Assuming that Y is the present value of a portfolio at period 1. In addition, define the loss as L = -Y, so the VaR for the interval p ϵ (0.1) is define as follow:

$$\mathbf{VaR_p(Y) = min\{m: P(L<=m) >= 1-p\}}$$

This previous formula can be interpreted as a quantity of loss (m) from a given portfolio at specified period, and it is surpassed with a defined probability p.

The general equation of the value at risk of a portfolio, given that the value of Y at period 1 is define as:

$$\widehat{\mathrm{VaR}}_p(X) = L_{[np]+1,n},$$

Given that L =-Y, and $L_{1,n} >= , \ldots, >= L_{n,n}$ is the sample in order. Therefore, VaR is the empirical (1-p) – quantile of L.

2.1.3.2.VaR calculation for a single asset

The VaR is calculated from its compound return. After all, we will define random shock that is a specific value of the unpredictable component: $z\sigma (t)^{(1/2)}$. Where *z* is standard normal, with standard deviation1 and mean zero and *t* is a unit of time. Therefore, the random shock is the occurrence of a normal variable with an assumed standard deviation per unit of time. As a random shock is modeled by $z\sigma (t)^{(1/2)}$. For a one instrument, the derivation of VaR is not complicated. We assume that the asset have annual volatility of 30%, and that the asset is the equity index[2].

As the VaR relate on horizon and is calculated relatively to a square root of time rule. So for confidence interval of 1%, over 100 days of trading the loss do not exceeded in more than one day. Furthermore, the daily VaR is a daily loss provoked from the index' volatility. In addition, to have daily volatility, we apply to the annual volatility the square root of time rule.

[1] Longin, F.M. *From value at risk to stress testing: The extreme value approach*, Journal of Banking & Finance, 24, 2000. PP.1097–1130.
[2] Jorion, P. *Risk2: Measuring the risk in value at risk*, Financial Analysts Journal, 52 (6), 1996. PP. 47–56.

For the same example of annual volatility of 30%, the daily volatility is[1]:

$$\sigma_1 = \sigma_{250} / (250) \wedge (1/2) = 30\% / 15.8114 = 1.897\%$$

For the normal assumption for the equity returns, the daily VaR is the multiplication of 2.33 times the daily volatility:

$$\text{Daily } 1\% \text{ -VaR} = 2.33 * 1.897\% = 4.42\%$$

For a 10 days' time horizon, the volatility will be:

$$\sigma_{10days} = \sigma_{1day} * (10)^{\wedge}(1/2) = \sigma_{1day}\ 3.162\ \sigma_{1day}$$

The 10 days VaR is 3.162 times the daily VaR:

$$\text{10-days VaR} = 3.162 * 4.42\% = 13.98\%$$

Different steps from deriving the VaR of a single asset:

- ✓ Mapping the asset to market risk parameters;
- ✓ With respect to each risk factor that has an influence on the value of the asset, measure the sensitivity of the asset;
- ✓ Input the volatility of the risk factors for a particular horizon;
- ✓ Define a loss percentile at a particular confidence level α.

2.2. ANALYZING BANKING RISK MANAGEMENT

The banking risk management has always been a hot topic for researchers after the Great Financial Crisis in 2007. However, risk management in banking context is challenging due to the amplified influence of the GFC on the banking sector, where regulators assumed that the crisis was provoked from the RM inefficiency, and the inadequacy of the risk models. In this subsection, we will try to analyze the several risk management types in banking industry.

2.2.1. Credit Risk Management

In previous subsection, we defined credit or counterparty risk as the possibility that a client, debtor or issuer will face problems to honor his financial obligation toward the bank. Furthermore, different researchers defined the credit risk management as the process of identification, measurement, monitoring and control of the risk created from the chances of default in credit repayments[2].

[1] Singh, M. K. Value at risk using principal components analysis, *The Journal of Portfolio Management*, 24 (1), 1997. PP. 101–112.
[2] Coyle. B. *Framework for Credit Risk Management*. Chartered Institute of Bankers, United Kingdom.2000.

Several financial analysts associate credit risk management' efficiency to the establishment of policies to manage credit risk. These policies are divide into three main categories: the first is limit or reduce credit risk, this policy concentrate on diversification, great risk exposure, overexposure and granting loans to related clients. The second policy is assets classification that aims to periodically appraisal the collectability of the credit portfolio. Finally, the third policy is provision for the anticipated loss by making allowances at a level adequate to absorb it[1].

For the policy that reduce credit risk, financial authorities and policy makers give huge importance to three fundamental problems: credit risk exposure to one costumer (the importance of one lender in the credit portfolio), interrelated customers financing, and overexposure to a single economic sector or geographic area.

Concerning the policy that aims to classify assets, is to guarantee the quality of the credit portfolio of the bank, by being periodically assessed using a classification and loss provision procedures. The approach of this policy is to estimate the probability and the likelihood that the loan will be repay, in addition to assess if loan classification suggested by the bank is adequate.

The lending policy of the bank need on concentrate on provision losses, and a number of fundamentals that make sound lending policies[2]:

- ✓ The basis of granting loans need to be sound and collectible;
- ✓ The bank's funds should be wisely invested, for the benefit of the shareholders and the protection of depositors;
- ✓ The loans granting policy should satisfy both economic agents and households.

The credit risk management has several essential objectives, which concentrate on the evaluation of the lending process, if it is soundly organized, if lending policies are appropriately translated in internal procedures and manuals, if the employees are respecting the established policy, and finally, if the policy information is available for all the lending operation.

2.2.2. Liquidity Risk Management

Liquidity management in banks is established through the fundamentals of the assets management that is for the short-term operations. However, the medium-term liquidity management, banks usually use the principles of liabilities management. The liquidity stability for one bank is not necessarily the same of liquidity needed for the functioning

[1] Catherine.S.F.H, Nurul.I.Y. *A preliminary study of credit risk management strategies of selected financial institutions in Malaysia*. Jurnal Pengurusan, 28. 2009. PP.45-65.
[2] Kithinji.A.M. *Credit risk management and profitability of commercial banks in Kenya*. School of business, university of nairobi, nairobi – kenya. 2010. P12.

of another bank. Furthermore, the level of adequate liquidity for a certain period cannot be stagnate at any given time.

A decision-making structure is essential for the establishment of liquidity management affective policies. In addition, different approaches need to be set, such as limitation of liquidity risk exposure, establishing several liquidity plans and scenarios, and finally an approach to funding and operations. The significant of liquidity management is reflected by the decision-making structure.

The bank management to satisfy its liquidity needs. Usually tend to the assets and liabilities management. In addition, banks try to dispose of extremely liquid trading portfolio assets, that is consist of assets that can be trade easily. For the liabilities management several measures are required, such as increasing short-term borrowings and short-term deposits on the side of liabilities, also increasing capital and the maturity of liabilities[1].

The structure of liquidity risk management is establish on three milestones: the measurement and management of Net Funding Requirements, the market access, and the contingency planning. Predicting the different possible future events is a fundamental element of liquidity planning and risk management. On particular periods, the analysis of "NFR" rely on the structure of a maturity ladder and the control of the cumulative net excess or deficit funds. Moreover, the banks need to estimate frequently their predicted cash flows as an alternative of concentrating only on the predetermined periods that might be there is a cash flow out or in.

The liquidity sufficiency of bank is evaluation rely on the cash flows behavior in different circumstances. Therefore, liquidity risk management consist of numerous scenarios. Upcoming, three essential scenarios in liquidity risk management[2]:

- The first is the going-concern scenario: this scenario is generally apply by banks to the management of depositions use by the bank, which is based on offering a benchmark for balance sheet and cash flows movements in regular course of business.
- The second is the crisis situation scenario: this scenario is usually apply by the bank if important part of the bank's liabilities cannot rolled-over of the bank's balance sheet. The present scenario is subordinate by the current liquidity regulations and supervisory measures.
- The third is the market crises scenario: this scenario is frequently apply in periods of market crisis, where the banking liquidity is influenced, this scenario consist of

[1] Cornett, M. et al. *Liquidity risk management and credit supply in the financial crisis.* Journal of Financial Economics, 101(2), 2011. PP. 297–312.
[2] Goodhart.C. *Liquidity risk management*. Financial stability review, special issue liquidity 11. 2008. PP. 39-44.

liquidity management is predicted on loan quality, with important distinction in funding availability between banks.

The watershed of liquidity risk management is the liability diversification and funding sources, the two elements are signs that the bank has well developed liquidity management. Moreover, the bank's ability to change its assets into cash (liquidity) and funding sources accessibility in circumstances of liquidity shortage are highly significant of the bank's financial health. However, other factors that influence the bank liquidity, like the bank's financial position and reputation that facilitate access to funding sources, also the bank is perspective of profitability. Over all in term of liquidity management, some banks are in a better position than other operators are in the sector.

2.2.3. Market Risk Management

In the previous section, the different factors of market risk were explain, as the interest rate fluctuations, equity risk, commodities and currency risk. Each parameter of market risk can be treated separately but they have a common threat, which is originates sudden changes in the portfolio structure of the bank. Therefore, the market risk management should take into consideration the next fundamental objectives[1]:

- Keep the bank save from unforeseen losses and guarantee income stability by identifying, assessing and understanding the market risk in the real time.
- Assuring that the bank's management process and organizational structure are adequate with international practices.
- Set a reasonable decision-making by contributing in the creation of transparent, objective and consistent information system of the market risks.
- The creation of a structure that assist the bank to understand the link between the business strategy and the operations in one side, and among the objectives of risk control and monitoring, on the other side.

The market risk management must consist of descriptive analysis of market strategies, market fluctuations and performance. Therefore, market risk analysis is based on the following milestones:

2.2.3.1.Modified duration

The duration is a mathematical equation that measure the percentage deviation due to sensitive variation of the interest rates in the economic value of an individual position. As a result, modified duration is a diversity of the known duration, which measure the sensitivity of the instrument's value due to interest rates changes, the distinction between the two types of duration, is that the simple duration presented in time units, on the other hand, the second is expressed as a ratio.

[1] Milanova. E. Market risk management in banks – Models for analysis and assessment. FACTA UNIVERSITATIS, Series: Economics and Organization Vol. 7, No 4, 2010, PP. 395 – 410.

Modified duration = (simple duration) / (1+ profitability)

2.2.3.2. The currency value changes

The currency risk management aims to reduce the currency change impact on the bank assets and liabilities. Therefore, accurate measurement is needed of the bank currency position; it was either long or short, using the following equation[1]:

The global position variation (PV_g) = long currency position (PV_l) - short currency position (PV_s)

2.2.3.3. Discrepancy analysis (GAP analysis)

The interest rate gap is the difference between assets and liabilities in term of interest rate sensitivity for a certain period. The gap analysis consists of analyzing this difference in both assets and liabilities for fixed and fluctuating interest rate.

Two cases are possible, positive or negative discrepancy, where the fist is when the difference indicates that for a certain period, the sum of assets being revaluated are larger than the sum of the liabilities over the same period. The second is when the liabilities being revaluated are bigger than the assets.

2.2.4. Operational Risk Management

For the different types of risk, risk managers try to optimize the risk, only for operational risk management, different approach is followed for ORM to minimize its probabilities. Consequently, ORM has multiple objectives need to be respect[2]:

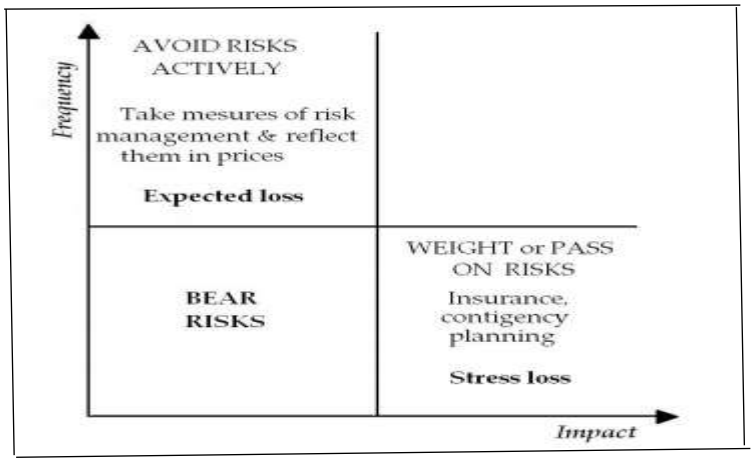
- Determine and clarify exposures and incidents created from people, processes, systems and external events;
- Systemize early alerts of possible operational incidents and anticipating potential problem;
- Manage the susceptibility of external and systemic risks from occurrence;
- Provide qualitative and quantitative operational information;
- Participate in the business decisions;
- Clearly identify and segregate the operational duties and empower business units to take the required actions.

[1] Mirković, V. Soundness of market risk measurement techniques during global financial turmoil. Ekonomika, br. 1, 2013. PP. 221–230.

[2]Marija.K. Operational risk: challenges for banking industry. Procredit Bank, Belgrade, Serbia. Vol. 46, No. 1-2, 2013. PP. 40-52.

The following figure explain the ORM approach:

Figure N°09: Operational risk management approach



Source: OSTERREICHISCHE .N. "*Guidelines on Operational risk management*".2006. www.oenb.at/en/img/operational_risk_screen_tcm16-49652.pdf. (Accessed March 30, 2020).

The ORM is generally focused on the risk characterized with high frequency and high severity, and the OR managers identifies, assess and control accurately the several sources of this type of OR, however, the easy managed OR is the risk with high frequency and low severity due to its occurrence repetitively the risk management master its management.

Operational risk management has its own challenges to the bank management. As known, operational risk factors are mostly internal events and the amplitude of possible losses are difficult to be exactly determined. Therefore, an effective mechanism for systematic operational risk management is needed.

2.2.5. Assets And Liabilities Management

The mismatch of the assets and liabilities of the bank create several types of risk, and the ALM approach provides a certain degree of protection against their arisen. The ALM is a systematic approach that define measure, monitor, modify and manage risks born from AL mismatch. As a result, the restructuration of the bank's assets and liabilities mange directly this gap.

The assets liabilities management covers the bank against a collection of serious risks that jeopardize the sustainability of the bank, such as liquidity gap, interest rate gap, hedging position and the economic value of the bank's balance sheet. The ALM scope is divided according ALM different roles. Where ALM blocks are[1]:

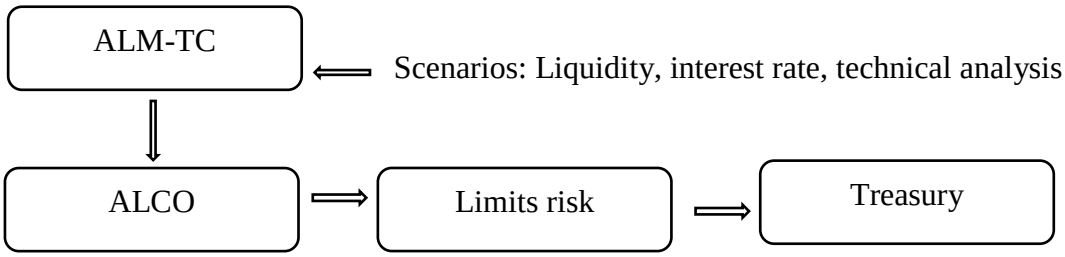
- Liquidity mismatches or traditional gap management;

[1] Novickytė.L and Petraitytė.I. *Assessment of banks asset and liability management: problems and perspectives (case of Lithuania).* Social and Behavioral Sciences (110). Elsevier. 2014. PP.1082 – 1093.

- Interest rate mismatches or interest rate gap management;
- Hedging interest rate risk based on simple gap analysis;
- Economic value of the balance sheet, ALM target associates to time profile of net interest income;
- Hedging of economic value, through convexity or optional gaps.

The ALM process includes the guidelines to business lines for making the objectives of the ALM in consistent with the global bank's policy. The next figure illustrate the ALM process:

Figure N°10: ALM decision-making process



Source: Bessis.J. *Risk management in banks*. A John Wiley and Sons, Ltd, Publication, third edition. 2011. P.270.

Where: ALCO is Assets Liabilities Committee and TC is Technical Committee.

2.3. RISK ADJUSTED PERFORMANCE

The traditional performance measures have an objective to evaluate the bank's contribution in wealth creation for shareholders by using its assets on risk-adjusted basis. In risk-adjusted measures of performance, the risk metric used is the capital allocation. The risk-adjusted measures are: the risk-adjusted return on capital (RaRoC) and the shareholders' value added (SVA).

The risk adjusted return on capital ratio represents the profitability percentage in benchmark to hurdle rates or risk-adjusted. On the other hand, the shareholders' value added ratio consist of both the size of transaction and the percentage of profitability, to determine if the transaction creates value for shareholders. Both risk adjusted performance ratios are based on the economic capital allocated and the expected loss. SVA is a ratio represents the income netted of debt cost minus the cost of economic or regulatory capital. The RaRoC is the revenue net from possible loss and operating costs to economic or regulatory capital applied as the risk-adjusted metric[1].

1 Stoughton, N. M., & Zechner, J. *Optimal capital allocation using RARO and EVA*. Journal of Financial Intermediation, 16(3), 2007. PP.312–342.

RaRoC is ratio that do not take into consideration the size of the transaction, it defines only if a transaction produces income or not regardless its size. However, the SVA ratio calculates value in presence of the transaction's size, nevertheless, this last indicator does not provide full vision whether it result from a low percentage, we can only determine with exactitude in case of combining with RaRoC ratio. As a result, the two ratios are complementary and should be use together.

2.3.1. Risk adjusted Return on Capital (RaRoC)

The RaRoC ratio as explained previously is netted of Expected Loss (EL) from revenues and risk-adjusted performance due to its formula of dividing net earnings by allocated capital. The next equation explains RaRoC ratio[1]:

$$\mathbf{RaRoC = (r \times X - i \times D - el \times A - oc \times X) / K}$$

Where: capital letters indicates the value and the small once are for the percentage. The following indicators explains the RaRoC formula:

- ✓ X for exposure;
- ✓ r (%) for asset all in revenue;
- ✓ i (%) for the cost of debt;
- ✓ D for the allocated debt;
- ✓ oc (%) for the operating costs;
- ✓ el (%) for the expected loss;
- ✓ K in monetary units for the allocated capital.

The RaRoC ratio is determined only in one case where K is zero, which means that risk does not equal zero. As a result, if transactions are risk free, the ratio is undefined.

2.3.2. Shareholders Value Added (SVA)

The SVA ratio is defined in monetary units. This ratio adjusts the profitability with expected loss, next with operating costs then with the risk-based capital, the SVA ratio appears as follow[2]:

$$\mathbf{SVA = EBT - EL - \mathit{k} \times K}$$

Where:

K is the required return on capital, presented as a percentage of capital not exposure.

EBT stands for Earnings Before Taxes, and EL is the value of the expected loss.

[1] Reddy, K., et. al. *Comparative risk adjusted performance of Islamic, socially responsible and conventional funds: Evidence from United Kingdom.* Economic Modelling, 66. 2017.PP. 233–243.
[2] Perold, A. *Capital allocation in financial firms*. J. Appl. Corp. Finance 17, 2005. PP.110–118.

Using the previous definition of the SVA ratio, we can conclude that if the RaRoC is above the hurdle rate, than the SVA ratio is positive, and vice versa. Although, the use of both ratios provide both profitability percentage and size of profits. In following SVA equation, D equals X, therefore, the capital is invested risk free:

$$\mathbf{SVA = \mathit{r} \times X + i_f \times K - i \times X - (EL+OC) \times X - \mathit{k} \times K}$$

Where: (i_f) refer to risk-free rate.

From the last equation, we can deduce an equation using risk premium over risk-free rate appears again as the spread of cost of capital over risk free rate multiplied by capital allocated[1]:

$$\mathbf{SVA = (r - i) \times X - (EL+OC) \times X - (\mathit{k} - i_f) \times K}$$

A positive SVA ratio applies the same conditions that RaRoC > *k*, or:

$$\mathbf{SVA / X = (r - i) - (EL+OC) - (\mathit{k} - i_f) \times K / X >= 0}$$

When risk tends towards zero, the RaRoC ratio becomes undefined or infinite, such in the case of counterparties rated Aaa. If capital decrease to zero, the revenue objective become covering operating costs, plus the cost of debt. However, in case of the SVA ratio, if risk equals zero, than SVA defined the earnings netted from operating costs. This remain meaningful, due to the nature of the earnings that it can be negative in some circumstances. RaRoC and SVA negative illustrate that the business destroys value for the shareholders.

2.3.3. Economic Income Statement

Economic income statements provide reports of risk-adjusted measures of performance. The economic income statements can be dressed using risk-based pricing, or risk-based performance and capital allocation[2]:

- The first is risk-based pricing has an objective to precise the minimum return of new transactions, in coherence with the bank's return target taking into consideration the risk tolerated by the bank.
- The risk-adjusted performance measures (RAPM) consist of two methods to evaluate the true profitability of the bank, and to provide as a measure of the management by objectives framework. The set of RAPM can be applied based on the net return and on the assets return.
- The risk-adjusted capital allocation use two main ratios based on return on capital, which are RaRoC and the economic value added (EVA).

[1] Agarwal, S., & Mirza, N. *A study on the risk-adjusted performance of mutual funds industry in India.* Review of Innovation and Competitiveness, 3(1). 2017. PP.75–94.
2 Anolli, M. *Risk-Adjusted Performance Measures.* Retail Credit Risk Management. 2013. PP.134–147.

3. ALGERIAN BANKING RISKS

The aim of this section is to identify the essential risks in Algerian banks, which will be used further coming in the empirical chapter. We will attempt to define the vulnerabilities of the Algerian banking system that may be the reason of delay of the financial system development. In addition, different international monetary authorities examined the financial stability of the banking system on Algeria, such as the World Bank and the International Monetary Fund.

Several factors may influence the monetary stability of country. The IMF mission in 2014 defined the key banking risks in Algeria, which are the credit risk, le liquidity risk, the Forex (financial market risk), the interest rate risk, the governance and hydrocarbon risk[1]. Beside the identified risks by the IMF, we will expose the risks identified from other research and monetary authorities in Algeria. In our essay to present the different risks in Algerian banks, we will divide this section into banking specific risks, macroeconomic risks and, governance and hydrocarbon risks.

3.1. BANKING SPECIFIC RISKS

A comparative study among the North African country exposed that Algeria's banking risk rating is very high in comparison to Tunisia, Morocco, and Egypt[2]. In addition, although the monetary support from the Algerian government, Algerian banks are suffering from national and international unpredictable environment, caused by the Covid-19 pandemic, oil-price changes and social instability. Different measures were taking by the monetary authorities in Algeria to control banking risks in the last year, which are loan freezing and reduction in capital adequacy and reserve requirements. While the Algerian banking system does not seem to have major stability concerns, however, the existing risks require special attention to be controlled and managed properly.

3.1.1. Interest Rate Risk in Algerian banks

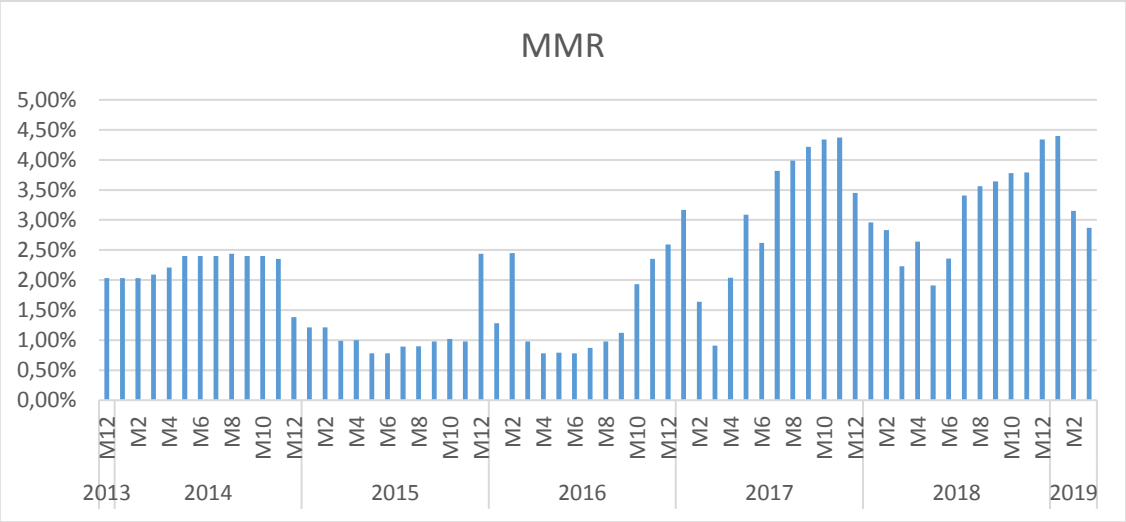
The interest rate risk is a component of market risk as previously defined, in the Algerian context, government restricted the banking exposure to this risk, through the application of some measures. Such as controlling the bonds duration mismatch, by detaining them to maturity. Beside the policy making stagnancy for several years now. Nevertheless, in the near future, interest rate risk require more attention to be monitored, as capital markets are progressing rapidly, and the fixed interest rate of the credit contracts are replaced by the variable interest rates so the bonds owners profit from the favourable interest rate fluctuations.

[1] IMF Country Report No. 14/161, Algeria financial system stability assessment, 2014, p 15. Https://www.imf.org/external/pubs/ft/scr/2014/cr14161.pdf.

[2] https://ihsmarkit.com/research-analysis/algerias-banking-risk-rating-very-high-risk.html. Visited: 25/04/2021 at 04:33AM.

The control of interest rates is the fundamental instrument to manage the liquidity issues, as the essential concern of the monetary policy is to control liquidity. Therefore, any changes of this last cause interest rate fluctuations. To examine the interbank interest rate fluctuations in Algeria, we prepared the next graphic, which presents the monetary market rates monthly variations from December 2013 to March 2019.

Graphic N°03: Monetary Market Rate fluctuations



Source: own computation

Several studies linked the interest rate changes with macroeconomic conjuncture, and in the Algerian context, the behaviour of interest rate is directly associated to oil-price changes[1]. Furthermore, research proved that during oil prices decline periods, the interbank market suffers from liquidity problems. Consequently, the rates were high. On the other hand, during the oil prices increase periods, the rates are notably low. As it appears from the above graphic, since the oil prices decline in 2014, the average of MMR fluctuations is getting high.

To understand more the importance of interest rate risk in Algeria, we studied the interest rate risk during the last decade, for both state owned banks (SOB) and private owned banks (POB).

The interest rate risk ratio used in the next table is calculated as follow[2]:

IRR = Interest Income / Total Loans

[1] Afroune. N and Achouche. M. *Les déterminants du taux d'intérêt interbancaire Algérien*, Roa Iktissadia Review ISSN 2253-0088, V08(01). 2018. PP. 182-199.

[2] Musiega. M. et al. *Influence of interest rate risk on performance of commercial banks in Kenya*, Economics and Finance Review Vol. 5(02) ,June, 2017. PP-14-23.

Table N°15: Interest Rate Risk in Algerian Banks

Year	IRR in POB	IRR in SOB	The Average of IRR in Algerian banks
2010	7,672%	6,813%	7,243%
2011	9,863%	6,497%	8,180%
2012	9,749%	5,832%	7,791%
2013	8,137%	5,524%	6,830%
2014	8,727%	5,443%	7,085%
2015	8,071%	5,530%	6,800%
2016	8,225%	6,108%	7,166%
2017	7,320%	6,128%	6,724%
2018	7,450%	6,050%	6,750%
2019	7,923%	5,373%	6,648%

Source: Own computation, based on the financial statements of the Algerian banks

For the last ten (10) years, the average variation of the interest rate risk measure was between 8% and 6%. Which mean that the Algerian banks have a total interest income equals 6% to 8% from the total granted loans. More precisely, this percentage is low in state owned banks in comparing to the private owned banks. In the empirical chapter, we will use this ratio, to investigate the relationship between Algerian banks profitability and interest rate risk.

3.1.2. Credit Risk And Loan Quality in Algerian banks

In the banking sector, the most important risk is the credit and loan risk. For the Algerian situation, credit risk was always moderate by the financial support from the government and monetary authorities. Generally, this is the case of the state owned banks, where the losses were shift to the government balance sheet due to authority interventions in the banking system.

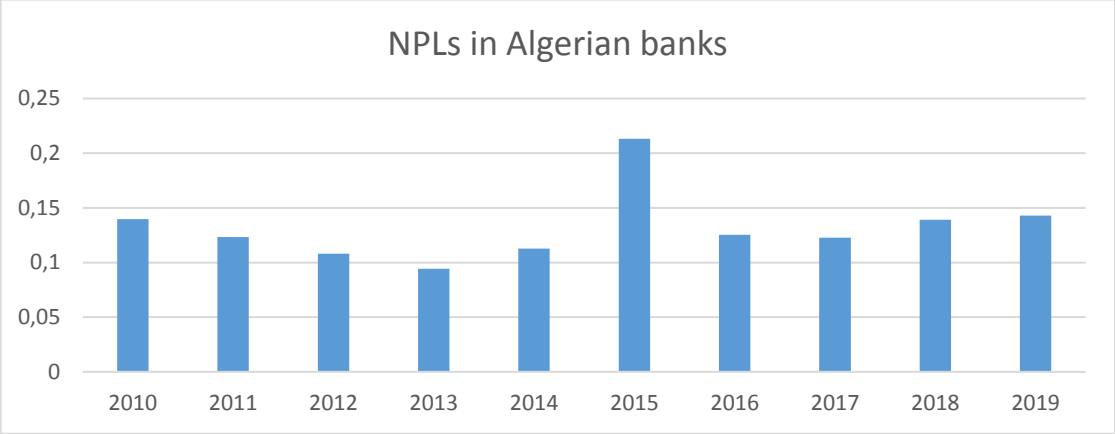
In the recent years, the credit risk in Algerian banks is aggravating due to the reduction of the government deposits caused by the oil prices decile and currency depreciation, which will lead to decrease the loans quality and increase non-performing loans percentage that is already high in comparison to international financial standards. In addition, the international monetary fund's report about Algeria announced that NPLs percentage equals 11% in 2012, than 10% in 2013 and 9% in 2014.

Non-Performing Loans (NPLs) ratio = Non-Performing Loans / Total Loans

Where non-performing loans are the loans of which payment of principle and interest has been overdue for more than three (03) months.

To complete this information, we prepared the graphic N°04 that summarizes the NPLs variation is Algeria during the last ten years.

Graphic N°04: NPLs variation in Algerian banks



Source: Own computation, based on the IMF and WB database 2020

This graphic confirm the NPLs reduction over the period from 2010 to 2013 recorded by the IMF's report. Than with the start of the hydrocarbon crisis, the PNLs reach a maximum percentage in 2015. The NPLs increase maybe caused by the Algerian banking assets quality deterioration or to the slow macroeconomic growth. Numerous explanations are possible. Therefore, an efficient credit risk management is essential to optimize banking and financial management. Moreover, for more comprehension of the credit risk management in Algerian banks, we calculated the credit risk ratio, from the financial statement of the Algerian banks over the last ten years.

Credit risk ratio = Total Loans / Total Assets

Table N°16: Credit Risk in Algerian Banks

Year	Credit Risk In POB	Credit Risk In SOB	The Average Of CR In Algerian Banks
2010	0,4606642	0,39874586	0,42970503
2011	0,48805026	0,43867889	0,46336458
2012	0,42815187	0,49112533	0,4596386
2013	0,50299992	0,5461915	0,52459571
2014	0,49167589	0,57185455	0,53176522
2015	0,52896999	0,62003832	0,57450416
2016	0,55950461	0,66394353	0,61172407
2017	0,55777792	0,68733861	0,62255826
2018	0,62261829	0,69347561	0,65804695
2019	0,62327171	0,72483418	0,67405295

Source: Own computation, based on the financial statements of the Algerian banks

This credit risk ratio measures the bank's exposure to counterparty default. The higher this ratio indicates a bank is loaned up and its liquidity is low, and the more risky a bank may be to higher defaults. Moreover, over the last ten years, Algerian banks documented an average of exposure that reaches 67% of the bank's total assets. This indicates that Algerian banks, both state owned banks and private owned banks are both highly exposed to credit risk. Therefore, this ratio will be use in the empirical approach to test its impact on the bank financial performance in Algeria.

3.1.3. Liquidity Risk in Algerian banks

The liquidity risk is create from the gap between assets and liabilities management, for the Algerian banking system, the central bank always fund facilities to mitigate any liquidity shock faced by the system. Moreover, the financial system specificity of having no foreign inflows lower the risk related to unexpected outflows. Additionally, the government deposits moderate liquidity risk in Algeria, which represents 43%[1] of total banking deposits. Therefore, Algerian banks are seriously dependent to funds from the government.

To measure the liquidity risk in Algerian banks, we used the loans to deposits ratio, it is presented in table N°17:

Liquidity risk ratio = Total Loans / Total Deposits

Table N°17: Liquidity risk ratio of Algerian banks

Year	liquidity risk in POB	Liquidity risk in SOB	The Average of LR in Algerian banks
2010	0,97483106	2,52358548	1,74920827
2011	0,92494358	0,6004496	0,76269659
2012	0,74236866	0,64857986	0,69547426
2013	2,92840434	0,72260539	1,82550487
2014	0,83922874	0,74523054	0,79222964
2015	0,90882754	0,81442681	0,86162718
2016	0,90848125	0,91039162	0,90943643
2017	0,85570375	0,93811599	0,89690987
2018	0,97091576	0,94656134	0,95873855
2019	1,14297054	1,09807274	1,12052164

Source: Own computation, based on the financial statements of the Algerian banks

[1] HIS. Markit. Gabrielle Ventura. 18 March 2021. https://ihsmarkit.com/research-analysis/algerias-banking-risk-rating-veryhigh.risk.html#:~:text=Government%20deposit%20drawdown%20is%20the%20biggest%20liquidity%2risk%20to%20Algerian%20banks.&text=Government%20deposit%20data%20are%20released,%25%20 rom%202.1%25%20in%202019.

The used liquidity ratio in the table above help to measure bank's liquidity, due to a comparison for the same time line between the bank's total loans and its total deposits. This ratio is interpreted as a percentage.

In the case of high percentage of this ratio, this means that the bank have liquidity shortage to cover any unpredictable fund requirement. Contrariwise, in case of too low ratio that maybe interpreted that the bank may not be earning as much as it could be.

The liquidity ratio in Algerian banks over the last ten years was progressing contradictory in private owned banks and in the state owned banks, where in 2010 the SOB had a 252%, than decreased to 109% in 2019. On the other hand, the POB in 2010 had 97% liquidity risk ratio than increased in 2019 to 114%.

Overall, liquidity conditions tightened in Algeria, with a loan to deposits ratio 112% in 2019, as credits development exceeded deposits mobilization despite the slowdown.

3.2. MACROECONOMIC RISKS

The export trade in petroleum and gas dominates the Algerian economy, despite the oil prices decline in the recent years. In addition, the Algerian economy is characterize with key strengths[1]:

- Important potential for shale gas development;
- Significant oil and gas reserves;
- Noteworthy perspective in agriculture, renewable energies and tourism;
- Advantageous geographical position.

On the other hand, Algerian economy know essential weaknesses, such as:

- Hydrocarbon curse, and dependency to its revenues;
- Social problems, lack of opportunities for graduates and youth;
- Dominance of public sector and state owned companies;
- Dilapidated infrastructure;
- Unforeseen and uncertain business environment.

Furthermore, due to the last oil prices crisis, Algeria went into recession, as the country is seriously dependent to oil revenues (21% of GDP and 93% of exports).

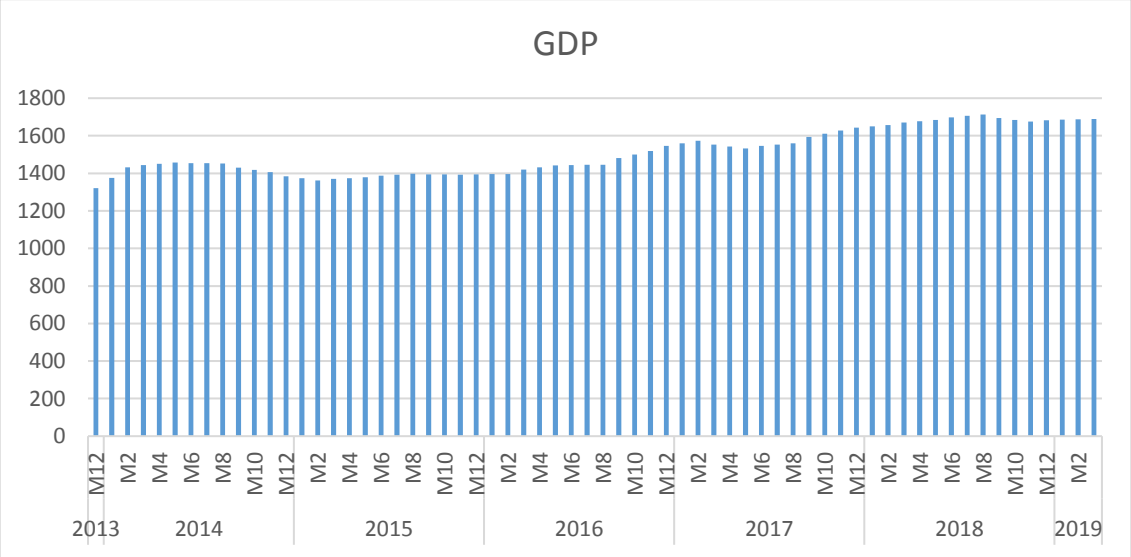
In addition, the Algerian economy environment is characterised in the last ten years with currency depreciation, high level of inflation rates, GDP growth instability and inactive financial market (FX).

[1] Coface. For trade. https://www.coface.com/Economic-Studies-and-Country-Risks/Algeria.

3.2.1. Algerian GDP Growth Instability

Growth can return as soon as possible, if the oil prices record positive changes, which would revive the global economy. In this circumstance, a substantial rebound in real growth. The economic healing would allow serious reduction in the overall budget deficit, and current account deficit. Nevertheless, Algerian government should take measures to shrink the tax base and create development program to diversify the economy. Or else, the hydrocarbon dependency will continue to slowdown the medium-term development prospects. In graphic N°05 a presentation of the GDP variations:

Graphic N°05: GDP Growth Variations in Algeria



Source: Own computation, based on the IMF and WB database 2020

In the last decade, the Algerian economy was damaged from historically low oil prices. Moreover, the Algerian banking system was not immune to the effects of the global oil price shock. The effect of the economic stability on banking financial performance in Algeria will be discussed in the empirical chapter, to capture the impact of macroeconomic risk on banking profitability.

However, the graphic above show a stable and slow increase in GDP levels in Algeria from 2013 to 2019. One of the reasons of the current GDP situation is the government decision against borrowing externally, where the Algeria's public debt is generally domestic.

The domestic debts increased sharply since 2016 to finance a budgetary deficit born from oil prices decline and growing expenditures.

By the end of 2019, the domestic Algerian debt represented 46% of GDP, in contrary to 1% of GDP for the external debt. Several factors influence the GDP variations in Algeria,

further-coming, we selected different macroeconomic determinants to explain the GDP variation using a VAR model, as a section in the empirical chapter.

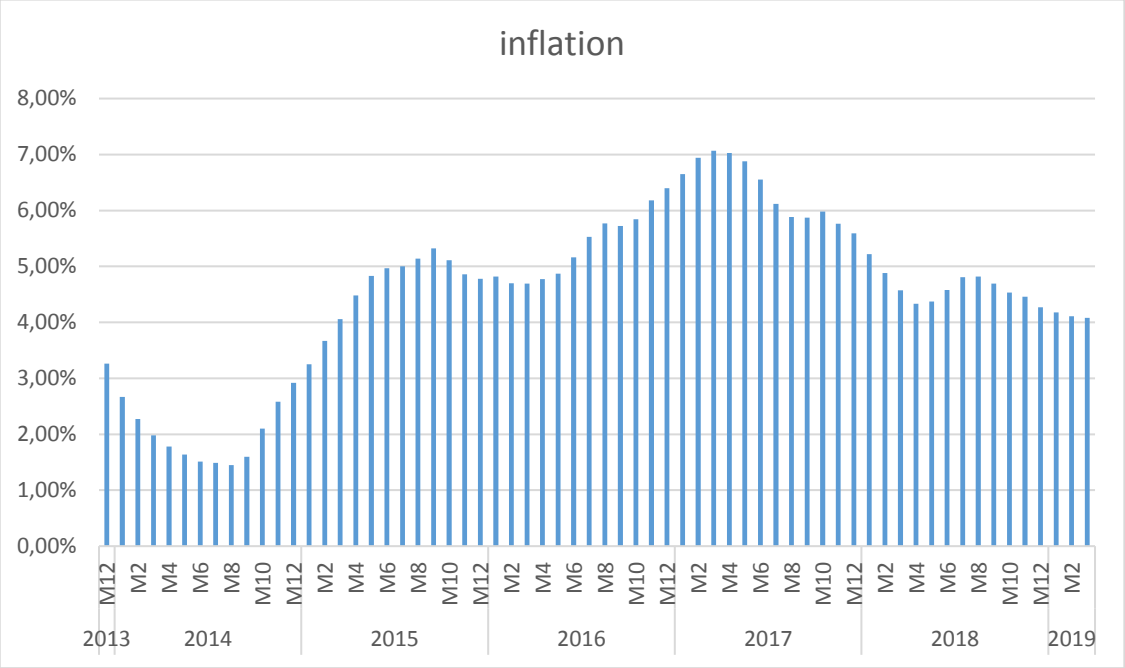
3.2.2. Inflation Rate Fluctuations in Algeria

Inflation in Algeria is one of the essential challenges for recent economic development in Algeria, and for monetary policy makers.

Furthermore, the first objective of the monetary policy is to achieve prices stability, and apparently, the monetary authorities failed to attain their goal, as inflation rates rose to double-digit levels in 2015. It was partly caused by higher import price inflation, and increase in the exchange rates pass-through as the dinar depreciated considerably next to major currencies.

The next graphic presents the inflation rate fluctuations in Algeria, before, during and after the oil-price crisis.

Graphic N°06: Inflation rate fluctuations in Algeria



Source: Own computation, based on the IMF and WB database 2020

Expressively the graphic above shows a significant increase in inflation rates from September 2014. As the dinar fall apart against the United States Dollar (USD) and the euro (EUR) currencies since the mid of 2014.

Furthermore, the Dinar depreciation is fuelling inflationary pressures, which were already strong because of other macroeconomic determinants. As a result, increase in the Consumer Price Index (PCI) from 1.2% on average in the first half of 2014 to 5.9% in May.

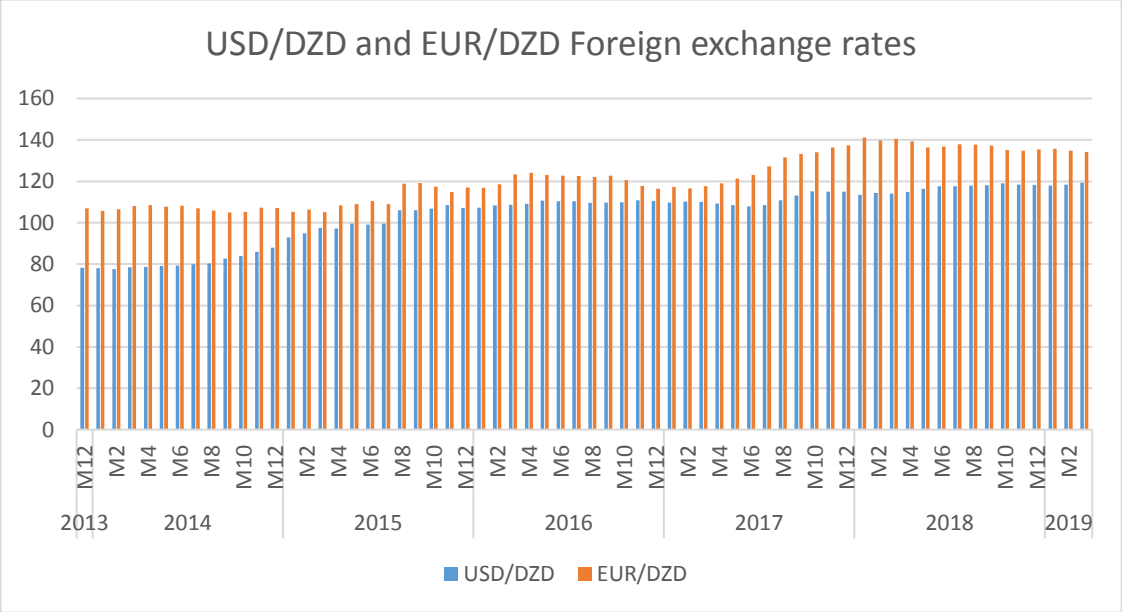
Simultaneously, food prices increased by 7.5% despite the government interventions to prevent prices explosion. A side from the impact of inflation rates growth on economic development, it represents a threat to the country's social stability.

Consequently, the central bank intervention was to stabilise the dinar at the expense of dipping foreign exchange reserves of the country. Therefore, the level of foreign exchange reserves has gradually declined, to cover imports of the economy, also to provide the banking system with the required liquidity to finance the economy temporarily.

However, if the monetary authorities do not limit its intervention of financing the budget deficit, it could impedes the monetary policy objective of stabilising prices and inflation rates.

Graphics N°07 shows the dinar depreciation against the USD and the EUR and the foreign exchange reserves reduction during the period from 2013 to 2019, for more understanding of the factors that caused inflation rates in Algeria.

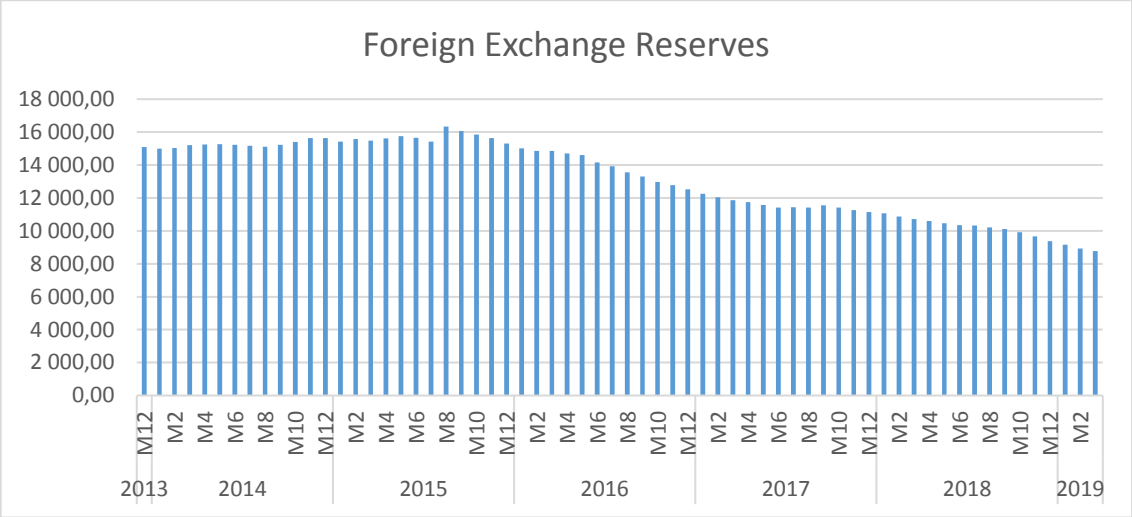
Graphic N°07: USD/DZD and EUR/DZD fluctuations



Source: Own computation, based on the IMF and WB database 2020

Graphic N°7 shows an explicit depreciation of the Dinar against the fundamental currencies (USD and EUR) since 2014. Moreover, the exchange rate policy in Algeria have an objective to maintain the equilibrium value of the real effective exchange rate, however, the exchange rate has usually been used to control inflation rate, this policy is effortlessly implemented due to the price-maker status of the central bank of Algeria on the financial market.

Graphic N°08: Foreign exchange reserves decline



Source: Own computation, based on the IMF and WB database 2020

The foreign exchange reserves in Algeria were always the authorities escape to relief the inflationary pressure, beside the monetary policy adjustment over time, in adoption with the current economic environment. Since 2014, base money has been the fundamental intermediate instrument of the monetary policy, and liquidity management means have dominated the monetary policy apparatus.

Furthermore, one of the fundamental obstacles of the exchange rate recovery in Algeria is caused by the foreign exchange market (FX) in Algeria, where banks are forbidden from lending in FX. However, the limit activity of banks in the FX shield them from direct foreign shocks.

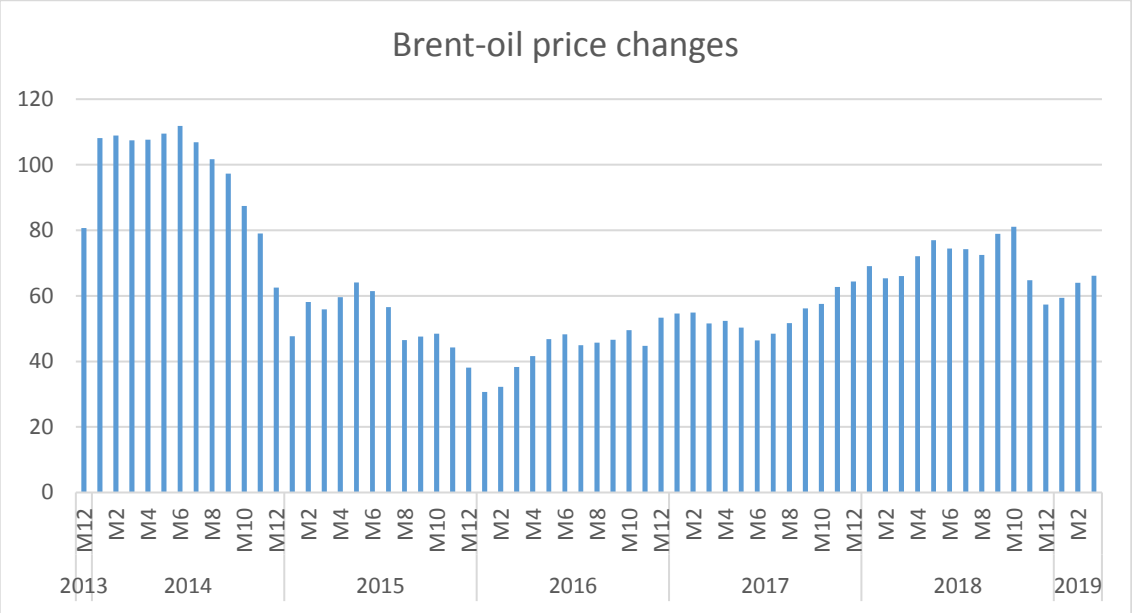
3.2.3. Hydrocarbon Risk in Algeria

The oil prices shock that started in mid-2014 has evidently had a foremost and occasionally destabilizing impact on notions profoundly dependent on oil and natural gas export income.

Algeria is no exception, and its capability to withstand the economic blow could have major implications for the world and especially Europe. Furthermore, the economic nature of Algeria characterized with low degree of trade and financial integration with the world economy isolates it from most external shocks.

However, this is not the case for hydrocarbon exports trade, which presents more than 90% of Algerian exports. Therefore, the banking system is extremely sensitive to oil-price changes. Moreover, the following graphic illustrates Brent-oil prices changes monthly from December 2013 to March 2019.

Graphic N°09: Brent-oil prices changes



Source: Own computation, based on the IMF and WB database 2020

In the graphic above, a demonstration of the oil-prices decline over the last years. Moreover, the oil-prices shock had a deep influence on the financial system and economic growth in Algeria, due to its dependency on oil exports trade revenue.

From historical evidences, Algerian government were not able to manage the oil price shock, back in 1980, which was the reason of economic situation deterioration, massive popular revolts, political repression and bloody civil war.

However, nowadays the government have the ability to withstand the crisis applying modest political and economic reforms.

Finally, the hydrocarbon shock generated new challenges to financial stability in Algeria. Moreover, the flexibility of Algerian banks to the external shocks is conditioned to some key procedures, such as the efficient sources allocation, and financing investments that have non-hydrocarbon potential growth.

Conclusion of the Second Chapter

Banks are extremely complicated organization, they operate in business environment characterized with numerous regulations, as they are responsible for public funds, and they are surely the organizations with the highest level of debts than the non-financial entities. Therefore, the risk management is more challenging than risk management of other businesses and requires special attention.

To comprehend banking risk management, we divided the second subsection into modelling banking risk management, analysing banking risk management than risk-adjusted performance.

From this part, we were able to define the bank's major risks, which are credit risk, liquidity risk, assets and liabilities risk, operational risk and finally market risk that is divided into interest rate risk, foreign exchange rate risk and share's risk. Furthermore, we presented the risk-adjusted performance, these ratios use risk-adjusted basis to measure the bank's retune.

Moreover, the risk adjusted return on capital (RaRoC) ratio is the bank's outcome net from loss and operating costs to regulatory capital, and the shareholders' value added is the indicator that presents the income netted of deb cost minus the cost of economic capital.

Finally, we presented the Algerian banking risks. We distinct the risks in Algerian banks to two main categories, bank specific risks: liquidity risk, credit risk, interest rate risk, and macroeconomic risks: GDP growth instability, inflation rate fluctuations and hydrocarbon risk.

The presentation of these dissimilar risks in the Algerian context facilitate the empirical background, where we will use the defined risks to understand their influence on bank profitability.

Chapter three:
RESEARCH PARADIGM, METHODOLOGY AND MATHEMATICAL

Chapter III: Research Paradigm, Methodology And Mathematical Tools

Introduction of the Third Chapter

This chapter identifies the philosophical bases of our research, the methodology used and the mathematical tools applied. Whenever the researcher decide to dive in the academic higher studies, he must select first and after all the way and how to investigate his fundamental research problem, so the findings would be justified following particular research paradigm, which gives the results of the research more credibility and reliability to the whole body of researchers in the discipline.

Moreover, for a particular researcher there is a singular way to comprehend truth and attain knowledge influences by his own point view of the world. The researcher's point view guide his thinking, his beliefs, and his assumptions about knowledge and society, this is what the social sciences name it paradigm[1].

Furthermore, the research paradigm is decompose to ontology, epistemology, and methodology. Where the ontology clarifies what the researcher beliefs about the nature of knowledge and reality, and the epistemology illustrates his way of knowing what he knows, finally the methodology used to attain knowledge as quantitative, qualitative or mixed methodology[2].

The research paradigm identification will help to justify the selection of a specific methodology. As known, that for each paradigm there is a related appropriate methodology to apply. Additionally, if the researcher has a positivistic assumption, therefore he is using a quantitative methodology. On the other hand, the researcher that has constructivist or interpretative assumptions, he has a sort of obligation to adopt the qualitative methodology.

In this chapter, we will present what we know, how we know it, and how we know what is real, by the identification of our paradigm assumptions, the methodology that we will use and the mathematical tools that we will apply, beside to the theoretical perspectives that was collected from chapter one and two. Consequently, by the end of this chapter we would be able to conduct our empirical chapter and answer the research problem.

[1] Schwandt, T.A. *Dictionary of qualitative inquiry (2nd Ed.)*. Thousand Oaks: Sage. 2001. PP. 183-184.
[2] Patton, M.Q. *Qualitative research and evaluation methods (3rd Ed.)*. Thousand Oaks: Sage. 2002.

Chapter III: Research Paradigm, Methodology And Mathematical Tools

1. RESEARCH PARADIGM AND EPISTEMOLOGY

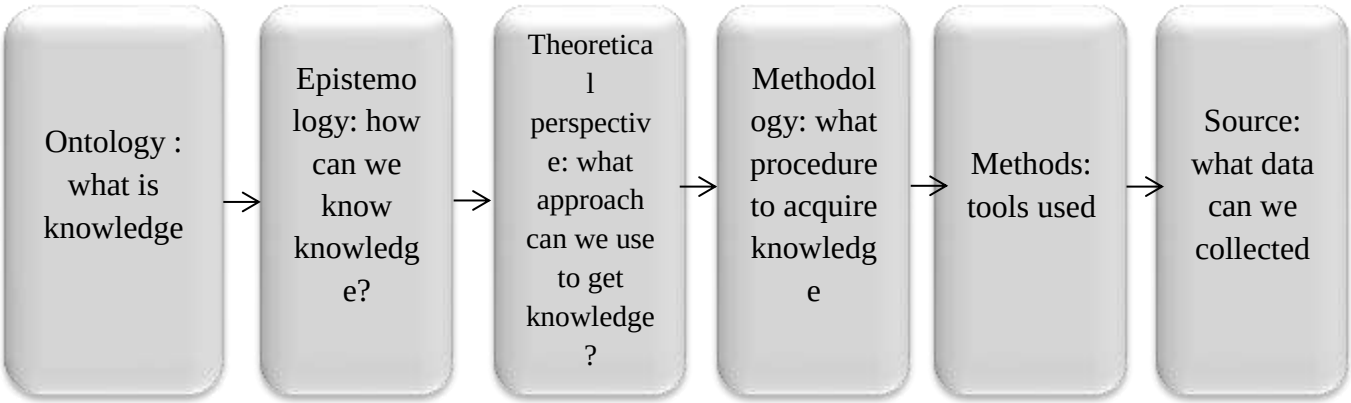
As academicians, we are obliged to be able to comprehend and articulate beliefs about the inherent and the basic of reality. What can be identified about this reality, and by what manner reaching this knowledge, these questions are the components of research paradigms.

Moreover, paradigm is the conceptual framework and the belief system with assumptions about the ontology, epistemology, methodology and the methods used. Furthermore, paradigm is the way that we select to understand the reality and to attain knowledge. We will comprehend more this concept in this section. Additionally, the research paradigm can be explained through the following steps:

Starting with the research ontology that explains what reality is ? Then the study's epistemology, which is "how the researcher knows this reality". Followed by the theoretical perspective that describes the approach used to get knowledge, at this point, we set the methodology procedure used to acquire knowledge, next stage is the identification of the method and tools utilized to get knowledge, finally what data can we collect to accomplish the study[1].

The next figure explains the procedure from setting up the ontology of the research till data collection stage:

Figure N°11: The Procedure Of Research's Paradigm Identification



Source: James Scotland. Exploring the Philosophical Underpinnings of Research: Relating Ontology and Epistemology to the Methodology and Methods of the Scientific, Interpretive, and Critical Research Paradigms, Canadian Center of Science and Education, Vol. 5, No. 9; 2012. PP. 9-16.

[1] Crotty, M., *Foundations of social research: Meaning and Perspective in the Research Process*.1998. PP.256.

The research ontology and epistemology illustrate how knowledge is viewed and how can the researchers see themselves in relation to this knowledge, followed by the methodological strategies used to discover it, the quality of the research would be increased by the right choice of philosophical awareness.

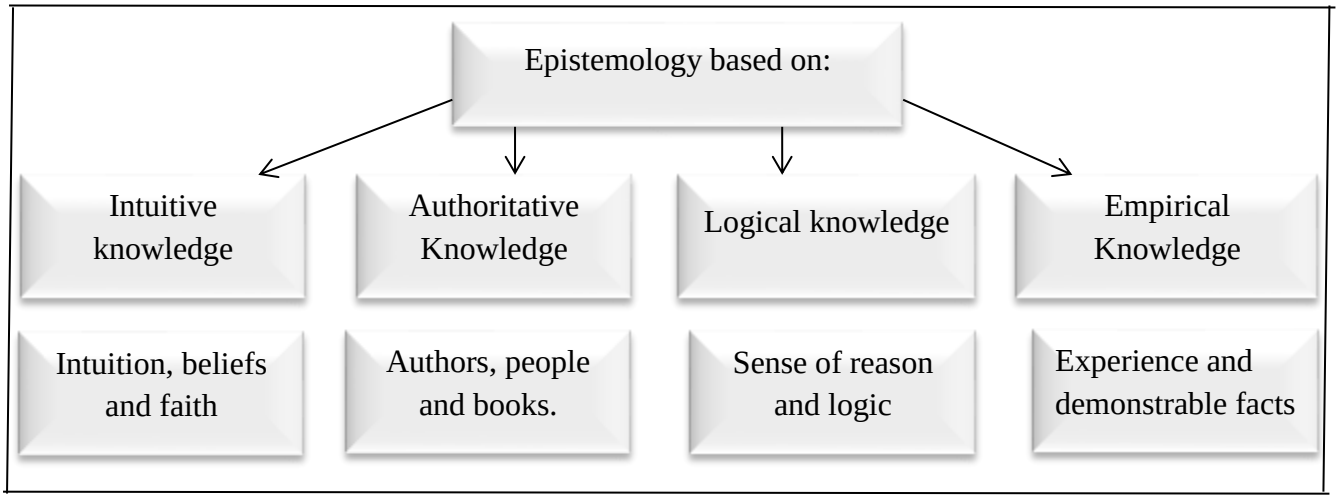
The choice of a particular paradigm associate the methodological strategy and the study methods to use, where the concept paradigm was utilized by the philosopher Thumas kuhan in 1962[1], to indicate the philosophical path of thinking, but in academic researches, paradigm refers to the researcher's worldview, or the researcher's perspective according to Mackenzie & Knipe in 2006[2]. This paradigm path affects the researcher's way of thinking, and how data and research findings should be interpreted. Research paradigm is essentially identified through the research ontology, epistemology and methodology.

1.1. RESEARCH EPISTMOLOGY, ONTOLOGY AND METHODOLOGY

1.1.1. Epistemology

The epistemology is "*the branch of philosophy that studies the nature of knowledge and the process by which knowledge is acquired and validated*"[3]. This discipline is focused on the nature and form of knowledge, thus, research epistemology is defined through a number of questions: how we know what we know? To investigate our knowledge, how do we know the truth? And what counts as knowledge? These questions are fundamental to identify the epistemology of a research. According to Slavin 1984, truth or knowledge can be acquired from four (04) sources, which are intuitive, authoritative, logical and empirical knowledge[4]. The following figure summarized the four sources of knowledge:

Figure N°12: Knowledge Sources



Source: Own computation

[1] Kuhn, T. S. *The structure of scientific revolutions*.(1st Edn). Chicago, IL: University of Chicago Press.1962.
[2] Mackenzie, N. & Knipe, S. *Research dilemmas: paradigms, methods and methodology*. Issues In Educational Research, 16, 2006, PP.1-15.
[3] Gall, M. D., et al. Educational research: An introduction (7th ed.). Boston, MA: Pearson.2003.PP.13.
[4] Slavin, R. E. *Research methods in education: A practical guide*. Englewood Cliffs, NJ: Prentice-Hall.1984.

So referring to the researcher's data sources, we can identify, which epistemology he adapts. Moreover, if the research counts on intuition, beliefs and faith, then he based on the intuitive knowledge on his research. However, if he rely on data collected from people, books or other authors, then he is grounded on the authoritative knowledge.

On the other hand, rationalist or logical epistemology is founded on the reason and logic as source of knowledge. Finally, the empirical epistemology is based on understanding the knowledge from sense experience and demonstrable facts.

Intuition is the belief and the sound perception of a human being. For example, we instinctively love our family and parents, this natural instinct is the ability to build emotions for certain people, without the interfere of conscious reasoning, as emotions as knowledge, in this case knowledge is based on intuitions.

It is intuitive that one plus one equals two, a rectangle has four right angles, and so on, this category of facts construct our intuitive knowledge, at some point, any attempt to invoke intellectual awareness about the intuitive knowledge, would guide us to intuition basics, beliefs and faith.

Generally, epistemology distinguish four (04) sources of knowledge. After knowing that intuitive knowledge takes different forms, such as belief and faith. On the other hand, authoritative knowledge is grounded on facts and information collected from people, books and authoritative sources. Thirdly, logical knowledge that use reasoning arriving to a new knowledge from a generally accepted facts. Finally, the empirical knowledge, which based on demonstrable and objective facts, using observation and experimentation methods and tools.

In a research frequently the author makes use of all these knowledge sources, he would go intuitive coming up with the initial idea of the research, then authoritative while building a literature review. Subsequently uses the empirical knowledge when engaging in procedures that lead to research findings, at the end the researcher would use logical knowledge through the process from findings to conclusions.

The epistemological path of a research is important to understand the researcher's worldview, and how he interprets and reads the different data and results, in this research, our epistemology and our way to find the truth is based on two paths, what the literature review, other authors produced on the field of risk management and financial performance as the main variables of the study, than an empirical approach to understand the nature of the relationship between them.

For that reason, the research epistemology is grounded firstly on authors, people and books to create a conceptual frame work, secondly on experience and demonstrable facts to build an empirical knowledge.

1.1.2. Ontology

Ontology is a subdivision of philosophical study of existence, it is the study of being, of reality, and the position that researcher take, in order to believe that some facts make sense or real, and

what establish reality. Ontological assumptions is the perception of a researcher, it examines his underlying belief system, it aids to set the conceptual frame of reality and what researcher believe as reality, the ontological position of a researcher is critical to understand what make meaning of data that he gather[1].

The ontological assumption helps to guide and orientate the researcher's thinking, in order to understand the research problem, its importance and to approach its solution, the ontology paradigm of a research is indispensable for understanding the world, as it is known[2], this philosophical position seeks to define the nature and the foundational concepts that composite them.

Ontology permits the researcher to identify his underlying belief system and philosophical assumptions, makes him question the nature of being, existence and reality. These assumptions build the ground of a research. How the author make meaning of the data he gathers, which helps him to orientate his thinking, and how he might find an answer to his research problem and fundamental question to contribute to its solution.

1.1.3. Methodology

Methodology assumption is the phase after identifying the research epistemology and ontology, where the researcher precise his strategy, and what procedure to acquire knowledge, by setting up the research plan of action and design, according to Crotty (2003:3) Methodology is "*the strategy, plan of action, process or design lying behind the choice and use of particular methods and linking the choice and use of the methods to the desired outcomes*". This phase helps to justify and interpret the use of specific methods and tools[3].

Fundamentally, methodology is the discipline of studying how to solve a research problem. Commonly, there is a different research methodology, and not only one accepted research methodology is generalized to all research problems, for each type there number of weakness and strength, there are not one ideal methodology and every methodology assumption involves loss as well gain[4].

The methodological assumption depends on the research paradigm choice, the beliefs of the author about reality which represent the research ontological assumption, secondly the researcher's epistemology (how he gets knowledge), after clearly identifies both the ontology and epistemology, the research will be able to fix how to gain knowledge by his methodological choice.

[1] Crotty, M. *The foundations of social research*. London: Sage, 1989, P10.
[2] Scott. D. & Usher, R. *Researching education: Data, methods, and theory in educational enquiry*. New York: Continuum. 2004. P157.
[3] Crotty, M. *The Foundations of Social Research: Meaning and Perspectives in the Research Process*, London: Sage Publications, 3rd edition,2003. P10.
[4] Schulze, S. *Views on the Combination of Quantitative and Qualitative Research Approaches***.** University of South Africa. Progressio 25(2), 2003. PP8-20.

The epistemological assumption, ontological and methodological must be a vital feature of any discussion about the nature of social science research as they are the components that give shape and definition to the conduct of an inquiry[1].

1.2. METHODS: TOOLS USED

The methods are selected based on the research main question, the researcher choose one phenomenon of interest, and the appropriate approach or perspective. Conducting a research has three essential approaches: quantitative, qualitative or mixed methods.

The choice of which method to use is grounded on the type of data needed, in order to find answers for the research problematic, based on the assessment, whether, the data is numerical, textural or both, researcher picks up one of the three over mentioned approaches to conduct research. Consequently, authors' mainly select the quantitative approach if they are treating numerical data, the qualitative approach if they are dealing with textural data, and mixed methods approach if research question requires both numerical and textural data.

1.2.1. Quantitative Research Approach

Quantitative approach was born with the need to quantify data. Subsequently; the quantitative approach has dominated the academic research field as legible method to possess new knowledge. The quantitative approach is constitute of a numeric or statistical approach to research design.

Quantitative research can be used in response to relational questions of variables within the research "*quantitative researchers seek explanations and predictions that will generate to other persons and places. The intent is to establish, confirm, or validate relationship and to develop generalizations that contribute to theory*" [2] .

The process of the quantitative approach commences with a problem statement, hypothesis construction, a conceptual framework and literature review, finally, a quantitative data analysis. To achieve this result, quantitative method employ experimental strategies, surveys, and collect statistical data[3], and the results of quantitative research are diverse, can be predictive, explanatory or confirming. Therefor we seek to understand the quantitative approach methodology with the next points.

1.2.1.1. Quantitative Research Methodology

Research methodology is defined by a group of social science authors as the general approach assumption that a researcher take, in order of having answers to the research problem, the

[1] Popkewitz, T. S., Tabachnick, B. R. and Zeichner, K. *Dulling the Senses: Research in Teacher Education. Journal of Teacher Education, 30*(5), 1979. PP. 52-60.
[2] Leedy, P. & Ormrod, J. *Practical research: Planning and design* (7th ed.). Upper Saddle River, NJ: Merrill Prentice Hall. Thousand Oaks: SAGE Publications. 2001, P102.
[3] Creswell, J. *Research design: Qualitative, quantitative and mixed methods approaches (2nd ed.).* Thousand Oaks, CA: SAGE Publications. 2003. P18.

researcher in this approach use mathematical and econometric models as data analysis methodology, on the other hand, quantitative research have three classifications:

Descriptive approach is the research method that examines the situation, as it is in the current state; this method involves the identification of the characterisation of a certain phenomenon, constructed on observation ground, or the investigation of correlation between two or more phenomenon.

Experimental approach is divided to: pre-experimental, true experimental, and quasi-experimental, where the researcher examines the treatment on an intervention into a study case and then measure and assesses the outcomes of the treatment.

Causal comparative research investigates how the independent variables are impacted by the dependent variables, which produce cause-effect relationship between the study's variables, this approach provide to the researcher an opportunity to test and examine the interaction between the dependent and independent variables, and determine their influence[1].

1.2.1.2. Methods Used in the Quantitative Research

It exist a verity of research methods to conduct quantitative research, starting with the survey research, observational studies, correlation developmental design are used in the descriptive research method.

The degrees of uses in experimental and causal comparative research are different, starting with the correlational research method where the author is investigating the differences between the two characteristics of the study case, based on the purpose of this method, which is to establish whether two or more variables are related.

The observational method, the author observes and detects a certain aspect of human behaviour. With being as objective as possible and records the data, this method can be a substitute to several qualitative research methods.

When in the survey research method, the researcher want to understand and comprehend a phenomena at a particular time, where this method is a way of gathering data in social sciences.

1.2.2. Qualitative Research Approach

Qualitative research is a general approach that includes discovery. Qualitative research is also defined as the model that occurs in natural setting, which enables the research to develop a level of detail[2].

[1] Vogt, W. *Dictionary of statistics and methodology: A nontechnical guide for the social sciences* (2nd ed.). Thousand Oaks, CA: SAGE Publications. 1999. P89.

[2] Creswell, J. W. *Qualitative inquiry and research design: Choosing among five traditions*. Thousand Oaks, CA: SAGE Publications. 1998.

It might be seen also as the research's point view of the phenomenon that he's investigating, to frame the research approach there are different type of research designs, which use qualitative research techniques, as a consequence, the several techniques have a huge impact on the research strategies explored.

The qualitative research is constituted of meaningful use of description, explanation and interpretation of the collected data, this approach helps building a new theories therefor it is considered to be less structured[1].

There are five areas of qualitative approach: case study, ethnography study, phenomenological study, grounded theory study, and content analysis, the research conducted using inductive reasoning and associated methodologies, the last presented five areas are representative for it.

Qualitative research construct its ground on inductive, rather than deductive reasoning, the researcher use the observational elements to provide answers and explanation to the question pose.

What makes the difference from quantitative research is the strong correlation between the researcher observer and the data of the research, where the author in this case is an outsider of the phenomena investigated, he have no beginning point or established assumption that he can start with[2], this qualitative research uses a data collected with relative objectivity to the researcher.

Beside the distinction between quantitative and qualitative research designs, a differences have been determined in each perspective research methodology.

1.2.2.1. Qualitative Research Methodology

To elaborate a qualitative research there are several methods, as over-mentioned: case study, ethnography study, phenomenological study, grounded theory study, and content analysis.

The different areas meet several needs, starting with case studies the grounded theory research explore processes, events, and activities but ethnographic research analyses comprehended cultural sharing behaviours of groups or individuals, both case study and phenomenology can be used to study individuals.

[1] Idem, Leedy and Ormrod.2001.
[2] Ibid, Leedy and Ormrod.2001.

The following table summarizes the different methods used in the qualitative approach, by presenting the definition of each method and its data collection process:

Table N°18: The Five Areas Of Qualitative Approach Methodology

Method	Definition	Author	Year
Case study	researcher explores in depth a program, an event, an activity, a process, or one or more individuals, The data collection for a case study is extensive and draws from multiple sources such as direct or participant observations, interviews, archival records or documents, physical artefacts, and audio-visual materials	Creswell	2003, P13
Ethnography study	ethnographies, in which the researcher studies an intact cultural group in a natural setting over a prolonged period of time by collecting, primarily, observational data, the data is collected from participant observations and from interviewing several key informants.	creswell	2003, P14
Grounded theory study	Grounded theory research is the process of collecting data, analysing the data, and repeating the process, which is the format called constant comparative method. The data can be obtained from several sources such as interviewing participants or witnesses, reviewing historical videotapes or records, observations while on-site.	creswell	2003, P14
Phenomenological Study	This study is "to understand an experience from the participants‟ point of view". The method of collecting data is through lengthy (1-2 hours) interviews in order to understand and interpret a participant's perception on the meaning of an event.	Leedy & Ormrod	2001, P 157
Content Analysis Study	This study is a detailed and systematic examination of the contents of a particular body of materials for identifying patterns, themes, or biases. The collection of data is a two-step process. First, the researcher must analyse the materials and put them in a frequency table as each characteristic or quality is mentioned. Second, the researcher must conduct a statistical analysis so that the results are reported in a quantitative format.	Leedy & Ormrod	2001, P 155

Source: Carrie Williams,. *Research methods*, Journal of Business & Economic Research, Grand Canyon University, March 2007 Volume 5, Number 3, 2007. PP. 67-69.

1.2.3. Mixed Methods Approach

The mixed approach was created in the late 1900s, to provide an alternative for researchers. Those who believe the existence of a compatible relationship between quantitative and qualitative research approaches[1].

The concept of this approach is that the researcher collect or analyses data from quantitative and qualitative research approaches in one combined study[2].

In this context, the researcher uses numerical data, which is necessary for quantitative approach, and also narrative data, which is the backbone of qualitative research, to collect a mixture of data, the process is might be the distribution of a survey that have closed-ended questions to obtain numerical data, or quantitative data. Then organise an interview with open-ended questions, to collect the narrative or qualitative data.

This approach is not considered replacement of neither quantitative nor qualitative approaches. It is more an extension of the two approaches. The objective for the researcher that uses mixed methods approach is to profit the strengths of each approach and minimise their weaknesses[3].

The mixed methods approach give the researchers the ability to design studies that gather methods of data collection and analysis from quantitative and qualitative approaches.

Thanks to this approach, researchers are now able to build and test theories, using inductive and deductive methods in the same study design.

The innovation of this approach is the ability of researchers to investigate complex nature of phenomenon, and provide answers for question from both the participant's point of view, and measurable variables.

The defenders of the mixed methods approach believe that researcher should do what works to predict, to explore, to describe, and the understand the phenomenon[4], which strengthen the idea that quantitative and qualitative method approaches are not only compatible and complimentary, but also eliminate the necessity to have an additional study to comprehend the whole phenomenon.

[1] Johnson, R. B. & Onwuegbuzie, A. J. *Mixed methods research: A research paradigm whose time has come*. *Educational Researcher, 33*(7), 2004. PP 14-26.
[2] Tashakkori, A. & Teddlie, C. *Mixed methodology: Combining qualitative and quantitative approaches*. Thousand Oaks, CA: SAGE Publications. 1998, PP 1-3.
[3] Ibid, Johnson, R. B. & Onwuegbuzie, A. J. 2004.PP14-26.
[4] Carr, L. T. *The strengths and weaknesses of quantitative and qualitative research: What method for nursing? Journal of Advanced Nursing*, *20*(4),1994, PP 716-721.

For each specific type of research questions use to address a qualitative or quantitative research method that it is covenant for a precise phenomenon. The quantitative method use numerical variables and provide an objective measure of reality.

On the other hand, qualitative method research allows the researcher to discover and build new theories, and finally, mixed methods approach find an interaction zone between the two approaches.

1.3. DIFFERENT APPROACHES TO EDUCATIONAL RESEARCH

Positivism, interpretivism and critical theory are the main approaches to educational research the distinction between each type of these approaches is essential to understand what researchers are claiming when adhering to different research paradigms.

Patton sees that "*When researchers operate from different frameworks, their results will not be readily interpretable by or meaningful to each other*"[1]. The awareness to the diverse ontological and epistemological assumptions to each researcher will help in term of understanding the importance and relevance of the study, additionally, the ignorance of other research paradigms can devaluate the research conducted under a different tradition.

As presented in the following table, there are a large number of paradigms, but they can be gathered in three main groups: positivist, interpretivist, or critical paradigms[2]. Additionally to these groups, other authors proposed a fourth pragmatic paradigm[3].

[1] Patton, M. Q. *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage. 2002, P 134.
[2] Candy. P.C. *Constructivism and the study of'self-direction in adult learning*. Studies in the Education of Adults, 21(2), 1989, PP 95-116.
[3] Tashakkori, A., & Teddlie, C. *Major issues and controversies in the use of mixed methods in the socialand behavioral sciences*. In A. Tashakorri & C. Teddlie (Eds.), Handbook of mixed methods in social & behavioral research. Thousand Oaks, CA: Sage. 2003. PP. 3-50.

The next table contains a brief presentation of the different paradigm approaches to educational research.

Table N°19: Ontology And Epistemology Position

Paradigm	Ontology	Epistemology	Theoretical perspective	Methodology	Method
Positivism	there is one reality	reality is measurable and the objective is reliable tools to obtain it	Positivism Post-positivism	Experimental research Survey	Quantitative method: sampling, statistical analysis
Constructivist/ Interpretive	reality is created by individuals	interpretation is used to discover the underlying meaning of events and activities	Interpretivism (reality needs to be interpreted)	Ethnography Grounded Action research	Qualitative method: observation, case study, narrative
Pragmatism	reality is renegotiable, debated and interpreted differently in each unpredictable situation	method that solves problems, finding out is the means, change is the underling aim	Deweyan pragmatism research through design	design-based research action research	mixed methods quantitative and qualitative and more
Subjectivism	reality is perceptual	knowledge is a matter of perspective	Post-modernism structuralism	Discourse theory Archaeology Genealogy	literary analysis Pastiche
Critical	realities are socially constructed	reality and knowledge are socially constructed and influenced by society	Marxism Queer theory feminism	critical discourse analysis, critical ethnography	Interviews, Focus groups, Questionnaires

Source: Crotty, M., *Foundations of social research: Meaning and Perspective in the Research Process*, London: SAGE Publications Inc, 1998, P 256.

1.3.1. Positivist Paradigm

Early in nineteenth century, positivism was bringing up to the surface, referring to a branch of philosophy, where positivism claims that reality and knowledge exists independently of humans. It is not affected by our senses and it is governed by unchanging laws[1]. Realism is the

[1] Richards, K. *Qualitative inquiry in TESOL*. New York, NY: Palgrave Macmillan.2003. P37.

ontological position or assumption of positivists, they attempts to understand the social world by the approaches used in the natural world.

Where in nature, it exist a cause effect relationship between phenomena, and its future can be predicted with certainty once reality is established. For them, there is no difference in social world, and reality is context, time and places free, if researchers are working on a given phenomenon, they should reach the same outcomes or findings, the epistemological assumption in positivist is the objectivism.

The researchers that follow this paradigm should act as objective observers to study phenomena that exist independently of them and they do not have an impact nor disturb what is being observed.

Whatsoever kind of interference to describe the phenomenon is forbidden, there for researchers use specific language and symbols to define it in their real form. Laws are governing the social phenomenon, which is how positivists defining this paradigm, hence, it is conceivable to formulate these laws and present them with accurate statements.

This paradigm was criticised by many scholars and academicians, based on the argument that scientific methods and objectivism are appropriate for conducting natural matters, and they are not as fruitful in social science.

The complexity of individuals and the social phenomenon, led them to judge the positivist assumption to be naïve, the criticisms of the positivist paradigm help the emergence of post-positivism, which combined both positivist and interpretivist paradigms[1].

Post-positivism was developed to target the weaknesses of the positivist paradigm, its ontological position is critical realism, it claims that reality does exists independently from the observer, but it can be apprehended imperfectly due to the complexity of the social phenomena, and also the beliefs and the values of the researcher may affect the subject observed.

Experimentation is the cornerstone of positivist methodology, based on the causal relationship between the variables of phenomena, hypotheses and questions are put in a certain form, then empirical evidence are gathered, the data collected is consequently analysed and formulated in the form of a theory that explains the relationship between independent and dependent variables.

Data analysis approach in positivist methodology was deductive. The process starts with proposing hypothesis, then; the researcher confirmed it or rejected it according to the study findings and results of statistical analysis.

[1] Grix, J. *The Foundations of Research*. New York, NY: Palgrave Macmillan.2004. P86.

Chapter III: Research Paradigm, Methodology And Mathematical Tools

To measure, to predict, to control, to construct laws and describe causality that is the purpose of this methodology[1]. If the results of a study proven that A caused B. Then a theory will be confirmed and generalised. The causal relationship between A and B would be wider applicable.

In order to achieve that, researchers should make sure that was not other factors involved in the study, and that really A caused B, but to do that in social world is a little bet challenging, to give validity to the results, the study should be established without any interference from extraneous variables.

The positivist epistemology regularly called for numerical data, and quantitative methods to analyse phenomenon, in social world, positivist claims that variables and features of social world have constancy across time and places, a specific feature can be isolated and treated as variables, this features can be expressed as numerical scales[2].

Through experiments or quasi-experiments, the quantitative data that positivist researchers use to answer questions and formulate theories can be collected.

Positivist approach elevates research to be good quality if it has: internal validity, external validity, reliability and objectivity[3]. Firstly, if the researcher was able to prove that the independent variables of the study had an effect on the dependent variable, then internal validity is confirmed. Secondly, if the findings of the study are generalizable, in this case, the research has external validity.

Thirdly, if the research was conducted over different times, places, contexts, by several researchers and reach at the same results, than it has reliability, finally, a researcher to be judge objective, he has to leave a side his beliefs and apprehensions of the phenomenon.

Despite the criticism of the positivist paradigm, by interpretivists and critical theorists. The attractiveness of an approach pursuing the precision, exactitude and the ability of prediction using the natural science is tools and methods make it understandable[4].

The social world and science can be chaotic, individuals are unpredictable and factors leads to events hard to overseen, this paradigm have an objective to minimise the impact of this factors, by seeking rules and laws, which help to make social world more objective and understandable[5].

[1] Cohen, L., and al, K. *Research methods in education* (6th ed.). New York, NY: Routledge.2007. P
[2] Gall, M. D., Gall, J. P., & Borg, W. R. *Educational research: An introduction* (7th ed.). Boston, MA: Pearson. 2003. PP. 19-20.
[3] Guba, E. G., & Lincoln, Y. S. *Competing paradigms in qualitative research.* In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (Vol. 2). Thousand Oaks, CA: Sage.1994. PP. 163-194.
[4] Gage, N. *The paradigm wars and their aftermath: A historical sketch of research on teaching since 1989.* In M. Hammersley (Ed.), Educational Research and Evidence-based Practice London, England: Sage. 2007. PP. 151-166.
[5] Ibid, Gage.N, 2007. PP. 81-82.

1.3.2. Interpretivism Paradigm

Over the dominance of positivism, interpretivism was a response, that rejects the notion of a single verifiable reality exists independent of our senses[1], the interpretivists reject the existents of permanent generalizable facts, where interpretive ontology is anti-foundationalism. It declines "*to adopt any permanent, unvarying (or foundational) standards by which truth can be universally known*"[2], alternatively, this ontology believes that social world have constructed several realities. For interpretivists, Knowledge and reality are created, not discovered, reality is interpreted by a relative amount of the researcher's objectivity, where, the sense of the researcher always mediated the reality, and never presented as it is, the epistemology of the interpretive ontology is subjective.

External reality cannot be directly accessible to observers without being contaminated by their backgrounds, concepts and worldviews. Some researchers defending the interpritism, such as: Flick says: *"Perception is seen not as a passive-receptive process of representation but as an active constructive process of production"*[3]. Moreover, Grix states:*"researchers are inextricably part of the social reality being researched, i.e. they are not 'detached' from the subject they are studying"*[4].

According to interpretivists, if two researchers studying the same phenomena, and they reach different results, with different interpretations, both can be accepted with the acknowledgement that is different researchers have several perspective to the same problem. The objective of this ontology not to reach a knowledge free of context, places, time and values, but to be able to understand the numerous interpretations of individuals, and their unique experience of interaction with the social phenomena.

The data collected following the interpretivism epistemology will always have this gap from the reality, caused by the involvement of the observer and his interpretations to the data, affected by his culture, language and previous experiences[5].

Although, as in ethnography and case studies, interpretivists mostly collect qualitative from participants over an extended period of time. Furthermore, inductive is the approach used in analysing data, where the researcher aims to understand and formulate theories that concerns the social phenomena studied.

On the other hand, the deductive approach starts with the identification of the patterns and themes before data collection and analysation process. The distinction between inductive and deductive approach allows interpretivists researchers to adopt the inductive approach, once

[1] Grix, J.*The Foundations of Research*. New York, NY: Palgrave Macmillan. 2004. P.82.
[2] Guba, E. G., & Lincoln, Y. S. Paradigmatic controversies, contradictions, and emerging confluences. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (3rd ed).Thousand Oaks, CA: Sage.2005. P204.
[3] Flick, U. A companion to qualitative research, constructivism. In U. Flick, E. von Kardorff, & I. Steinke (Eds.), Thousand Oaks, CA: Sage.2004. P89.
[4] Ibid, Grix.j. *The Foundations of Research,* 2004.P83.
[5] Blaikie, N. *Designing Social Research*. Cambridge, England: Polity Press.2000. P120.

again, **Grix** states about interpretivists: *"they tend to see theory as deriving from data collection and not as the driving force of research"*[1], in this case data are usually verbal audio/ video instead of statistical or numerical data.

The researchers use methods that needs qualitative data, but also numerical data can be involved, as mentioned before, in the interpretivist approach qualitative data are used, such as standardized open-ended interviews, semi standardized open-ended interview, and informal conversational interviews etc.

The validation of interpretive research necessitates credibility (internal validity), transferability (external validity), dependability (reliability) and confirmability (objectivity)[2], if researchers assiduous and honest in their process of approaching the truth, the quality of the findings will be guaranteed for people in other contexts and the methods of the research are well detailed.

The criticism of this approach was grounded on several characteristics of this paradigm, which are the involvement and interaction of the researcher with the participants of the study. Which cause lack of objectivity, inability to generalize the results and conduct theories using interpretivist approach, even though interpretivist paradigm is the finest for specific researches using surveys and closed ended questionnaires.

1.3.3. Critical Theory

Critical theory's ontological position is that of historical realism, this ontology claims that reality exists, but it has been deformed by cultural, political, ethnic, gender and religious factors.

The epistemology assumption of the critical theory is subjective, for that the defenders of this approach see that the sense of the researcher obligatory would affect the research. Hence, critical researchers attempt to make clear their epistemological assumption when starting an investigation. According to Kincheloe & McLaren*"no one is confused concerning the epistemological and political baggage they bring with them to the research site"*[3].

For the critical theory scholars: the laws that legitimise some kinds of knowledge and delegitimise others should be criticised, inasmuch as the objective of the critical educational is not just to illustrate or comprehend the social world but to change it[4]. This approach is critical for interpretivists. Also positivists for taking some facts to be undisputed, and those have no vision in changing the world[5].

[1] Ibid, *The Foundations of Research*, 2004.P108.
[2] Idem, Guba, E. G., & Lincoln, Y. S. 1994. P114.
[3] Kincheloe, J. L., & McLaren, P. Rethinking critical theory and qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *The Sage handbook of qualitative research* (3rd ed). Thousand Oaks, CA: Sage. 2005. PP. 305-306.
[4] Patton, M. Q. *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage.2002. P210.
[5] Scott, D., & Usher, R. *Researching Education* (2nd ed.). London, England: Continuum. 2010. P.35.

The aim of the critical educational research is to make sure that the generated knowledge to the social world is valid, the critical researchers' attempt to reveal the beliefs and action that limits the freedom.

Dialogic and dialectical are the critical approach is methodology, which necessitates the researcher to involve into the study, with an objective to generate a change to the situation and social world. In order to avoid the possibility of margining the participants, investigators use a collaborative approach and start the study by formulating questions, following by data collection and analysis.

The changing of the social world that grounded on discrimination and injustice could be accomplished by the methodologies of critical educational research:

Firstly, critical ethnography is objective is to question the social assumptions that as taken for granted by other researchers, such as, race, culture, gender, economy, and politics, with process of analysation and craterisation looking for changing the situation.

Secondly, critical discourse analysis, in the procedure of investigating data, the analysts established to study how the powerful use language to maintain their authority, Gall et al states that *"An individual's awareness is both expanded and constrained by the language that is available to the individual for encoding his experience"*[1], consequently, by controlling language researchers can control consciousness and awareness.

Thirdly, action research is the method of investigating instantaneous problem by determines the problem, programming an intervention, fulfilment the plan, perceiving the changes, and reflecting on the changes perceived. Finally, ideology critique reveals values and practices that have an objective to subjugated individuals.

Qualitative data is dominant in critical research although quantitative data can be used, when it comes to judge the good quality of this paradigm, researcher need to ensure the understanding of political, cultural, ethnic and gender background of the social phenomena investigated.

On the other hand, Richards explain the second quality of critical research as: *"action designed to redress the unequal and oppressive structures that have now been exposed"*[2], the critical research aims to measure the degree to which the study 'misunderstandings about the dominant ideology and status quo are exposed and the degree to which it assists.

This section of our research was deducted to understand what knowledge is, the epistemology assumption of a research, methodology and the methods to obtain it, then, the different research paradigms, we discovered that each paradigm has its own methods to reach knowledge, where, the interpretive paradigm aims to understand, and the critical paradigm aims to emancipate.

[1] Gall, M. D., Gall, J. P., & Borg, W. R. *Educational research: An introduction* (7th ed.). Boston, MA: Pearson.2003. P497.
[2] Richards, K. *Qualitative inquiry in TESOL*. New York, NY: Palgrave Macmillan.2003. P40.

2. THE HYPOTHETICO-DEDUUCTIVE METHOD

The hypothetico-deductive method is divided to two parts; the hypothetico refers to a theory or a hypothesis, from the different sources that researcher use to establish his conceptual framework, than a deductive part, which test hypotheses and leads to predictions.

The missing part in the nomination of this method is where the researcher need to compare between the consequences deducted with experiment or what we can observe. The results of comparison can pass or fail the consequences, the generation and formulation of the research hypothesis in some cases can be established to account for some already known facts, it aims then to test further consequences from it by deduction, in this case consequences become subject to test.

A fundamental interrogation rises concerning the pass and fails process, and its transmission back to the hypothesis, this generates obstacles for the H-D method. Deduction need to be not the only method to obtain the test consequences, non-deductive or inductive methods are better in case the hypotheses are statistical, henceforward, the H-D method should be named the Hypothetico-inferential method to include both the deductive and non-deductive approaches.

2.1. THE STRUCTURE OF THE H-D METHOD

Generally, the hypothesis are certainly not examined by themselves, except by the rule of instantiation, and that need additional information, concerning the conditions in which the hypothesis applies, mostly obtaining more information about the circumstances of the investigation is more complicated, that's why, having more than one hypothesis is needed.

Coming forward a list of different items need to be present, so that the H-D method works[1]:

- The hypothesis (H) normally are applied to system (S), so, more information about the system is needed, for example, if hypothesis concerns a banking system, hence, information is needed about the system, such as the number of banks, financial performance indicators, market shares, and profitability and so on. In case of missing information about the banking system, results would be faulty; missing information is not the only possibility in which system (S) fails to model correctly a real system (R)[2].

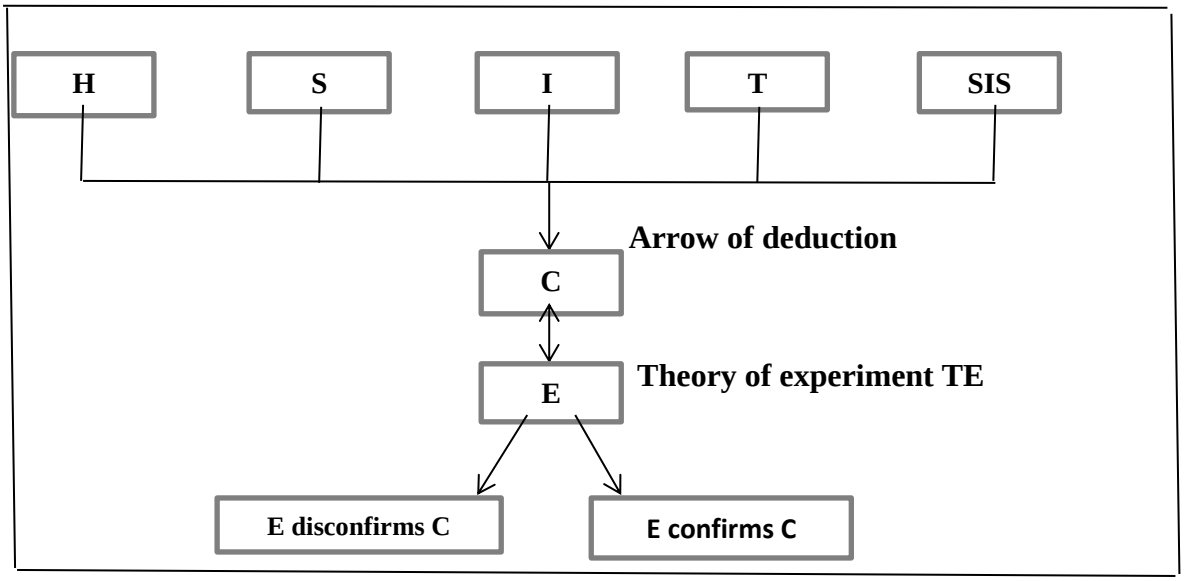
- The second type of information is called initial conditions (I) of system (S) at a given time, in this way, we can predict what state the system will be in at a later time, or the way around, to know how the state of a system at an earlier time.

[1] Glymour, C. *Discussion: Hypothetico-Deductivism Is Hopeless*', Philosophy of Science 47.1980. PP. 322–325.
[2] Gemes, K. *Hypothetico-Deductivism, Content, and The Natural Axiomatization of Theories*', Philosophy of Science 60. 1993. PP. 477–487.

- Other background theories (T) are needed to apply our hypothesis, but they are not under test, consequently, the background theory (T) is fundamental to be able of deductions about the changes of the studied phenomena, but one again (T) cannot be a target of any testing.
- Fourthly, the "sis assumption" is an assumption made that there is sufficient isolation of the system from any other external effects.
- Finally, the results extracted from a H will be compared with information from elsewhere, this represent the fifth kind of information needed called evidence (E), evidence can be obtained by observation or experiment, in case of experiment a background theory is employed in the experiment (TE).

The following figure represents the structure of the H-D method:

Figure N°13: The Structure Of The H-D Method



Source: Gemes, K. *Hypothetico-Deductivism, the Current State of Play, the Criterion of Empirical Significance Endgame*, Erkenntnis 49. 1998. P20.

The previous figure represents components involved in the structure of Hypothetico-deductive method. It gives a whole idea about the process of deducing a test consequence (C), starting from the main hypothesis of the study combined with other factors: S, I, T, SIS, and the existence of an additional Factors (A) for auxiliaries used in Appling H, furthermore, there is a logical imposed factor[1].

In the H-D method, other factors are used other than A to deduct C, usually functional relations between different numbers of variables can be established by inductive methods.

[1] Park, S-J. *Hypothetico-Deductivism Is Still Hopeless*, Erkenntnis 60. 2004. PP. 229–240.

The H-D method aims to deduct experimental laws, based on theoretical principles, by the H-D method, an advantage would be added if deductions to new and previously unknown laws, then be empirically investigated to be correct[1].

2.1.1. An Alternative To The H-D Method

The H-D method is pillar of the scientific research, also known the true scientific research method. As previously mentioned, it needs other information and structured with a number of steps to observe the investigated case or phenomena, it helps the researcher to make a testable hypothesis, also the researcher cannot entirely confirm a hypothesis, and it can be disproved later[2].

2.1.1.1.The Prediction-Observation (P-O) Gap And The H-D Method

The basis for any scientific research is to compare between the prediction and the observation by testing a theory, researchers can judge the efficiency of a theory if the gap between P-O is restricted, and more large become the gap between P-O a theory is disconfirmed, in this situation changing the theory is require with a new and solid one.

The condition for confirming a theory by P-O small gap is fundamental for the achievement of the natural and social science, it is an essential element in almost every scientific method, and manly the H-D method[3].

Several methods are based on the P-O gap, and also H-D method, this method is seen by a large range of philosophers as one of the most efficient procedures for testing empirical hypotheses and theories.

Glymour testified that *"Despite the inability of the Hypothetico-deductive account to explain evidential relevance, . . . , [it] remains today one of the most popular. The reason, I think, is that it is so obviously the correct account of a great deal of the history of science[4]",*

Salmon added "*From a general hypothesis and particular statements of initial conditions, a particular predictive statement is deduced. The statements of initial conditions, at least for the time, are accepted as true; the hypothesis is the statement whose truth is at issue. By observation we determine whether the predictive statement turned out to be true. If the predictive consequence is false, the hypothesis is disconfirmed. If observation reveals that the predictive statement is true, we say that the hypothesis is confirmed to some extent[5].*

[1] Idem, Gemes, K. 1998. PP. 449–476.
[2] Griffin Wiersma NS. *The wesleyan tradition and qualitative inquiry in contemporary counseling psychology: Heart and mind as art and science.* Christian Scholar's Review, 36(2). 2007. PP. 167-183.
[3] Ibid, Glymour, C. 1980. PP. 322–325.
[4] Ibid. Glymour, C. 1980. PP. 47-48.
[5] Salmon, W. C. *The foundations of scientific inference.* Pittsburgh: University of Pittsburgh Press.1967. P. 18.

Thus, the H-D method one of the most used methods in the modern natural and social science, on account of its history of science, and to its procedure to confirm or disconfirm a theory based on the gap between the observation of a researcher and the predictive statement.

2.1.1.2. A Critique Of The H-D Method

The structure of the H-D method illustrate that this method is not perfect and it can be an object of criticism. As presented previously, this method requires the existence of other elements to confirm or disconfirm a theory, such as background theory, auxiliary hypotheses, logical developments, and probability theory.

The second week point in the H-D method is in term of the findings of the method, where H-D method confirms or disconfirms the whole theory with all its constituents, but it cannot differentiate and disconfirm a specific part of a theory.

The H-D method has a sort of deficiency explaining the actual scientific work, and the structure of a research paper illustrating experimental results. Hence, this method is not appropriate for all possible areas of research.

2.1.2. Research Design, Data Collection And Analysis

The phase of data collection and analysing is fundamental to determine the research design, which is seen as the procedures for collecting, analysing, interpreting and reporting data in research studies. The research design is the planning made by the researcher to link between the hypotheses.

The theoretical problem of the research, and on the other hand the empirical part of the research, more explicitly, research design is the setting of the procedures, the methods applied in term of data collecting and analysing, and supply answers to the research problem and question[1].

The research design can be in three possible forms: exploratory, descriptive and explanatory. This classification is based on the purpose of the research, where each design is made for different purpose.

If a researcher aims to describe a particular phenomenon, situation or individual, he should adopt a descriptive design, though, descriptive design cannot help a researcher to explain the occurrence of a specific event[2]. Consequently, explanatory or exploratory research design as a substitute is advisable in this situation.

Ambiguous phenomenon or a problem that has not been clearly defined necessitates exploratory research design[3], the exploratory design is not for objective to provide final and conclusive answers to the research problem, but simply explores the theme studied. Furthermore, its

[1] Creswell, J. W., & Plano Clark, V. L. *Designing and conducting mixed methods research*. Thousand Oaks, CA: Sage. 2007. P.58.
[2] Blumberg, B and al .*Business Research Methods*. McGraw-Hill, Maidenhead. 2005. PP. 330-333.
[3] Saunders, M and al. *Research Methods for Business Students*. 4th Edition, Financial Times Prentice Hall, Edinburgh Gate, Harlow.2007. P

objective is to provoke new problems that have not been previously studied, in other cases, exploratory research provides the basis for more conclusive research answers.

The third type of research design is the explanatory, which aims to explain the descriptive information, the explanatory studies have an objective to answer the why and how questions, it is grounded on exploratory and descriptive research and continue to identify real reasons behind the occurrence of a phenomenon.

Explanatory research aims to find the actual causes, reasons and deliver evidence to support or declaim an explanation or prediction. This design is conducted to determine and identify particular relationships among different aspects of the phenomenon studied.

As presented previously, the aim of our research is to explore the relationship between risk management with banking financial performance. To realise this, it needs statistical data and analysis, quantitative results. Also seeks to justify the established relationship with qualitative study. For that reason, the research design is explanatory that provides answers for both questions "how" and "why".

The research apply both quantitative and qualitative approaches which benefit the study from the complementarity between the two approaches, where qualitative method is used to conduct and understand the findings from quantitative data. Patton said, *"qualitative data can put flesh on the bones of quantitative results, bringing results to life through in depth case elaboration*[1]*"*.

Therefore, if a researcher adopts a mixed-method design, three issues should be clearly stated: priority, implementation and integration of the quantitative and qualitative methods. More precisely, the order of data collection and analysis, firstly, the priority of one method over another, than the connection between phases in the research process, and integration of the results[2].

2.1.2.1. Implementation Decisions

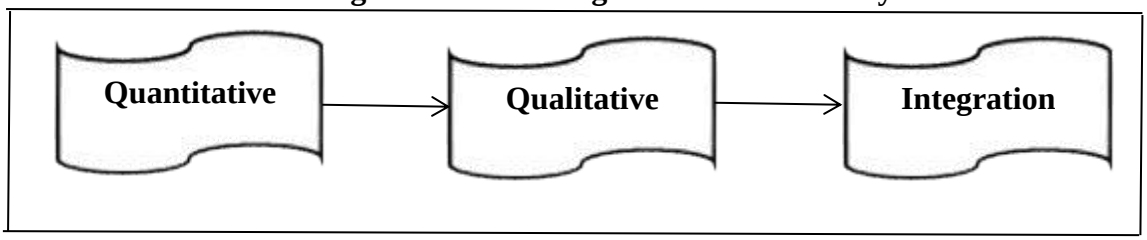
There are two possibilities in term of putting in order qualitative and quantitative methods: the can be in sequence, where one follows the other, or concurrently[3]. If the study is following explanatory design assumption, so it takes place in two sequential phases, first with the quantitative data collection and analysis occurring and frequently providing the inclusive importance of the study.

Additionally, the sequential design is selected in case the research purpose is to seek development and explanatory by relating quantitative and qualitative data.

[1] Patton, M. Q. *Qualitative evaluation and research methods (2nd ed.)*. Sage Publications, Inc. 1990, P132.
[2]Ivankova, N. V., and al. *Using Mixed-Methods Sequential Explanatory Design: From Theory to Practice.* Field Methods, 18(1), 2006. PP. 3–20.
[3] Ibid. Ivankova et. al., 2006. P10.

The research adopts a sequential design as the objective of the study is to quantitatively test the relationship between risk management and banking financial performance, furthermore, the research will investigate the quantitative findings using qualitative data, so a larger explanation of the relationship is provided, the results of the quantitative and qualitative studies are integrated to ensure triangulation and complementarity.

Figure N°14: Timing Decision Of A Study



Source: Own computation

2.1.2.2. Priority Decisions

Priority is about the importance of the quantitative or qualitative methods in the process of answering the research problem.

The study may provide the same weight of priority to each method, as it can be weighted unequally, consequently, the decision priority between quantitative or qualitative approach is based on their influence to address the problem studied.

Our research in coherence with the objective of the study is obviously gives priority to the quantitative method. The main and secondary research questions of the research can be studied through forming a causal relationship between the variables and the qualitative approach is aimed to explain the quantitative findings.

Additionally, the research's main objective is to test already existed theory in the banking context and has no purpose to add a new theory to the existing conceptual structure on the risk-financial performance relationship. In this context, the quantitative method is more fundamental in terms of comprehending the phenomenon studied.

Moreover, the qualitative findings are required to profoundly measure the relationship between the variables studied. Both the availability of data and the literature framework are needed to quantitatively test the hypothesis of the research and establish answers, which supports the priority choice in this research from practical consideration.

2.1.2.3. Integration Decision

Integration is the phase or phases in a study process where the research uses a mixed method or integration of quantitative and qualitative methods[1].

If the researcher does not explicitly relate the two methods, a research in this case is simply collection of multiple methods rather than a mixed methods design, even if the researcher applies both quantitative and qualitative study[2].

Bazeley states *"integration of conclusion is commonly seen in mixed methods research, but blending data or meshing analyses has been much less common[3]",* consequently, quantitative and qualitative data should be integrated not only at the phase of findings reporting.

However, at the stage of data collection and analysis, for the aim to integrate the maximum them to methods. This research based on the integration of the framework between the two methods and in each stage of data collection, analysis and reporting.

- **Data collection**: in this study, we will use two type of data, the first is quantitative data, and it will be collected from public available resources (from ONS, BCA, MFI, BM..), then the data will be used in econometric model. The results of the quantitative study will be the base for the second part of the study, which is qualitative study.

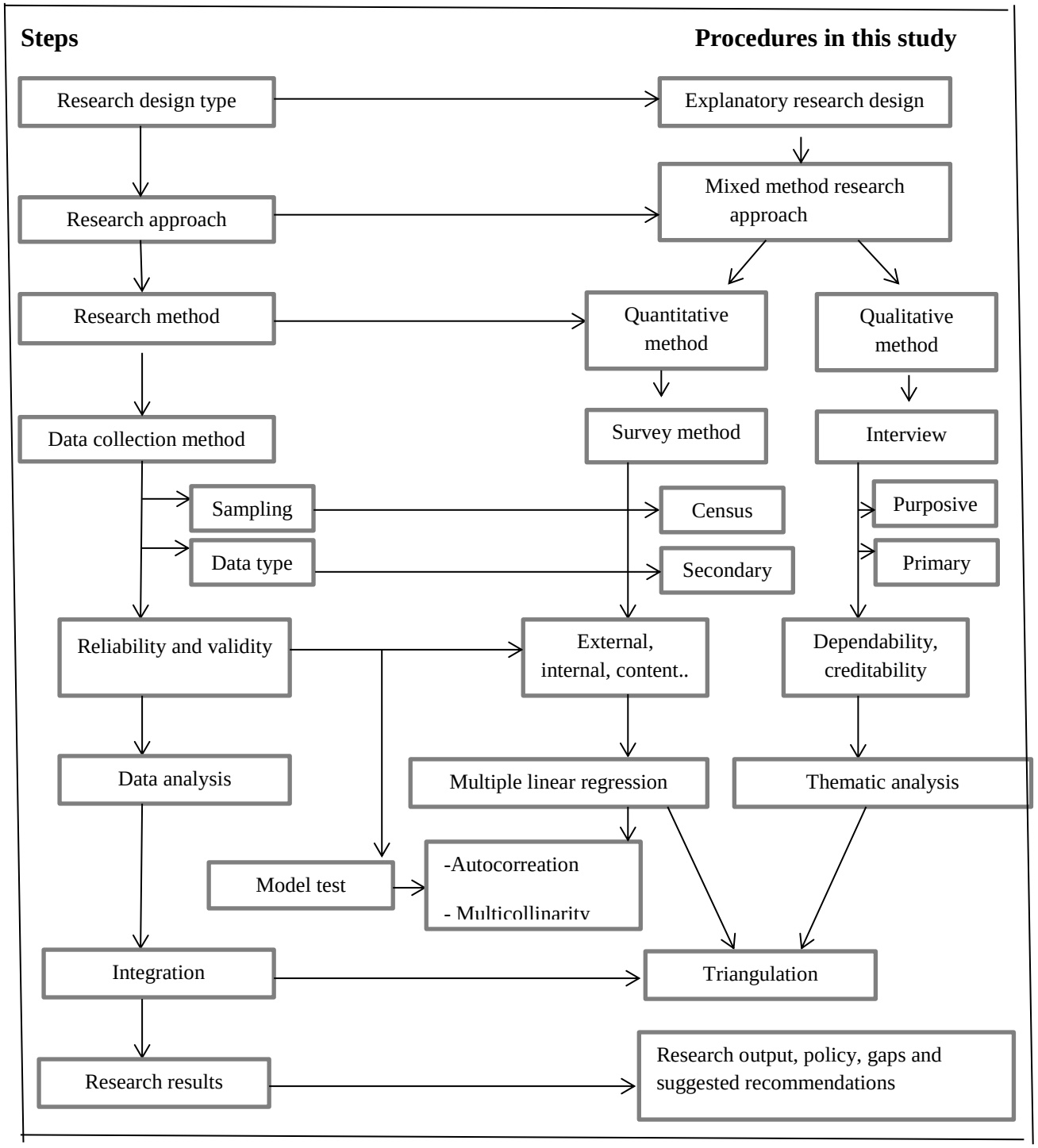
- **Data analysis**: the research treatment process in the quantitative approach relies on the results of the econometric model's findings. On the other hand, qualitative approach is there to provide elements of interpretation in context of triangulation method.

- **Outcome of the entire study**: the methodology used in this research is the mixed methodology of the quantitative approach and qualitative approach to establish the integrated result that provides answers to the research fundamental question. The results of separated evaluation and assessment on the quantitative and qualitative approaches are compared and connected.

[1] Creswell, J. W., & Tashakkori, A. *Developing publishable mixed methods manuscripts*. Journal of Mixed Methods Research, 1. 2007. PP. 107-111.
[2] Idem. Creswell, J. W., & Plano Clark, V. L. 2007. PP103-104.
[3] Bazeley, P. *Editorial: integrating data analyses in mixed methods research*", Journal of Mixed Methods Research, Vol. 3 No. 3. 2009. PP. 203-7.

The following figure represents the whole process of the study, step by step and the procedure that is necessary in that stage:

Figure N°15: Research Design Of The Study



Source : Tesfaye. B. *Research design and methodology*, University of South Africa, https://www.researchgate.net/publication/329715052, consulted the 30/11/2019, at 21:00h.

2.2. HYPOTHETICO-DEDUCTIVE: CONFIRMATION AND LIMITATION

As previously mentioned to evaluate the H-D confirmation, researcher need to ensure successful predictions deducted from the hypothesis under test.

2.2.1. Hypothetico-Deductivism Confirmation

The standardization with empirical world of the hypothesis studied is fundamental, the H-D method have the objective to answer the following questions: how do data contribute to the assessment of a hypothesis? When do they undermine a hypothesis, and when do they confirm it? Can we formalise an intuitive, precise and accessible confirmation relation between hypothesis and data?

Once these questions are answered, important perceptions are cleared: the first element is the research assessment tool that a researcher would be able to develop practical useful one, second, the researcher will improve his comprehension of how science functions and proceeds, finally, the research findings will affect a big range of questions.

The H-D method to be characteristic of evidential support needs a specific structure of process[1]: the researcher forms the main hypothesis of the study, and based on the available evidence if the predictions deducted from the hypothesis turns to be successful, then the results are confirmed.

2.2.2. Bayesianism And H-D Confirmation

In philosophy of science, the bayesianism is the main competitor to the H-D confirmation, and most of the time is considered to be most captivating approach of the H-D confirmation[2]. The bayesianism is a quantitative approach of confirmation, the function of this approach is that the degree of confirmation is explicated as increase in degree of belief in the hypothesis under study.

The several degrees of acceptance and belief are founded on the probability of exposing to a certain loss. This gives more credibility to the Bayesianism application to statistical data analysis, also helps the confirmation of non-probabilistic scientific theories.

In case that the researcher has a considerable level of belief in the theory his studying, then, the level of support-confirmation increases, that the hypothesis studied is tested in the face of the evidence. Without protraction, some fundamentals need to be noted so e can compare between the Bayesianism and H-D account. Firstly, the previous assumptions of the hypothesis tested have a major role, where researchers may have different beliefs. Additionally the main

[1] Fitelson, Branden. *The Paradox of Confirmation*. Philosophical Compass 1, 2006. PP. 95-113.
[2] Moretti, Luca. *The Tacking by Disjunction Paradox: Bayesianism versus Hypothetico-Deductivism*. Erkenntnis (64). 2006. PP.115-138.

hypothesis does not deliver a strong evidence to reject the previous extreme as irrational opinions.

However, even if a researcher obtained strong evidence, he cannot reject automatically a certain hypothesis. The objectivity is fundamentally required to eliminate the side effect of the problem mentioned previously, where data supposed to yield unambiguous policy advice.

Furthermore, numerous researchers' models are highly idealized, and the assumption of having a certain level of belief in the accuracy of a hypothesis may not be functional[1], that's why, it is difficult to judge which conclusions are defensible by a bayesianism analysis, and how it bears on public policy. Globally, despite the virtues of the Bayesianism but it may fail to provide confirmation of subjective theories.

Despite the fact that the levels of belief are conflicting, frequently there is an agreement on the strength of confirmatory reasoning. Furthermore, the structure of confirmatory reasoning is based on the Bayesianism analysis to measure their effect.

More specific, the confirmation of a theory by the evidence provided by the researcher usually seems to be in virtue of certain objective, logical relations that increase the level of belief. Consequently, the Bayesianism approach is always useful approach to quantitatively measure the strength of a support relation.

However, this approach does not provide insights into the structure of evidential support. Beside all the positivity of the Bayesianism reasoning of confirmation but this is not the whole story[2].

The overhead observations inspire the search for a structural, in virtue of objective account of confirmation in science. The H-D method may be the right applicant since researchers and philosophers usually perceive explanatory and predictive advantages, and strict testing of the hypothesis, as the main element to evidential support.

Also in the present statistical literature, the previously mentioned problems with applying Bayesianism logic has advertise the idea of "what if a statistically refined Hypothetico-deductive method might not be no longer suitable for providing evidential inferences"[3], alternatively of allocating probabilities to hypothesis under test, researchers prefer mobilise a statistical tests in order to define if they are statistically adequate.

[1] Frame, D.J.and all. *Probabilistic climate forecasts and inductive problems*. Philosophical Transactions of the Royal Society A (365). 2007. PP. 1971-1992.
[2] Fitelson, B and Hawthorne. J. *How Bayesian Confirmation Theory Handles the Paradox of the Ravens*. The Place of Probability in Science. Eds. E. Eells and J. Fetzer. New York: Springer, 2010. PP. 247–76.
[3] Gelman. A and Shalizi. C.R. *Philosophy and the practice of Bayesian statistics*. British Journal of Mathematical and Statistical Psychology (66). 2013. PP. 8–38.

This point which make the reconciliation with the H-D method and makes an attractive plan for the researchers, and as design model for scientific theory choice, for those researchers that believe in the importance of a strict testing to the hypothesis under study to provide empirical support. Besides, that point differentiates the H-D method qualitative reasoning of confirmation.

Strict and severe test applied to the hypothesis under study is an important philosophical orientation of Karl Popper's approach of science. Undeniably, that the origin of the H-D method is founded on the prediction condition, which mean that a hypothesis need to undergo a severe test to be accepted, otherwise, researcher must reject the hypothesis as falsified[1].

But, researcher and scientist want to have a solution for the disproved hypothesis by the prediction condition. From this point, the concept of confirmation inters. The founders of this orientation see that genuine confirmation established in raising the credibility of a hypothesis.

When it comes to the degree of confirmation, it is defined by several details: the successfulness of the prediction, the diversity of evidence, the strictness of the tests, and the empirical content of the hypotheses.

The hypothetico-deductive method is the appropriate method in scientific research even in the statistics territory, in this level, it is obvious that the H-D reasoning is the leading substitute to the Bayesianism approach, also when it comes to the Popperian intuitions, and the H-D method can provide the ultimate formal model for scientific confirmation.

2.2.3. Objections To H-D Confirmation

The definition of the H-D method focused on the discussion of qualitative accounts of confirmation. Though, researchers have attached some objections to the H-D confirmation, as start, Clark Glymour supposed that evidence E and hypothesis H have a relationship of contingency and reliability with each other, also in case that E is true, that affects the material conditional H relying on the contingent relationship, so what implies to one side effects the other one.

As conclusion to this reasoning Jan springer summarized the H-D confirmation as follow "*the logical consequence of a statement to believe true _ to our background knowledge. But relative to H implicates E, E can be derived from H, so E H-D confirms H relative to H implicates E. So an arbitrary H is H-D confirmed by any true evidence E, leading to the famous conclusion that H-D confirmation is hopeless*[2]*".*

[1] Popper. K. R. *The Logic of Scientific Discovery*. London: Hutchinson. 1934. P71.
[2]Sprenger, J. *Hypothetico-Deductive Confirmation.* Philosophy Compass, 6(7), 2011. P6.

Glymour in his theory has misinterpreted the relation between the evidence E and hypothesis H. Glymour has double counts the E, where he counted on the evidence E to the assumptions of the hypothesis, the same evidence E is used later in the study to confirm the hypothesis, that what makes the theory of Glymour not admissible, hence this objection can be rejected.

The other objection to the H-D confirmation is the vulnerabilityb of it to the test made by Duhen and Quine, where they concluded that no single H can be tested in isolation, they see that a single hypothesis does not require an empirical prediction. So it can not be confirmed.[1]

The distinguishing between the hypothesis under test H and the hypothesis in use K fixes the problem of the hypothetico-deductive model, it is admitted that H can be H-D confirmed only if researcher added auxiliary hypotheses K. the biggest gauntlet for the H-D method confirmaion is the objections presumed by several researchers and scientists, among them is

Hempel[2], when he discussed the idea of 'converse consequence condition', based on the tacking paradoxes, the main assumption of his objection is the irrelevant conjunctions, which are tackling the hypothesis H in the process of confirmation, if a piece of evidence E confirmed the hypothesis H, then an arbitrary X (auxiliary hypothesis) that is consistent with H and K contribute in the confirmation of the tested H.

The same author determined three conditions for H-D confirmation: firstly, the admission that H:K:X is consistent, then, the condition that if H:Kj=E consequentely H:K:Xj=E, caused by the logical relationship, finaly, K by itself can not cause E, for the reason that researchers already know that E H-D confirms H relative to K. therefore, the attachment of an arbitrary unrelated conjuct to a confirmed hypothesis limitate the confirmation relation. Which makes it highly unacceptable.

In general, the reasoning of the H-D confirmation requires to explain why an evidence used in the test of the studied hypothesis does not confirm every theory that insinuate it. The previous problem and objection to the H-D confirmation has a complementary side of the evidence. Concerning the attechement of irrelevant disjunctions to E similarly limitate the confirmation relation: in case E confirms a hypothesis H, then the H-D method confirms the same H for arbitrary E0.

The core of objections use the fact that the known H-D confirmation does not relate no account to the evidence relevancy. If these objections stayed unanswered, then the H-D confirmation will maintain fragile. The argument about the fragility of the H-D confirmation has been going on for decades.

[1] Glymour, Clark. *Discussion: Hypothetico-Deductivism is Hopeless*.Philosophy of Science (47).1980. PP. 322–25.
[2] Hempel, Carl G. *A Purely Syntactical Definition of Confirmation*. Journal of Symbolic Logic 8. 1943. PP. 122–43.

2.3. ANSWERS FOR THE THE TACKING PROPOSALS

The solution suggestions attempt to limitate the tacking paradoxes using an acount of appropriate entailment in first order predicate logic[1]. This unpretentious language is proper for emerging answers and ideas, which can consequently be transmitted to more complicated languages.

Horwich and Grimes were the first that offered solution proposals to the tacking paradoxes, but their proposal failes in providing a global solution, that was discovered later b Gemes in 1993. The failure of the two authors have encouraged the reaction that having answers to the tacking paradoxes is an unachievable end[2].

Facing the previous pessimistic end gave birth to a new stream, in the early nineties Gerhard Schurz made the first proposal, it was more oriented to the idea of replaceability of a well formed method in the outcome of logical implication. In his trial and observation gives rise to a theory of irrelevant conclsions[3].

With several definitions, Schruz had a result that the tacking paradoxes disappeared as a consequence of adding the replaceability criterion, thus the theory seems to offering solution the objections to Hypothetico-deductive confirmation. But this reasoning have problem related to the logical equivalence, though the lack of invariance of this reasoning.

As long as the contenet remains the same, a confirmation relation should not depend on the way a theory is articulated. To trait this problem, Schurz offered a numerious propositions based on technical adjustments that come at the expense of sophistication and transparency. Although, Schurz offered a maintainable proposition in the literature, but also he vreated a gap, that gives the possibility for improvement.

The substitution proposition is the relevant models, Grimes in 1990 suggested to modify hypothetico-deductive confirmation using the condition that at least one relevant model of the results should be in consistency with all models of the antecedent.

This proposition encounters the tacking by the disunction paradox, unfortunately a counterexamples made it a case of criticism, and scientists thought that it is certainly not a releval prediction of hypothesis.

[1] Fitelson, Branden. `*The Paradox of Con_rmation.* Philosophical Compass 1. 2006. PP. 95-113.
[2] Moretti, Luca. *The Tacking by Disjunction Paradox: Bayesianism Versus Hypothetico-Deductivism*. Erkenntnis (64). 2006. PP. 115–38.
[3]Schurz, Gerhard. *Bayesian H-D Confirmation and Structuralistic Truthlikeness: Discussion and Comparison with the Relevant-Element and the Content-Part Approach*. Logics of Scientific Discovery. Essays in Debate with Theo Kuipers. Ed. Roberto Festa. Amsterdam: Rodopi, 2005. PP. 141–59.

Ken Gemes's proposal is centred about the idea of the content of a hypothesis. He proposed modifications to the previous suggestion by demanding all relevant models of the consequence not only one in the relevant logical entailment.

Scientists occasionally try to confirm interconnected collective hypotheses, therefore, researchers require relevant background assumptions used in the hypothesis testing process, here comes the problem, and the base of objections from several scientists, where they are asking for H-D confirmation reasoning that traits the theories as a whole, and without laying on a specific axiomatization.

If philosophers and researchers can be able to achieve that, then the results would be more sustainable and attractive as a proposition solution for the holistic challenge of H-D confirmation objections.

First of all, the H- D method is not hopeless, that was a result of the previous discussion between several scientific works. Secondly, the H-D confirmation was boosted with Bayesian reasoning in terms of quantifying the confirmation level, thirdly, the fundamental idea of the H-D is to test the consequences of a theory if they are in coherence with the reality[1].

All the previous presented points serve to demonstrate that in the presence of all the objections, hypothetico-deductive method has a wider scope than it is commonly believed.

[1] Fisher, Ronald A. Statistical Methods and Scientific Inference. New York: Hafner, 1956.

3. MATHEMATICAL TOOLS

This research is using mixed methods, qualitative methodology to comprehend the environement of the Algerian banks, their differences, the influence of the ownership sturcture on its performance.

Then, a quantitative methodology is adopted to test the relationship between the macroeconomic factors that impact the GDP variatons in Algeria, so we will have an overview of the macroeconomic risk and its origins.

Finally, an econometeric model would be studied in the last section of the empirical chapter the provide answers for our fundamental problem, which is the impact of risk ratios and economic unstability on bank financial performnace in Algeria? In the current section, we will theoritacly present the different methematical tools that we are planning to apply in the empirical of this research.

3.1. VAR MODEL

As the nomination demonstrate, vector autoregressive models study the autoregressive processes, which means there is a linear dependency relationship between the variable on its own lagged, and on the other hand between the variable and the other variables in the vector.

Consequently, the process's upcoming values are weighted by the summation of previous, and present values plus possibly some exogenous variables and noise. For that reason, the VAR models were able to achieve successfulness in term of analysing multivariate time series. The univeriate autoregressive model has as a natural extension to dynamic multivariate time series.

Regarding the economic and financial time series VAR model has confirmed to be appropriate describing the dynamic behavior of it. Usually, VAR models offer superior predictions to the univariate time series models, and establish theory foundation instantaneous equations models. The VAR models has flexibility when it comes to the prediction process, caused by the possible upcoming lanes of certain variables in the model. Plus data explanaition and prediction, beside that the VAR model helps in policy analysis and structural interpretation.

Specific assumpltions are made concerning the causal structure of the data under test to achieve structural analysis, and the outcomes of causal impacts of unforseen shocks to certain variables on the variables of the study are interpreted and summarized.

Two tools are used to test the causal impacts which are impulse response functions and forcast error variance decompositions[1].

[1] Hatemi-J.A. *A new method to choose optimal lag order in stable and unstable VAR models*. Applied Economics Letters (10:3), 2003. PP. 135-137.

3.1.1. The Stationary Vector Autoregression Model

We suppose that Yt = (y1t, y2t, . . . , ynt)', which signifies (n*1) vector of time series variables. And (VAR (p)) is the p-lag vector autoregressive model that has the next form[1]:

$$\mathbf{Y_t = c + a_1 Y_{t-1} + a_2 Y_{t-2} + \cdots + a_p Y_{t-p} + \mu_t,\ t = 1, \ldots, T} \qquad \mathbf{(1)}$$

The significance of each variable is: ai are (n*n) coefficient matrices and μt is (n*1) representing the white noise vector process. The following example is a VAR (2) for more illustration of the relationship between Yt and ai:

$$\mathbf{Y1t = a11y1(t\text{-}1) + a\ 12\ y2\ (t\text{-}1) + \mu 1t} \qquad \mathbf{(2)}$$

$$\mathbf{Y2t = a21y1(t\text{-}1) + a\ 22\ y2\ (t\text{-}1) + \mu 2t} \qquad \mathbf{(3)}$$

We use the next matrices notation:

$$Yt = \begin{bmatrix} y1t \\ y2t \end{bmatrix} \qquad \mu t = \begin{bmatrix} \mu 1t \\ \mu 2t \end{bmatrix} \qquad A = \begin{bmatrix} a11 & a12 \\ a21 & a22 \end{bmatrix}$$

So we obtain the following vector equation:

$$\mathbf{Yt = A\ y\ (t\text{-}1) + \mu t} \qquad \mathbf{(4)}$$

The VAR (p) model verifies the next properties[2]:

$$E\ (\mu t) = 0 \text{ for all the values of t.}$$

$$E\ (\mu t\ \mu s') = \sigma\ (\mu), \text{ for: t = s. or 0 otherwise.}$$

These hypotheses can be translated to the next equations[3]:

$$Cov\ (\mu it, \mu ij) = Wij = Wji \qquad \text{for all values of i and j;}$$

$$Cov\ (\mu it, \mu ij) = 0 \text{ if } t \models s \text{ and for all values of i and j;}$$

[1] Pesaran, H. H., & Shin, Y. *Generalized impulse response analysis in linear multivariate models.* Economics Letters, 58(1),1998. PP. 17–29.
[2] Davis, R. A., Zang, P., & Zheng, T. *Sparse Vector Autoregressive Modeling*. Journal of Computational and Graphical Statistics, 25(4), 2016. PP.1077–1096.
[3] Härdle, W., Tsybakov, A. and Yang, L. *Nonparametric vector autorgression*, Journal of Statistical Planning and Inference 68: 1998. PP. 221–245.

The previously mentioned hypothesis of the VAR (p) model and other related to the stationarity provide proves that error vectors are independent of y(t-1), y(t-2),.., the innovation added by the VAR approach is the independency of the error vectors μt.

In a specific case where p=1, we will have VAR (1), that's mean that the process is based on one lag, where the general presentation of VAR (1) and based on the equation number (4) is as upcoming:

$$\mathbf{Y_t = A\ y\ (t\text{-}1) + c + \mu_t} \qquad \mathbf{(5)}$$

We also know that with using the lag operator, we obtain: L yt = y (t-1), that gives as the possibility to rewrite the equation number (5) as follow:

$$\mathbf{Y_t = A\ L\ y_t + c + \mu_t} \qquad \mathbf{(6)}$$

$$\mathbf{Or\ \ (1\text{-}A\ L)\ y_t = c + \mu_t} \qquad \mathbf{(6')}$$

Where c is a column vector with n components.

To present efficiently the essential features of the data, the basic VAR (p) model may be too restrictive, so to present the data properly, the VAR (p) model needs some extensions, such as a linear time trend or seasonal dummy variables.

Furthermore, stochastic exogenous variables are needed as well. With the aforementioned mentioned extensions, the VAR (p) model has a general form:

$$\mathbf{Yt = a\ 1\ y\ (t\text{-}1) + a\ 2\ y\ (t\text{-}2) + \ldots + a\ (p)\ y\ (t\text{-}p) + \Phi\ d(t) + G\ x(t) + \mu t} \qquad \mathbf{(7)}$$

d(t) : (1*1) matrix of deterministic components;

x (t) : (m*1) matrix of exogenous variables ;

Φ and G are parameter matrices.

3.1.2. Stability And Stationary Of VAR (P) Process

To study the stability and stationary of a VAR (p) process, researchers usually use the finite or infinite form of *MA* for the yt process[1], which provide explanation of yt equation using μt, μt-1,.., that will allow us to determine the statistical characteristics of the yt vector.

In case of vector autoregressive model of (p) order, the eigenvalues of the A matrix are the solution of the next equation:

$$\mathbf{Det\ (A - \lambda I) = 0} \qquad \mathbf{(8)}$$

[1] Zhang, Z., Zhang, X., & Tong, J. *Exponential ergodicity for population dynamics driven by α-stable processes.* Statistics & Probability Letters (125). 2017. PP. 149–159.

Where Det is the determinant of the matrix (A- λ I), that can be written as follow:

$$\begin{bmatrix} A1 - \lambda I & A2 & A3 & \ldots\ldots & Ap \\ I & -\lambda I & 0 & \ldots\ldots & 0 \\ 0 & I & -\lambda I & \ldots. & 0 \\ 0 & \ldots\ldots\ldots\ldots\ldots\ldots & & & 0 \\ 0 & \ldots\ldots & 0 & I & -\lambda I \end{bmatrix}$$

The stationary condition is based on the eigenvalues of the A matrix, which can be presented as follow:

$$\textbf{Det } (-\lambda^{(p)} I (p) + \lambda^{(p-1)} A1 + \ldots..+ \lambda A (-1) + A p) = 0 \qquad (9)$$

*The values of the equation solution should be lower than the unit.

The transformations operated on the A matrix modify the value of the determinant, especially when we multiply the column with λ, the determinant on its own is multiplied in power by λ, in the same time showing a denominator itself multiply in power by λ.

The stationary condition of the VAR (p) model necessitates that the roots of the next equation to be in the interior of the unit disk:

$$\textbf{Det } (\lambda^{(p)} I - \lambda^{(p-1)} A1 - \lambda^{(p-2)} A2 \ldots..- A p) = 0 \qquad (10)$$

Other researchers prefer to present the conditions as the roots of the following equation:

$$\textbf{Det } (I - A1\, z - A2\, z^{(2)} - \ldots.. - A\,(p)\, z^{(p)}) = 0 \qquad (11)$$

In this case the roots are required to be in the exterior of the unit desk, researchers suppose that $z = 1/\lambda$ to change from the fist condition to the second.

In addition, in the case, where the eigenvalues are different from the zero, the conditions on λ and z are equivalents, but if it does exist values for $\lambda = 0$, the condition on z is uniquely the roots $z = 1/\lambda$.

The VAR (p) model can be defined as structural model SVAR, where each variable depends on its own past, and simultaneously depends to the past of the other variables. Example: for n= 2 and p = 1, the structural form of VAR p model is[1]:

$$\mathbf{y1t = b1\ y1\ (t\text{-}1) + b12\ y2\ (t\text{-}1) + c\ 12\ y2t + v1t} \quad \mathbf{(12)}$$

$$\mathbf{y2t = b2\ y1\ (t\text{-}1) + b22\ y2\ (t\text{-}1) + c\ 21\ y1t + v2t} \quad \mathbf{(13)}$$

Where v1t and v2t are term errors, the fundamental advantage of the structural form according to the reduced form of the VAR (p) model is the admission of the instantaneous effect and the lagged effect, while the reduced form is mainly presented in function of the lagged effects only.

In vector autoregression model, the number of lag can be different from one variable to another for the same VAR (p) model. Also for the vector yt that has two components xt and zt, we can face the specification of having one lag for the first variable xt and to lags for the second variable zt:

$$\mathbf{xt = b11\ x(t\text{-}1) + b12\ z(t\text{-}1) + c11\ z(t\text{-}2) + vt} \quad \mathbf{(14)}$$

$$\mathbf{zt = b21\ x\ (t\text{-}1) + b22\ z(t\text{-}1) + c12\ z(t\text{-}2) + wt} \quad \mathbf{(15)}$$

We suppose that :

$$yt = \begin{bmatrix} xt \\ zt \end{bmatrix} \qquad B = \begin{bmatrix} b11 & b12 \\ b21 & b22 \end{bmatrix} \qquad C = \begin{bmatrix} c11 & 0 \\ c21 & 0 \end{bmatrix}$$

We obtain the standard form of the VAR (p) model with the constraints “c12 = c22 = 0”:

$$\mathbf{yt = B\ y(t\text{-}1) + C\ y(t\text{-}2) + \mu t} \quad \mathbf{(16)}$$

In a VAR (p) model, we accept always that the μt vectors are independent. In addition, if the error terms are auto-correlated, here we will face another specification of the VAR model, which is VAR (∞).

In regards, the conditions of the eigenvalues that ensure the stationary of the process, but also it ensure the invertible of the lag operator.

In VAR (p) model, even if one of the eigenvalues is equal to the unit, while the other eigenvalues are lower than the unit, so the process is not a stationary process in the level of all the components of the model.

[1] Mao, X.. *Stationary distribution of stochastic population systems*. Systems and Control Letters 60, 2011. PP. 398-405.

3.1.3. VAR (p) Estimation

In VAR (p) model, all the matrixes A_i, and also the constant vector c are unknown matrixes need to be estimated, so the total number of parameters to estimate is evaluated as upcoming[1]:

$$Pn\hat{}(2) + n + n(n+1)/2$$

To simplify the mathematical equation, we will use the VAR model with p = 1 and n = 2 that y_{1t} and y_{2t}:

$$Y_t = \begin{bmatrix} y_{1t} \\ y_{2t} \end{bmatrix}$$

Or $$Y'_t = \begin{bmatrix} y_{1t}, y_{2t} \end{bmatrix}$$

By stacking the T observation in time, we will have:

$$Y = Y_{-1} A' + u'_t$$

Where Y, U and Y_{-1} are matrixes of dimensions (T, 2), defined as upcoming[2]:

$$Y = \begin{bmatrix} y'1 \\ : \\ y't \end{bmatrix} = \begin{bmatrix} y_{11} & y_{21} \\ : & : \\ y_{1T} & y_{2T} \end{bmatrix} \quad U = \begin{bmatrix} u'_1 \\ : \\ u'_t \end{bmatrix} = u_{11} \begin{bmatrix} u_{21} \\ : \\ u_{1T} \end{bmatrix} \begin{bmatrix} \\ : \\ u_{2T} \end{bmatrix}$$

And :

$$Y\text{-}1 = \begin{bmatrix} y'_0 \\ : \\ y'_{T-1} \end{bmatrix} = \begin{bmatrix} y_{10} & y_{20} \\ : & : \\ y_{1\,T-1} & y_{2\,T-1} \end{bmatrix} = \begin{bmatrix} y_{1,-1} & y_{2,-1} \end{bmatrix}$$

For all j = 1 or 2, the j column of Y correspond to the temporal components of the j_{th} variables of the model, which verify the equation[3]:

$$y_j = Y_{-1} a_j + u_j$$

Where: $$\begin{bmatrix} a'_1 \\ \\ \end{bmatrix}$$

[1] Gourieroux, C., & Jasiak, J. *Noncausal vector autoregressive process: Representation, identification and semi-parametric estimation.* Journal of Econometrics, 200(1),2017. PP. 118–134.

[2] Chen.X, et al. *Covariance and precision matrix estimation for high-dimensional time series*", *The Annals of Statistics*, vol. 41, no. 6, 2013. PP. 2994-3021.

[3]Rao.M, et al, *Estimation in autoregressive processes with partial observations:* Proofs. *Available: http://stanford.edu/~milind/reports/system_id_icassp_proof.pdf.*

$$A = \quad a'_2$$

Or also:

$$A' = \begin{bmatrix} a_1, a_2 \end{bmatrix}$$

And $$uj = \begin{bmatrix} u_{j1} \\ : \\ u_{jT} \end{bmatrix}$$

Take into consideration the previous hypotheses on u_t, we will have:

$$E(uj) = 0$$

$$Cov(u_{jt}, u_{ks}) = \begin{cases} w_{jk} & \text{for all } t = s \\ 0 & \text{for all } t \neq s \end{cases}$$

Where w_{jk} the element of the j line and the column k of Ω, as a result $E(u_j u'_j) = w_{jj} I_2$, and I_2 is the identity matrix with two dimensions.

The aforementioned hypotheses signify the VAR model constitute a family of regressions defined by the following hypotheses[1]:

$$y_j = Y_{-1}\, a_j + u_j$$

And

$$Cov(u_{jt}, u_{ks}) = \begin{cases} w_{jk} & \text{for all } t = s \\ 0 & \text{for all } t \neq s \end{cases}$$

The estimation of the parameters a_j of the matrix A with the least squares method is:

$$a_j = (Y'_{-1} Y_{-1})^{\wedge(-1)} Y'_{-1}\, y_j.$$

Which mean:

$$A' = (Y'_{-1} Y_{-1})^{\wedge(-1)} Y'_{-1}\, Y.$$

[1] F. Han, H. Lu, H. Liu, *A direct estimation of high dimensional stationary vector autoregressions*. Journal of Machine Learning Research, vol. 16, 2015. PP. 3115-3150.

Or also:

$$A' = Y' Y_{-1} (Y'_{-1} Y_{-1}) ^{(-1)}.$$

The estimation with no constraint of A matrix previously presented can be the object of the criteria of minimisation of the global sum squared error terms:

$$\sum_{t=1}^{T} u'_t u_t = \sum_{t=1}^{T} (y_t - A y_{t-1})' (y_t - A y_{t-1}) = Tr (Y - Y_{-1}A') (Y - Y_{-1}A')'.$$

The derivative to the unknown matrix A lead to the next necessary condition:

$$-2 Y'Y_{-1} +2 AY'_{-1}Y_{-1} = 0$$

So:

$$A = Y'Y_{-1} (Y'_{-1}Y_{-1}) ^{(-1)}$$

The estimation of the A matrix depends on the structure of the covariance between the error terms u_i for all i= 1,2,…., n.

The elements w_{jk} of the matrixes variance covariance Ω_u are estimated with:

$$W_{jk} = (1/T) u'_j u_k$$

Where u'_j and u_k design the least of equations related to yj and yk after estimation of aj and ak using the least square method.

On the other hand the estimation of the Ω_u is:

$$\Omega_u = (1/T) U'U$$

The same approach of estimation is applicable for the VAR model with p number of lags exceeds one with eventually a constant vector a_0.

3.1.4. Validation Tests

The estimation of the several parameters in VAR (p) model theoretically never has been a problem and especially when the specification is known with certitude. This essentially concerns the order of the VAR processes, also the existence or the non-existence of a constant vector.

One of the major interrogations faced in the VAR (p) model is the lags number (p), consequently the tested hypothesis H_0: $p = p_0$ facing an alternative value H_1: $p = p_1$ or p_0 and p_1 are two completely positive known as $p_1 > = p_0$. The test to apply likelihood-ratio test[1]:

$$LR = -2 (L(p_0) – L(p_1))$$

The previous equation is under the hypothesis H_0, practically the order of the process is unknown, researcher need the upper-mentioned test to identify the optimal number of lags (p), to achieve that we pick a relatively a fairly high number of (p), than we apply the test related to the nullity of the Ap_0 matrix, which provide the next test:

$$H_0: Ap_0 = 0 \text{ against } Ap_0 \neq 0$$

The likelihood-ratio test allows us to accept or reject the hypothesis H_0. In case of non-rejection of H_0, so the order of p is defined. Otherwise, the rejection of H_0 the lead us to do the test again with:

$$H_0: Ap_{0-1} = 0 \text{ against } Ap_{0-1} \neq 0$$

In both cases, the likelihood ratio test is under the hypothesis H_0.

3.2. DYNAMIC PANEL DATA ANALYSIS

In the field of social science, the panel data analysis is one of the most used mathematical tools for quantitative approaches, especially, in research related to business and economics. The popularity of this technique came from its simultaneous ability to study individual effects, several periods, and in the same time, the independent regressors or endogeneity of the model. In this tool, there are two categories of models: static and dynamic models.

Moreover, the dynamic panel data provides more advantages in comparison to the static panel data, as it give the researcher to address several instrumental variables, beside the heterogeneity of the individuals[2].

Different quantitative research on the field of economy are using databases with long time periods and small number of individuals, for example, in our research we are trying to understand the relationship between risk management and macroeconomic risk on profitability

[1] Bergmeir, C., et al. *A note on the validity of cross-validation for evaluating autoregressive time series prediction.* Computational Statistics & Data Analysis, 120, 2018. PP.70–83.
[2] Ruíz-Porras, A. *Econometric research with panel data: History, models and uses in Mexico*, MPRA-paper 42909, University Library of Munich, Germany. 2012.

of Algerian banks. In order to build this model, we will use the dynamic panel data that suits the most the nature of our sample.

3.2.1. Review on Dynamic Panel Data

Empirical research using panel data can use static or dynamic panel models. However, the use of static panel model will limit the study to the use of fixed or random effects model, where they have an assumption that the effects are constant over time. On the other hand, dynamic panel models are more suitable to address endogenous models.

Panel data is different from time series as it perform models using several individuals (banks), across a determined period of time (t). Therefore, the application of panel data needs two conditions: data collected from dissimilar individuals (n) over time (t).

In addition, to the last two conditions, the number of observations need to be large number of individuals (n) and small period of time (t), in order to have adequate degrees of freedom and avoid over identification, and to capture the variability of the phenomenon.

In the case of our research, our panel data is characterized with n equals 18 and t equals 10. The equation of the panel date models is written as follow:

$$Y_{it} = \alpha\, Y_{it-n} + \beta_i X_{it} + \omega_{it} \text{ ……..(1)}$$

Where:

Y_{it}: Dependent variable of the individuals i in time t.

Y_{it-n}: Lag of dependent variable. Individuels i en time t-1.

α : Constant.

β_i: Coefficient of variable i.

X_{it}: Independent variable i in time t.

ω_{it} : $\varepsilon_i + \mu_{it}$.

Our focus in this research is to study quantitatively a large number of individuals or banks observed for relatively a small number of time periods (10 years), plus the application with macroeconomic data.

3.2.2. Types of Dynamic Panel Data

The analysis of endogenous models have been progressed, and new estimation possibilities are introduced, due to the evolution in the analysis of dynamic panel data and the construction of estimators. These models have been particularly attentive to the econometric analysis of the endogeneity.

To address the models' endogeneity, two fundamental methods have been develop[1]:

- Traditional instrument variables that aims to build instruments variables in levels.
- Variables generation in differences.

Despite the fact that the literature has revealed advances in the dynamic panel data analysis, there are always some problems in the application of these analysis.

The above-mentioned methods depends on the use of instrumental variables and the application of lags on the explanatory variables in differences or in levels.

The different writings of the endogenous variables lagged in differences or in levels:

$$\mathbf{X}_{(t-n)} \ldots\ldots\ldots\ldots \text{ Instrument in levels}$$

$$\mathbf{X}_{(t-n)} - \mathbf{X}_{(t-(n-1))} \ldots\ldots\ldots\ldots \text{ Instrument in differences}$$

The application of instruments in levels or in differences is explained by the next equations:

$$\mathbf{Y_t = Y_{t-1}; Y_{t-(n-1)} = Y_{t-n}} \ldots\ldots\ldots \text{ Equation in levels}$$

Where: Y_{t-n} is the instrument of $Y_{t-(n-1)}$

$$\Delta \mathbf{Y_{t-1} = Y_{t-2} - Y_{t-1}} \ldots\ldots\ldots \text{ Equations in differences}$$

Different estimators are possible, to construct instruments in the dynamic panel data. In 1991, Arellano and Bond[2] build the first estimator. This estimator applies as instruments the lags in differences. Therefore, it is known as difference Generalized Method of Moments (GMM).

Than in 1995, Arellano and Bover[3] developed new estimators that uses as instruments variables in levels and lags in differences, this innovation permitted researchers to work with panel data composed by small period of time, which mean limited number of instruments, this method is called as system GMM.

[1] Labra. R, and Torrecillas. C. *Estimating dynamic Panel data. A practical approach to perform long panels*. Revista Colombiana de Estadística. Volume 41, Issue 1, January 2018. PP. 31-52.
[2] Arellano, M. and Bond, S. *Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations*. The Review of Economic Studies 58(2). 1991. PP. 277-297.
[3] Arellano, M. & Bover, O. *Another look at the instrumental variable estimation of error-components models*. Journal of Econometrics 68(1). 1995. PP.29-51.

In 2006, Roodman developed a third GMM method[1]. This invention was similar to system GMM logic. However, it provide more options in term of the instruments used. The Xtabond2 tolerates to use distinctly the endogeneity of the independent or the dependent variables.

The system GMM allows the use of instruments in differences and in level, as explained earlier. Dissimilar equations explains its calculation.

Moreover, the estimators mentioned above permits the application of two options: one-step and two-steps differences. In addition, the distinction between these two options is the key for the determination of over-identification in a dynamic panel model.

3.2.3. Generalized Method Of Moments GMM Limits

The application of GMM estimators certainly have some problems, the two essential issues are the serial autocorrelation of errors and the proliferation of instruments. The last two problems will have greater consequence on the estimation quality if the panel used is made-up of a relatively high period of time (t) and limited number of individuals (n).

The proliferation of instruments indicates the existence of a high level of instruments. Which would cause over-identification issue in the model, as a result of the instrumental variables generation in levels and in differences.

Therefore, two test are possible to check the appropriate number of instruments, which does not produce over-identification: Sargan test and Hansen test[2].

Finally, the dynamic panel data analysis necessitate that the equation errors not be serially correlated, this condition can be fulfilled using Arellano and Bond test to avoid error serial autocorrelation.

[1] Roodman, D. *How to do xtabond2: An introduction to difference and system GMM in Stata*. 2006.
[2] Sargan, J. D. *The estimation of economic relationships using instrumental variables.* Econometrica: Journal of the Econometric Society 26. 1958. PP. 393-415.

Conclusion of the Third Chapter

This chapter summarizes the three paradigm components, ontology, epistemology and methodology. As a result, we were able to define the research paradigm as the approach adopted by a number of researchers in the discipline established on having been both verified and examined for long period. Moreover, based on the nature of the paradigm, the researcher would be able to select the appropriate methodology.

After understanding the different research paradigms that are apply in the economic and social sciences, we were able to identify the most appropriate epistemology and methodology of our research. From the paradigm literature review, we can select the positivism and post-positivism paradigm as the most suitable to our study, as the ontology of this paradigm claim that there is one truth and reality. Moreover, this reality is measurable and objective epistemologically, and by the application of quantitative and experimental methodology, we can attain one general truth and knowledge.

The research paradigm identification was follow by the applied method choice. After, studying the H-D method, we were able to determine the processes of the data collection nature, the data analysis procedures and the outcome interpretation. As the hypothetico deductive method based on setting several hypotheses and theories as the research's base, than a deductive process to test these hypotheses.

Furthermore, we collected our data from two sources, the Algerian banks financial statement for the last ten years for bank specific variables and the World Bank to obtain the macroeconomic variables, which represents quantitative data required for the establishment of the econometric model. Then, the results of the quantitative method will provide the base for the qualitative methodology by interpretation of the different results.

The third section of the current chapter interested in presenting the different mathematical tools that will be applied in the empirical chapter, where the VAR model will be used in investigating the factors that affect the Algerian economic growth measured by the GDP growth variations.

The second tool is the panel data analysis that will investigate the impact of the risk ratios and macroeconomic risk on bank profitability in Algerian banks. Therefore, we presented above the theoretical concepts of the VAR model and the panel data analysis to justify the use of the two instruments, as they are the most appropriate mathematical tools for the nature of our sample and our problem.

Chapter four:
OWNERSHIP STRUCTURE, ECONOMIC GROWTH AND PROFITABILITY VARIATIONS OF THE ALGERIAN BANKS

CHAPTER IV: Ownership Structure, Economic Growth and Profitability Variations of Algerian Banks

Introduction of the Forth Chapter

Banks have a major role in identifying the characteristics of the financial system and the economic stability. Where they have an intermediary role between financial market supply and demand, the use of complex financial instruments, and practicing risk transfer through the usage of risk management practices. Furthermore, banks face multiple risks that can jeopardize their sustainability, such as credit risk, liquidity risk, market risk, exchange rate risk, interest rate risk, and operational risk. Several international financial organizations tried to regulate and model the above-mentioned risks. To facilitate risk downsizing by banks and control its influence over the performance.

Besides the economic growth, a productive financial system allows better observation of financial crises and partake in the economic and financial stability. Hence, practitioners, academicians, regulators, and bank managers showed interest in investigating the relationship between risk management and bank profitability. To this end, our thesis will focus on providing empirical evidence to quantify the impact of risk management on bank profitability in Algerian banks. Therefore, this chapter will be divided into three sections; the first one is conducted to describe the data used, the period, the sample, and the methodology. The second section will provide findings on the Algerian economic and financial stability using VAR model analysis. Finally, the third will study the impact of risk management on bank profitability using panel regression analysis.

The literature review chapters supplied the research with the necessary conceptual framework, which made the empirical background of the study. Consequently, we can investigate in the present chapter the impact of risk management on bank profitability through the use of the different risk ratios faced by the Algerian banks and the profitability ratios to measure whether they have a negative, positive, or no impact on the dependent and independent variables of the study.

The financial instruments used in this chapter will be adapted to the sample's nature, for the section that will study the impact of risk management and profitability, we were able to collect, a database of 18 Algerian banks over the period 2010-2019. The data used in the empirical work was obtained from the financial statements of the Algerian banks, which create a panel of 180 balanced observations. However, we are planning to separate the sample into state-owned banks (SOB) and private-owned banks (POB), as known, the banks owned by the Algerian authorities dominate the banking sector in Algeria, in terms of size, the granting loans, the number of branches distributed over the country and the size of clients portfolio. Therefore, to obtain real and more accurate findings, we decided that the sample need to be divided into SOB and POB.

For the section that studies economic and financial stability, we conducted a VAR model, we were able to assemble a database including monthly observations over more than five (05) years, ranging from December 2013 to March 2019. Therefore, there are 64 observations. The data used in this section were collected from different databases: the Algerian central bank (ABC), the World Bank (WB), and the International Monetary Fund (IMF).

CHAPTER IV: Ownership Structure, Economic Growth and Profitability Variations of Algerian Banks

1. A COMPARATIVE CASE STUDY BETWEEN SOB AND POB

The Algerian banking system is fundamentally characterized with the dominance of the state owned banks, the banks owned by the Algerian authorities are six (06) banks, on the other hand, private owned banks or mixed ownership banks in our sample are twelve (12).

In term of number, we can tell that private banks are the majority. However, it is not the case, if we change the factor of comparison. Therefore, in the present subsection, we will illustrate the key differences and similarities between the two categories of banks operates in Algerian banking sector.

1.1. LITERATURE REVIEW AND THE CURRENT BANKS IN ALGERIA

1.1.1. Literature Review

Several researches investigated if state owned banks are more efficient than private owned banks, or otherwise, in an effort to identify the factors that boost bank profitability. Most of these studies examined the bank's lending behavior based on its ownership, the implication of a bank ownership structure for bank performance and competition, or the relationship between state owned banks and banking crises.

Paola Sapienza. (2002) investigated the effects of bank ownership over bank lending behavior in Italy, the author used a comparative case study among SOB and POB, to examine the interest rate charged by each type of banks for identical two companies. The results of the study found that private owned banks charge higher interest rate than do state owned banks to undistinguishable or similar enterprises.

Moreover, the state owned banks usually favors companies positioned in areas characterized with lack of growth, although the last are able to borrow more from POB. A more interesting finding of the study was that the state owned bank's lending behavior is directly affected by the election results of the party affiliated with the bank: the fluctuation of the interest rate charged on the borrowing firms is related to how strong the political party in the area where the companies is located[1].

Robert Cull et al. (2018) to examine the impact of bank ownership over bank profitability and competition in different countries, the researchers conducted an explanatory study a cross countries. Where they found that domestic banks are less efficient than foreign owned banks in developing countries.

While the host country is facing idiosyncratic shocks, foreign owned banks tend to enhance competition in the banking system, and help stabilizing the credit granting policy. However, the same category of banks can also be the source of transmitting external shocks.

[1] Paola Sapienz. *The Effects of Government Ownership on Bank Lending*, Journal of Financial Economics, Northwestern University & CEPR, October 2002, PP1-48.

Finally, essentially in developing countries, the state owned banks proved to have few benefits on bank profitability and competitiveness[1].

Marcia Millon Cornett et all conducted a study in 2010 to scrutinize the impact of bank ownership over performance using an international comparison. The period of the research was from 1989 to 2004. The results revealed a performance differences among state owned banks and private owned banks during the financial crisis in Asia.

Three factors were measured to assess the implication of ownership on performance changes, which are cash flow returns, core capital and credit quality. Furthermore, the findings showed that the three patterns are less in state owned banks prior 2001. In addition, the results were more amplified in those countries characterized with government involvement and political corruption[2].

To investigate the effect of bank ownership on performance in Algerian banking sector several studies were established, in 2019, Ihaddaden. M.F and Bouhaba.M[3] enquired this problem using Data Envelopment Analysis (DEA).

The results of the study demonstrated that state owned banks and mixed owned banks are less performing than their counterparts are. In addition, they concluded that private banks are operating with unsuitable financial resources, while the banks owned by the Algerian authorities are facing difficulties managing their financial resources.

Another research was established inspecting the relationship between ownership structure and bank efficiency within the Algerian banking sector. Hacini and Dahou (2018a)[4] compared the efficiency of domestic and foreign banks in Algeria employing two DEA models (CCR and BCC) from 2000 to 2012.

The results showed that domestic banks are less efficient than foreign ones, as a result of their superior scale efficiency. The mixed results of the literature review, drove us to participate to this debate, as ownership structure is a key determinants of bank performance, we are willing to establish a comparative case study between the Algerian banks based on their ownership.

In order to set the ground for upcoming parts of our research, we see fundamental to compare the efficiency of Algerian banks using ownership structure as the key factor of comparison. We will use performance ratios such as Return on Assets and Return on Equity, also, we will use risk management ratio to judge risk management soundness in Algerian banks.

[1] Robert Cull et al., *Bank Ownership Trends and Implications,* Policy Research Working Paper (8297), world bank group, 2018, PP. 1-46.
[2] Marcia Millon Cornett et al., *The impact of state ownership on performance differences in privately-owned versus state-owned banks: An international comparison,* Journal of Financial Intermediation, January 2010, PP. 74-94.
[3] Ihaddaden. Mf and Bouhaba. M, *a performance comparison between state-owned, mixed and private banks in Algeria*, Les Cahiers du Cread, vol. 35 (n° 01), 2019, PP. 5-20.
[4] Hacini, I., Dahou, K., *Comparison on Efficiency of Foreign and Domestic Banks Evidence from Algeria*. Journal of Banking and Financial Economics. 2018a. PP.106–119.

In addition to capital adequacy ratio, beside size and deposits. At first, we will present the different operators in Algerian banking system and their ownership structure.

1.1.2. Banks Ownership In Algerian Banking System

The modern Algerian banking system can be qualified as independent open system, in 2020, Algerian banking system is composed of six (06) state owned banks and twenty (20) private owned or mixed owned banks, all the private twenty banks are foreign only Albaraka bank that is composed of mixed capital (public and private).

The essential criteria used in our selection of the sample was the banks that operated in the Algerian banking sector at least for the last ten (10) years. It is known, that the global number of bank system operators is twenty six (26) actually in 2020. However, several banks do not have a financial history of ten (10) years. Therefore, we selected the banks presented in table N°20. We start with a presentation of the eighteen (18) banks and their ownership in the following table.

Table N°20: Algerian Banks Ownership

Bank	Ticker	Ownership
Sociéte Générale Algérie	SGA	Private
Gulf Bank Algérie	AGB	Private
Arab Banking Corporation	ABC	Private
Trust Bank-Algeria	TRUST	Private
Al Salam Bank Algeria	AL SALAM	Private
Banque Al Baraka d'Algérie	AL BARAKA	Private
The Housing Bank For Trade and Finance-Algeria	HOUSING	Private
Fransabank Al-Djazair	FRANSABANK	Private
Crédit agricole corporate et investissement Bank-Algérie	CACIB	Private
H.S.B.C-Algeria	HSBC	Private
BNP Paribas Al Djazair	BNP	Private
Citibank N.A Algeria	CITI	Private
Banque nationale d'Algérie	BNA	Public
Banque extérieure d'Algérie	BEA	Public
Banque de l'agriculture et du développement rural	BADR	Public
Banque de développement Local	BDL	Public
Crédit populaire d'Algérie	CPA	Public
Caisse nationale d'epargne et de prévoyance	CNEP	Public

Source: Own Computation, Based on the Financial Statements of the Algerian Banks

In fact, the private banks are dominant in term of number, however, the public banks capture the majority of the banking activities, due to their branch network. By the end of 2016, the Algerian banking system is composed of 1489 branches. Where 76% of banking market is detained by the state owned banks (1134 branches) verses 24% is held by the private banks (355 branches)[1].

Furthermore, the total equity of banking sector is dominated by the domestic equity, in which it represents 95% for the domestic equity and 5% for the foreign equity[2]. in order to moderate the domestic bank equity share, Algerian authorities need to revise the banking regulations, to make the banking investment more open to foreign capital, reinforce supervision's organisations, restrict intra-sectoral boundaries, and reduce the entry barriers[3].

1.2. BALANCE SHEET AGGREGATES COMPARISON OF ALGERIAN BANKS

1.2.1. Total Assets Share Of State And Private Owned Banks In Algeria

Bank asset represents what a bank owns, this aggregate is composed of two types: liquid assets made of cash and balances with central bank, due from other financial institutions, trading securities, available for sale securities, other securities and unearned income from securities.

In addition, non-liquid assets consist of investment securities, fair value of hedging derivative financial instruments, gross loans, loans held for sale, and the interest-earning components of other assets[4]. In the present subsection, we will start our comparison between state owned banks and private owned banks, by comparing the total assets of each category.

The total assets of the Algerian banking system was detained up to 62% by the state owned banks, on the other hand, private owned banks held almost 38%. For the last 10 years the percentage of total assets kept by SOB and POB was slightly fluctuating, which preserved the domination to the state owned banks.

[1]CBA (2017). Annual Report of Central Bank of Algeria 2016. Algeria: Central Bank of Algeria.
[2]Lee, J.-K. Financial Liberalization and Foreign Bank Entry in MENA. 2002. Retrieved from. http://citeseerx.ist.psu.edu/ viewdoc/download?doi=10.1.1.200.6230&rep=rep1&type=pdf.
[3]Claessens, S. *Competition in the financial sector: overview of competition policies*. The World Bank Research Observer, 24(1), 2009, PP. 83-118.
[4] Moody's investors service, banking account and ratio definitions, February 2011, PP.2-6.

Table N°21 illustrates the total assets evolution from 2010 to 2019 and the percentage of total assets detained by each type of banks over the years.

Table N°21: Total Assets Evolution Of Algerian Banking System (2010-2019)

Year	State Owned Banks - Total assets	SOB %	Private Owned Banks - Total assets	POB%
2010	23236019610	62,04%	23236019610	37,96%
2011	26155913324	61,98%	26155913324	38,02%
2012	28459715190	62,20%	28459715190	37,80%
2013	30169342401	62,19%	30169342401	37,81%
2014	35366607853	62,20%	35366607853	37,80%
2015	36655595674	62,25%	36655595674	37,75%
2016	37728174987	62,30%	37728174987	37,70%
2017	40701437509	62,04%	40701437509	37,96%
2018	44461528760	62,02%	44461528760	37,98%
2019	47486996813	62,11%	47486996813	37,89%

Source: Own Computation, Based on the Financial Statements of the Algerian Banks

In comparison with MENA countries, which experience a reduction of the state owned share in the last decade, also the state banks are playing a modest role in the financial system of the following countries: Saudi Aribia, Bahrain, Jordan, Kuwait, Lebanon, Yamen and Oman.

On the other hand, countries such as Algeria, Libya and Syria provide a major role to state owned banks in the financial intermediation. In contrary, Egypt, Morocco and Tunisia have consolidated the private owned banks to 71% of the banking sector's total shares in 2008[1].

From the table above, and in comparison with the MENA countries. The Algerian financial authorities are clearly trying to reduce the share of state owned banks in the last two decades.

However, the 62% of total assets is still dominated by the state owned banks, and it is considerably a high percentage, which provide role domination in comparison to private owned banks in the country.

[1] Farazi Subika et al,. *Bank Ownership And Performance In The Middle East And North Africa Region*. January, The World Bank. 2011. P.06.

1.2.2. Deposits share of state and private owned banks in Algeria

Bank deposits are a fundamental component of its assets, it reflects the soundness of the bank intermediation activity, and its ability to attract client's funds.

The bank deposit may explain its capability to negotiate the deposits and loans interest rates. The subsequent table illustrates the deposits evolution for each bank category during the last decade.

Table N°22: Total Deposits Evolution Of Algerian Banking System (2010-2019)

Year	State Owned Banks - Total assets	SOB %	Private Owned Banks - Total assets	POB%
2010	4139788085	88,70%	527148955,9	11,30%
2011	5826690277	90,18%	634219161,2	9,82%
2012	6136179593	88,25%	816789026,5	11,75%
2013	6456789232	87,62%	912569565,8	12,38%
2014	7699422350	88,84%	966949337,3	11,16%
2015	7785108992	89,34%	928686716,8	10,66%
2016	7574394669	88,10%	1023180525	11,90%
2017	8391727080	87,00%	1254257976	13,00%
2018	9066701874	87,44%	1302349436	12,56%
2019	8576722959	86,63%	1324004820	13,37%

Source: Own Computation, Based on the Financial Statements of the Algerian Banks

State owned bank's total deposits showed a decline of approximatively two percent (02%) from 2010 to 2019, the same share was gained by the private owned banks.

However, the hiatus among the two category is tremendous. This fact can be explained through several factors:

- The first, that private owned banks are exist only in the large cities and in the north of the country, while state owned bank's network branches cover all the national territory, which allowed SOB to attract more depositors and increase their total assets share.
- The second factor is the state of mind of the depositors, where they believe that their deposits are more guaranteed by the state owned banks.
- The last factor is the accessibility to deposits less costly by the state owned banks, due to full deposit insurance enjoyed by public banks contradictory to private banks.

1.3. STATEMENT INCOME AGGREGATES COMPARISON OF ALGERIAN BANKS

1.3.1. Net operating income evolution from 2010-2019

The bank net income is the total of net interest income and net non-interest income. Furthermore, net interest income is the deduction of interest expenses from the interest income, same for net of non-interest income that is made of net fees and commissions, income from trading activities, income from financial engineering provided by the bank, and other income.

The present balance sheet aggregate is a highly important to understand the bank's ability to generate profit. Therefore, we present a comparison between net operating income among state owned banks and private owned banks in Algeria from 2010 to 2019 in the next table.

Table N°23: Net Operating Income Evolution Of Algerian Banking System (2010-2019)

Year	Private Owned Banks - Net operating income	POB %	State Owned Banks - Net operating income	SOB%
2010	29042910,95	22,25%	101487091,5	77,75%
2011	36122941,51	23,56%	117206783,8	76,44%
2012	41606612,75	26,10%	117832978,6	73,90%
2013	40092438,78	28,18%	102193921,1	71,82%
2014	38979158,51	24,93%	117391363,9	75,07%
2015	37306428,7	19,83%	150843915,6	80,17%
2016	36110318,6	17,59%	169135404	82,41%
2017	35739837,69	15,12%	200709411,2	84,88%
2018	53696407,89	17,22%	258040695,3	82,78%
2019	52875847,13	23,48%	172365657,5	76,52%

Source: Own Computation, Based on the Financial Statements of the Algerian Banks

Similar to the results showed from the aggregate compared above, the state owned banks tend to register a higher level of net operating income, and the share of private owned banks is around 17% to 22%. Although the private owned bank income deteriorated for the period 2015 to 2018, however, they regained their share in 2019.

Moreover, the Algerian economy and after two decades of investment efforts financed primarily through domestic loans, the Algerian economy remained dependent on hydrocarbon resources. Furthermore, as the fact that the majority of the private banks in Algeria are foreign banks except for ELBARAKA bank.

The deterioration could be explained by the oil prices shock, which destabilised the Algerian economy, and drove the foreign funds and investments to shrink their activity in Algeria in apprehension from an economic collapse, which generate net operating income reduction.

1.3.2. Net interest income evolution from 2010 to 2019

The bank's net interest income is the subtraction of the interest expenses made of paying the bank's deposits, from the interest revenue made of the loans, mortgage and securities interests. Furthermore, the net interest income can be consider as a financial performance measure that reflects the bank's sensitivity to interest rates changes and the quality of its assets and liabilities.

Therefore, we used the net interest income to judge whether state owned banks are more efficient than private owned banks. The next table present the evolution of net interest income in each bank category in Algeria for the period 2010-2019.

Table N°24: Net Interest Income Evolution Of Algerian Banking System (2010-2019)

Year	State Owned Banks - Net interest income	SOB %	Private Owned Banks - Net interest income	POB%
2010	165604094,6	83,31%	33172532,92	16,69%
2011	195457616,6	82,15%	42463458,97	17,85%
2012	217849878,7	84,11%	41149053,88	15,89%
2013	257502517,8	83,93%	49314354,19	16,07%
2014	309892219,1	84,80%	55563089,74	15,20%
2015	358683775,2	85,55%	60562727,01	14,45%
2016	403867065,3	86,04%	65538576,23	13,96%
2017	460111410,3	85,74%	76499431,95	14,26%
2018	525176303	85,17%	91469221,6	14,83%
2019	516012091,8	84,44%	95057427,06	15,56%

Source: Established by the author from the financial statements of the ABS

From the total net interest income of Algerian banks, those owned by the state are holding a share of 83% to 86%, on the other hand, privately owned banks their portion is about 17%. There are no significant variation over the last decade in term of interest income, and state owned banks remain dominant of the lion's share in the banking sector.

Moreover, the differences observed in net interest income according to ownership type is caused several reasons that was previously mentioned. The net interest income reflects the bank efficiency in term of generating profit out of its intermediation activity, from granting loans and collecting deposits.

Therefore, the state owned banks pervasion all over the Algerian territorial facilitate its mission of reaching as much as possible client. As a result, generating a higher net interest income than private owned banks that located in the north of the country and present in large cities only.

1.4. LOANS BEHAVIOUR COMPARISON OF ALGERIAN BANKS

1.4.1. Loans Share Of State And Private Owned Banks In Algeria Over 2010 To 2019

The granting loan behaviour of governmental banks in Algeria was always derived by the authority's instructions, which provides loans to companies despite their financial health and financial performance, it was only conditioned to be in coherence with government development policies.

On the other hand, foreign or private banks were not driven by the same motivation and they were respecting the level of non-performing loans, the bank profitability and to the loan's granting cost.

In the following table, we illustrate the loan's share of each bank category in Algeria and its evolution during the period 2010-2019.

Table N°25: Total Loans Evolution Of Algerian Banking System (2010-2019)

Year	State Owned Banks – Total loans	SOB %	Private Owned Banks – Total loans	POB%
2010	2366464033	85,50%	401265395	14,50%
2011	2981100053	86,51%	464938635,6	13,49%
2012	3697299276	88,24%	492590542,3	11,76%
2013	4491511194	88,03%	611027157,9	11,97%
2014	5596619064	89,26%	673391053,8	10,74%
2015	6245030702	88,93%	777297093,1	11,07%
2016	6826812226	88,82%	858947184,3	11,18%
2017	7638780095	88,10%	1031752805	11,90%
2018	8580469859	87,86%	1185588539	12,14%
2019	9460051881	88,46%	1234685808	11,54%

Source: Established by the author from the financial statements of the ABS

The state owned banks dominates the loan granting market, where they control a share of 85% to 89% of all market loans in Algeria, where the rest of the twelve private banks shares a percentage of 14% to 10% of the banking loans.

The loan fluctuation indicator is in consistency with net operating income and net interest income, as the loan granting activity is the fundamental profitability maker in banking industry.

However, this measure is not enough to understand the loan behaviour in Algerian banks. Therefore, we measured the non-performing loans indicator, to distinguish if the private owned banks or state owned banks have more efficient loan policy.

1.4.2. Non-Performing Loans Evolution Of Algerian Banks From 2010 To 2019

The non-performing loan (NPL) is an important measure of credit risk in banking. The loan is considered in default when the probability of repayment are substantially low.

Moreover, a loan is qualified as NPL if the borrower was not able to honour his engagement (interest+ principal) within nineteen (90) days.

In the succeeding table, we present the NPL percentage in state owned banks and in private owned banks for the last decade.

Table N°26: Non-Performing Loans Evolution Of Algerian Banking System (2010-2019)

Year	State Owned Banks - Non performing loans	Private Owned Banks - Non performing loans
2010	23,17%	4,79%
2011	20,92%	3,71%
2012	16,98%	4,62%
2013	14,37%	4,47%
2014	13,06%	9,49%
2015	33,44%	9,20%
2016	15,42%	9,63%
2017	16,40%	8,15%
2018	20,78%	7,06%
2019	20,66%	7,91%

Source: Own Computation, Based on the Financial Statements of the Algerian Banks

The non-performing loan is a negative indicator, where a high percentage reflects the financial unwellness, and reveals the inefficiency of loan granting policy of the bank.

For the last decade, banks owned by the Algeria authorities provide almost 34% non-performing loans that have a harmful impact on the financial health of the bank. However, the percentage in privately owned banks is considerably low in comparison to the last category.

The monetary policy undertakers in Algeria kept the same loan granting policy for the last decade despite its financial inefficiency. The state owned banks created a procedure to control the credit risk by applying a conservative policy in granting loans, which explain the liquidity excess.

However, the table N°26 shows that the percentage of non-performing loans in state owned banks is notably high, especially in 2010, which reached 23.17%. In opposite, the percentage of non-performing loans in POB endure low. Where, it did not surpass ten percent (10%). This proves that credit risk management is more efficient in POB than in SOB.

1.5. ERFORMANCE MEASURES COMPARISON OF ALGERIAN BANKS

1.5.1. Return On Assets (ROA) Comparison Of Algerian Banks

The return on assets ratio is a famous performance measure, it is calculated by dividing total net income over total assets. The ROA ratio measures the profit earned per monetary unit of assets.

In addition, it give an image of how good the manager run the bank and how well they manage the bank investment to generate profit. At this stage, we will compare the bank efficiency based on its ownership structure, we will be able to determine whether state owned banks are more efficient in term of using their assets or the private owned banks.

In the subsequent table and Graphic we illustrate a comparison of the ROA ratio over 2010 to 2019.

Table N°27: Return On Assets (ROA) Comparison Of Algerian Banking System (2010-2019)

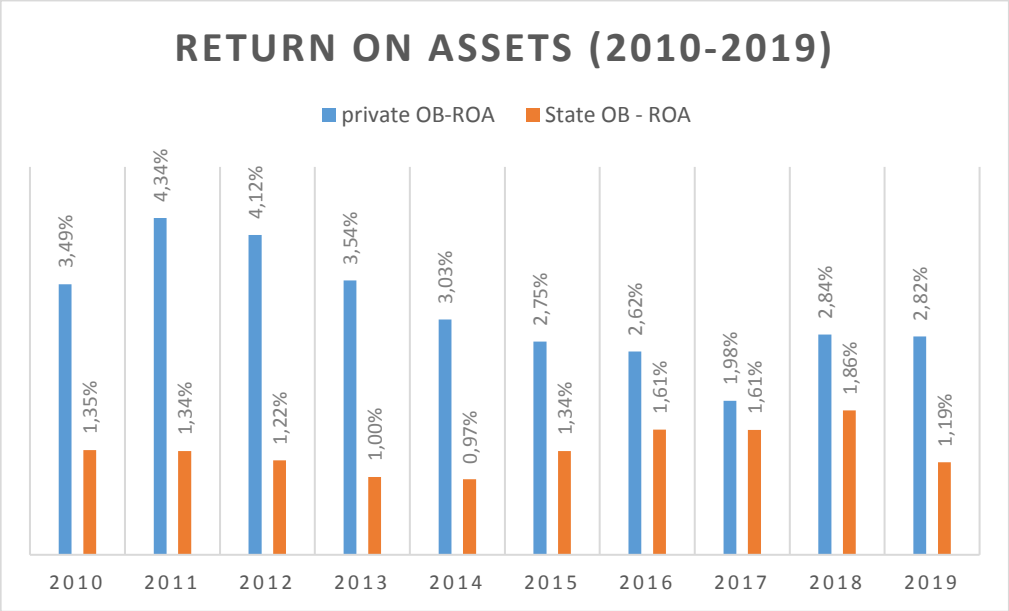
Year	Private owned banks-ROA	State owned banks - ROA
2010	3,49%	1,35%
2011	4,34%	1,34%
2012	4,12%	1,22%
2013	3,54%	1,00%
2014	3,03%	0,97%
2015	2,75%	1,34%
2016	2,62%	1,61%
2017	1,98%	1,61%
2018	2,84%	1,86%
2019	2,82%	1,19%

Source: Own Computation, Based on the Financial Statements of the Algerian Banks

The results of the table above are more illustrated in the following Graphic N°25. Where, the gap between the financial performance measure is clearer and can be seen without analysing the numbers.

The Graphic N°16 explains the ROA evolution in state owned banks and in private owned banks for the last ten (10) years.

Graphic N°16: ROA Evolution In SOB And In POB Over 2010-2019



Source: Own Computation, Based on the Financial Statements of the Algerian Banks

In contrary to the previous comparisons, ROA ratio in private owned banks has significantly exceeded the state owned banks. Where the state owned banks ROA fluctuates from one (01%) to two (02%) percent. However, in private owned banks the same ratio reached more than for (04%) percent in 2011.

The ROA ratio will be used in the coming section as one of the dependent variables of the study, it is useful to know that private owned banks recorded higher levels than state owned banks during the ten years of the study.

Where in the literature the most reliable financial performance ratio that measures the bank's assets efficiency.

1.5.2. Return on Equity (ROE) comparison of Algerian banks

The return on equity ratio is another famous financial performance measure. It is calculated by dividing net income to shareholder's equity. The present ratio measures the shareholder's profitability.

The following table and Graphic illustrates the variation of ROE ratio in the last decade in state owned banks and in private owned banks.

Table N°28: Return On Equity (ROE) Comparison Of Algerian Banking System (2010-2019)

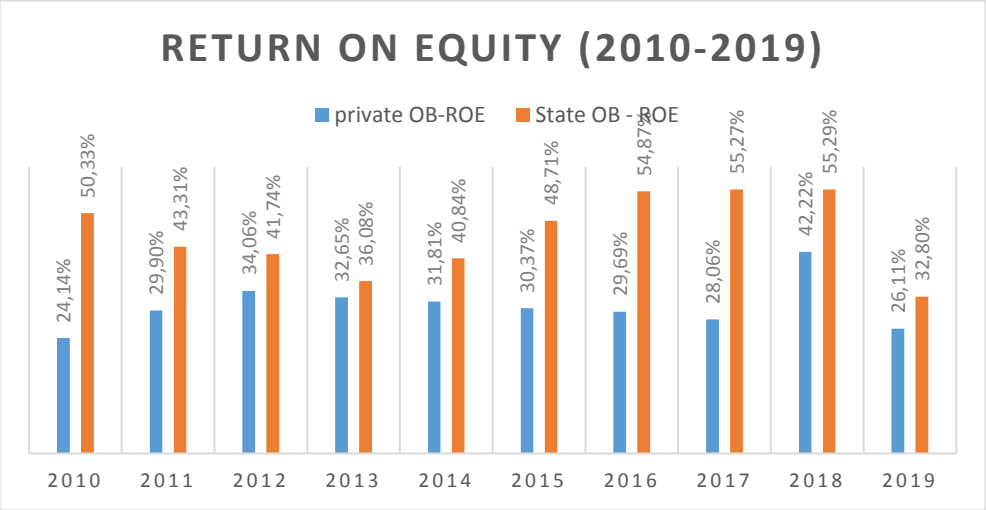
Year	Private owned banks-ROE	State owned banks - ROE
2010	24,14%	50,33%
2011	29,90%	43,31%
2012	34,06%	41,74%
2013	32,65%	36,08%
2014	31,81%	40,84%
2015	30,37%	48,71%
2016	29,69%	54,87%
2017	28,06%	55,27%
2018	42,22%	55,29%
2019	26,11%	32,80%

Source: Own Computation, Based on the Financial Statements of the Algerian Banks

The comparison of return on equity ratio between SOB and POB shows that state owned banks equities are more performing than private owned banks.

Where this ratio surpassed 55% in state owned banks in 2017. However, it only recorded a percentage of 28% in privately owned banks. Graphic N°17 shows better the ROE growth from 2010 to 2019.

Graphic N°17: ROE Evolution In SOB And POB Over 2010-2019



Source: Own Computation, Based on the Financial Statements of the Algerian Banks.

The ROE ratio have a different use, which is measuring the bank growth rates that it can be a good starting point to estimate the bank stock's growth rate. From the Graphic above, we can conclude that state owned banks have more opportunities to grow.

Yet, the variation gap of this ratio in SOB is remarkably high, where it fluctuates from 50% in 2010 to 32% in 2019. On the other hand, it only variate from 24% in 2010 to 26% in 2019 for the POB.

In the present section, we tried to compare the financial statement of the two bank category that operates in Algerian sector, which are: balance sheet aggregates, statement income statement, loans behaviour and financial performance measures.

The comparison was based on the bank's ownership structure, whether it was owned by the Algerian government or privately owned. We previously mentioned that all the private owned banks in our sample are foreign banks only for ALBARAKA bank that it is made of mixed capital. The results of the current exploratory study were as follow:

- The balance sheet aggregates comparison exposed that state owned banks are more able to collect public deposits than private owned banks, same for the banking total assets, the share of state owned banks was variating over the ten years of study between 62% to 63%. However, the state owned banks in MENA countries was experiencing assets reduction over the same period.

- The second banking financial statement was compared is the statement income aggregates, we selected the net operating income and the net interest income, which indicates the bank's ability to generate profits. The findings of the analysis showed that state owned banks generates more net operating income and more net interest income than private owned banks.

- Thirdly, we examined the Algerian bank's loan granting policy, from table 25 and 26, we notice that state owned banks dominates a share of 88% of the total loan market in Algeria, however, they record a 20% nonperforming loans of this share. Furthermore, private owned banks have a share of 12% from the total loan market in Algeria and nonperforming loans (NPL) represent a 9% of this share.

- Finally, we compared the performance measures ratio (ROA and ROE) between Algerian banks. Conflicting results was found, where the return on Assets (ROA) ratio showed that private owned banks are more financially efficient, but the return on equity (ROE) ratio indicated that state owned banks have more growth opportunities in Algerian banking market than private banks.

The previous findings cannot be complete without analysing the economic and financial context of Algerian banks during the period of study. The Algerian economy knew a period characterized by restored macroeconomic equilibrium in the beginning of the 2000s.

However, the Algerian economy remained exposed to external shocks due to its dependency towards hydrocarbon resources.

Moreover, in 2014, Algerian economy was highly effected by the oil prices decline, which generated new challenges to financial stability in Algeria.

Although that the Algerian banking sector has no external debt, however it was highly impacted by the dinar depreciation caused the deterioration of the foreign exchange reserve.

On the other hand, the Algerian banking sector in 2014 and 2015 persist having sound financial indicators, which lead us to question, if the oil price deterioration do not affect the financial performance of Algerian banks what are the factors that do?

2. ECONOMIC AND FINANCIAL STABILITY OF ALGERIAN BANKING SYSTEM

Financial stability is strongly connected with monetary policy, the international financial environment and economic stability. Precisely in case of economic crises, real sector losses can be transmitted to the financial sector.

Furthermore, losses caused by the crises stemming from the real sector are compounded in the case of an increasing level of economic interrogation in the financial sector.

The last global financial crisis incited the researchers to investigate the impact of economic and macro-prudential policy of the financial sector stability. Although Algeria is one of the country in which the GFC had no significant impact on its economy or financial stability.

However, it is fundamental to analyze the stability of the relationships between real and financial variables after the end of the GFC in 2008 and the oil prices decline in 2014.

The ultimate objective of this section is to estimate a model that instantaneously clarifies the dynamics of macroeconomic and financial variables and to evaluate whether the identified relationships are stable over time and if there is confirmation of the unstable behavior of these relationships.

Analysis of the relations between the monetary policy, the financial and banking sector and the real economy is made within a vector auto-regression model framework (VAR).

2.1. VAR MODEL ESTIMATION

Concerning the macroeconomic and financial variables, we have decided to use: Gross Domestic Product (GDP), Inflation rate, the price of Brent-oil, foreign exchange rate (USD/DZD, EUR/DZD), Foreign exchange reserves, money supply (M2), the money market rate (MMR), and the total credit to the economy (Loan).

Empirical analysis is based on Algerian monthly data for the period December 2013- March 2019. To assess the consequences of the oil prices decline and the financial variables and the economic stability in Algeria. The present section contributes to the frame of the literature (Hartmann, Hubrich, Kremer, & Tetlow, 2014)[1].

The VAR model estimates the influence of financial variables and monetary policy on the macroeconomic variables.

[1] Hartmann, P., et al. *Melting Down: Systemic Financial Instability and the Macroeconomy*. European Central Bank (ECB). 2014. PP. 1-42.

We estimates a VAR model defined as in equation (01) (Lutkepohl, 2005)[1]:

$$y_t = A_0 + A1\, y_{t-1} + \ldots + A_P\, y_{t-P} + \varepsilon_t, \qquad (01)$$

Where:

y_t – vector of endogenous variables,

A_P – matrix of auto-regression parameters, $p = 1, \ldots, P$,

A_0 – vector of constant term,

$\varepsilon_t \sim NID(0, \Sigma)$ – vector of error terms.

2.1.1. Variables Stationary Test

The stationary test is fundamental to identify the appropriate (VAR) model to adopt. To do so, we analyzed the Dickey and Fuller Augmented test (Appendix N°03), we resumed the test results in the following table.

Table N°29: Stationary Test Results

	At level	1st Difference
Stationary series	/	- GDP - inflation - USD/DZD - EUR/DZD - M2 - MMR - total loans to the economy- Foreign exchange reserves

Source: Own Computations, based on Eviews 8.1 results

The results analyses showed that GDP is not stationary at level, but stationary at first difference. The same results were concluded for the following series: Inflation, USD/DZD, EUR/DZD, M2, MMR, total loans to the economy, Foreign exchange reserves.

The non-stationary at level of the variables guide us to a VECM model (Vector Error Correction Model), which has the particularity of modeling series that are not stationary at level, but stationary at the same level (which is the first difference in our case).

However, before proceeding with the development of this model, it is necessary to test the causal links that may exist between the variables of the study, in order to make sur that this model is reliable.

2.1.2. Determination Of The Optimal Number Of Lags: Lag(P)

The identification of the optimal number of lags in a model is of utmost importance. Indeed, the choice of too high number of lags increases the number of parameters to be estimated and thus reduces the degrees of freedom, which influences the quality of the model estimated.

[1] Lutkepohl, H. *New introduction to multiple time series analysis*. Springer Science & Business Media. 2005.

On the other hand, too low number of lags leads to the loss of information in the process being studied. In addition to the arbitration between the estimation quality and the loss of information, it is also necessary to take into account the constraint represented by a low number of observations.

The Lag Length Criteria command on Eviews (Appendix N°03) allows us to choose an optimal lag, which is five (05) in our case a P=05. This lag will be used in the study of causality, of the Co-integration relation and in the model estimation.

In the following table, we summarized the results showed by the fundamental criterion of lag order selection, which are: the sequential modified (LR), the Final Prediction Error (FPE), the Akaike Information Criterion (AIC) and the Hannan Quinn information criterion (HQ).

Table N°30: Lag Order Selection Results

Lag	LogL	LR: sequential modified LR test statistic (each test at 5% level)	FPE: Final prediction error	AIC: Akaike information criterion	HQ: Hannan-Quinn information criterion
0	-1711.498	NA	1.72e+14	58.32197	58.44568
1	-1088.570	1034.694	1867948.	39.95152	41.18861
2	-981.1146	145.7019	915928.0	39.05473	41.40522
3	-888.5122	97.31099	1051210.	38.66143	42.12531
4	-709.7143	133.3408	130218.8	35.34625	39.92351
5	-467.6525	106.6713*	9070.966*	29.88653*	35.57718*
* indicates lag order selected by the criterion					

Source: Own computations, based on Eviews 8.1 results

2.1.3. Causality Test

We examined the causality using Granger test, the results on Eviews are showed in appendix N°03, and the test interpretation is based on the probability results. Indeed, if the probability that is less than 0.05, than we reject the null hypothesis so the variable cause the GDP.

According to the results, and after five months response period, the variables that cause GDP are Foreign exchange reserves, MMR, price of Brent-oil and USD/DZD exchange rate.

The results are summarized in the following table.

Table N°31: Causality Test Results

Null Hypothesis:	Obs	F-Statistic	Prob.
RESERVES does not Granger Cause GDP	59	2.55467	0.0396
GDP does not Granger Cause MMR	59	2.29975	0.0494
GDP does not Granger Cause BRENT	59	3.18704	0.0145
GDP does not Granger Cause USD_DZD	59	2.78391	0.0275

Source: Own computation, based on Eviews 8.1 results

The conducted causality test between the variables of the study showed other interesting results (Appendix N°03). We found that the foreign exchange reserves in Algeria cause the variation of the loans distributed to the real economy, at a confident level of 0.05.

The second outcome concerned the MMR variable we found that it is caused by both Loans and Reserves variables at a confidence level of 0.05. The last outcome confirmed that USD/DZD exchange rate cause the variation in loans variable at 5% confident level.

2.2. VECM MODEL : CO-INTEGRATION TEST, VECM MODEL ESTIMATION

The study of nonstationary series using methods adapted to stationary series leads to spurious regressions and therefore to erroneous results. The researches of Granger (1983), Engel, and Granger (1987) are considered as an innovation for the study of time series.

Furthermore, these works enlightened the co-integration concept, which allows the study of non-stationary time series but which are linked by a linear combination that is stationary. Therefore, it is possible to identify stable long-term relationships while considering the short-term dynamics of the variables used.

2.2.1. Co-Integration Test

Before the construction of a VECM model, it is needed to conduct a Johannsen co-integration test to determine the number of co-integration relationships that exist between the variables. In order to establish this test, we will take into consideration the variable GDP and the variables which according to Geanger test, cause the GDP, namely: Reserves, MMR, Brent, Loans and USD/DZD.

The Johanson test results are briefed in the following table:

Table N°32: Johanson Co-Integration Test

Hypothesized	Trace	0.05	
No. of CE(s)	**Statistic**	**Critical Value**	**Prob.****
None *	112.6964	95.75366	0.0021
At most 1	48.99691	69.81889	0.6807
At most 2	32.32469	47.85613	0.5942
At most 3	17.21827	29.79707	0.6239
At most 4	7.662558	15.49471	0.5022
At most 5	0.057761	3.841466	0.8100

* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

Source: own computation, based on Eviews 8.1 results

We accept that there is one co-integration relationship between variables. From the co-integration test results, we deduce that the null hypothesis of no co-integration relationship is rejected, as we found that the probability is less than 5%.

Furthermore, the findings identified the existence of one co-integration relationship results, as the related probability is more than 5%. Therefore, we accept that there is one stable relationship between the unstable variables of the study.

Once we confirm the existence of a co-integration relation, we need to make sure that this relation is not fictitious, by checking that the residuals from this equation are indeed stationary. To do this, we will apply the ADF test on the series of residues.

The next table N°33 illustrates the results of ADF test to check the residual's stationarity.

Table N°33: Residuals Stationary Test (ADF Test Results)

Augmented Dickey-Fuller test statistic		**t-Statistic**	**Prob.***
		-8.535458	0.0000
Test critical values:	1% level	-3.542097	
	5% level	-2.910019	
	10% level	-2.592645	

*MacKinnon (1996) one-sided p-values.

Source: Own computation, based on Eviews 8.1 results

The results of ADF test confirm the reliability of the co-integration relationship found, based on the probability result that is less than 0.05, we can judge that the residuals of this equation are indeed stationary.

This finding give us the opportunity to study short-term dynamics and the long-term adjustment mechanism using the error correction model.

2.2.2. VECM Model Estimation

The VECM (04) model estimation with (06) variables showed the results in appendix N°03. From this outcome, we can write the VECM model as follow:

$$GDP(-1) + 0.055627 * Reserves(-1) - 4.002487 * Brent(-1) - 13.73937 * USD/DZD(-1) + 0.105715 * Loans(-1) + 182.5777 * MMR(-1) = U(-1) \quad \textbf{……. (01)}$$

The VECM model estimation showed the existence of correction mechanism for the GDP variable that we study. The amplitude of the correction force equals 1.2775%, the percentage can be consider feeble, that it can be interpreted as the adjustment of GDP variable is very slow.

The second observation that we can conclude from equation (01), is that the RMM variable is non-significant for the long-term equation, where the T-statistics = $|0.53317| < 2$ (Appendix N°03). Which signifies that for the long-term, the GDP variation does not depend on MMR delayed by one period. However, the GDP variation depends on past variation in MMR.

The Reserves variable is significant where $T = |15.8019| > 2$. Which means that the GDP variation depends on the Reserves variation for the long-term, same for the Brent, USD/DZD and loans variables that effects the future variation of Algerian GDP.

2.2.3. VECM Model Validation: Residuals Normality Test, Residuals Autocorrelation Test.

The stability of the constructed model is fundamental. Two conditions are required to judge the model stability, which are residuals normality test and autocorrelation test.

2.2.3.1. Residuals Normality Test

We will now test the residuals normality using Jarque-Bera test. This test is based on the asymmetry and kurtosis coefficients (Kurtosis and skewness respectively).

The results are showed in the following table.

Table N°34: Residuals Normality Test

Component	Jarque-Bera	df	Prob.
1	11.26974	2	0.0036
2	246.5647	2	0.0000
3	53.02194	2	0.0000
4	0.344746	2	0.8417
5	2.347988	2	0.3091
6	0.023017	2	0.9886
Joint	313.5721	12	0.0000
Joint	Skewness	6	0.0000
Joint	Kurtosis	6	0.0000

Source: Own computation, based on Eviews 8.1 results

The table above illustrate the residuals normality for the estimated model, where the joint probability of the three conducted tests (Jarque-bera, Skewness and Kurtosis) equals 0.000, which is obviously, less than 0.05. Therefore, we can accept the hypothesis of the residuals normality.

2.2.3.2. Residuals Autocorrelation Test

The table N°34 allows us to confirm the absence of autocorrelation between the residuals of our model. Indeed, all the correlations fall within the confidence interval and all the probabilities associated with the Q-statistics are greater than 5%, which means that no correlation is significant.

Table N°35: Residuals Autocorrelation Test

Lags	LM-Stat	Prob
1	39.49638	0.3165
2	40.19446	0.2897
3	41.48196	0.2440
4	29.62796	0.7644
5	38.55842	0.3546

Source: own computation, based on Eviews 8.1 results

From the two conducted normality and autocorrelation test, we can conclude that the VECM model estimated is reliable.

Moreover, the results proved the residuals normality and no autocorrelation is significant among the model residuals.

2.3. VARIANCE DECOMPOSITION AND FORECASTING

The variance decomposition allows us to predict the short-term chock impact on GDP as for the medium-term. Therefore, we decomposed our period to twelve months, so we can see the effect of individual shock on GDP and from the other variables.

The variance decomposition results are illustrated in the following table.

Table N°36: Variance Decomposition Results

Period	S.E.	GDP	BRENT	USD_DZD	LOAN	RESERVES	MMR
1	11.05083	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	19.82410	97.48697	0.092628	0.057673	0.992323	1.157262	0.213140
3	29.67882	94.39743	0.692360	0.361267	1.951578	2.422512	0.174853
4	38.83890	90.66062	0.584508	0.212190	3.723499	4.710009	0.109174
5	46.83710	87.78039	0.615013	0.146732	4.024721	7.356017	0.077125
6	54.36995	85.51366	0.620490	0.108891	3.855193	9.802461	0.099308
7	61.23335	82.12679	0.607359	0.088193	3.829429	13.12798	0.220248
8	67.61062	79.40500	0.528383	0.072826	3.995072	15.69939	0.299333
9	73.37142	77.17931	0.455624	0.069647	4.000432	17.94035	0.354646
10	79.18565	75.08858	0.392463	0.096016	4.018443	19.96566	0.438843
11	84.94025	72.99877	0.341417	0.134995	4.147587	21.88951	0.487717
12	90.36228	71.37057	0.302958	0.180528	4.225938	23.39793	0.522079
13	95.64368	69.94913	0.274672	0.228412	4.280511	24.71827	0.549003
14	100.7492	68.69692	0.251261	0.259546	4.331531	25.88947	0.571269
15	105.5498	67.60024	0.232375	0.266826	4.378148	26.93600	0.586415
16	110.0979	66.67661	0.215823	0.269114	4.402960	27.82683	0.608655
17	114.4143	65.88853	0.201996	0.265150	4.418011	28.59972	0.626596
18	118.5138	65.23719	0.189652	0.258817	4.418907	29.25037	0.645064
19	122.4373	64.65029	0.178995	0.254773	4.424994	29.82717	0.663781
20	126.2394	64.12825	0.169639	0.254114	4.437319	30.32939	0.681289
21	129.9187	63.66877	0.161527	0.256826	4.449183	30.76930	0.694390
22	133.5401	63.25284	0.154347	0.262912	4.459015	31.16391	0.706974
23	137.1044	62.86836	0.148290	0.269753	4.475040	31.52165	0.716912
24	140.6028	62.52385	0.143103	0.275393	4.489481	31.84393	0.724239

Source: computed from Eviews 8.1

The variance decomposition provided us with two categories of results, first is the short-term impact of shocks on GDP, and the second concerns the medium-term influence of shocks. From the table above we can conclude that for the short-run (three months), impulse, innovation, or shock account for 94.40% variation of the fluctuation in GDP (own shock).

Moreover, the GDP variation can be influenced by its shock of 94.40%. On the other hand, in the long run (24 months or 2 years) the own shock of GDP can explain only 62.52% of GDP variations.

The second variable that affects the GDP the most is the foreign exchange reserves (Reserves), where a shock in the foreign exchange reserves can affect the GDP to 2.42% for the short term, and to 31.84% for the long term (two years).

Then the variable loans, a shock to loans can cause a 1.95% change in GDP for the three months, and 4.49% variation within twenty four months. Innovation on the other variables (Brent, USD/DZD, and MMR) affect approximatively by less than one percent (0.96%, 0.36%, and 0.17%) the variation in GDP for the short run, and the long run (0.14%, 0.28%, and 0.72%).

As previously mentioned, the variance decomposition analysis provides information on the respective importance of the innovations in the changes of each of the variables in the VECM model estimated.

Therefore, it can be seen that the variables: Reserves, Brent, USD/DZD, Loans, and MMR largely contribute to the determination of the variance of the forecast of the GDPs.

This section presents the conclusions from the estimates of the VAR model for the Algerian economy. The VECM estimated model was used to assess the links between monetary, financial, and real variables and to assess the stability of the estimated relationships. Based on VECM results and the empirical findings we can suggest that financial shocks influence significantly the real economy.

The estimated VECM model showed that the real economy in Algeria is affected positively and significantly, by the foreign exchange reserves, the loans provided to the economy, and the monetary market rate.

However, it is influenced negatively by the prices of Brent oil and the USD/DZD exchange rate. After estimating this model, we made sure that our estimated model is reliable by testing the model residuals, which ensure the normality and non-auto-correlated residuals.

Afterward, we tested the variance decomposition to forecast the future behavior of our variables. The empirical outcome was decomposed into twenty-four (24) months, to assess the short-term impact of shocks on real economy fluctuations, by interpreting the variance decomposition results in three months, then to evaluate the influence over GDP variable in twenty-four (24) months, to have an insight about the medium-term impact.

Combining the model estimation results and variance decomposition results. We can have as conclusions that the positive relationship between the real economy variable (GDP) and the foreign exchange reserves variable (Reserves) means that a positive shock on reserves variation influences positively the short and the medium-term fluctuations of the GDP. In other words, a 1% increase in reserves variable causes a 2.42% increase in GDP variation over three months and a 31.84% increase over two years later.

It is noted that after two years the innovation impact is more amplified on GDP variations. The other direction of causation is not proven by our study, as the Granger causality test showed causation in one direction, with an actual p-value less than 0.05 for several lags of four (4). The relationship tested among GDP and reserves showed results in coherence with several modern studies between the two variables.

According to Samih Antoine and Wael Aboukhodo (2017) (2017)[1] there is a positive association between foreign exchange reserves and GDP in GCC countries, explaining that higher reserves make the market more stable, which enhances economic growth.

Another study explained this positive relationship in developing countries that an increase in reserves leads to a permanent decline in consumption, which may enhance investment and economic development Fukuda, S., and Y. Kon (2010)[2].

Algerian economy is dependent on the hydrocarbon price changes. This is another outcome of this study in that we found a negative and significant relationship between GDP and Brent oil price variations in Algeria. For more understanding of this relation's nature, we distinguish between the short-run dynamic and the long-run one.

Our results show that oil price shocks have a greater negative impact over the short term than the medium-term effects. These results reveal the dependence between oil prices and economic growth can be explained through the impact of oil shocks on aggregate demand, where an increase in oil prices decreases aggregate supply explained by the fact that once the oil prices are high companies purchase less energy, consequently the hydrocarbon productivity declines implicate decrease in the Algerian economic development.

The study of the relationship between GDP and the USD/DZD exchange rate proved to be negative and significant. These contradictory results also showed that the short-term (0.36%) impact is greater than the medium-term effect (0.27%).

[1] Samih.A.A and Aboukhodor.W. *Foreign Exchange Reserves and the Macro-economy in the GCC Countries*, Accounting and Finance Research Vol. 6, No. 3. Sciedu Press. 2017. PP.72-87.

[2] Fukuda, S., and Y. Kon . *Macroeconomic Impacts of Foreign Exchange Reserve Accumulation: Theory and International Evidence*. ADBI Working Paper 197. Tokyo: Asian Development Bank Institute. 2010. PP. 1-23. Avalable: http://www.adbi.org/workingpaper/2010/02/19/3515.macroeconomic.impact.forex.reserve.accumulation/

The present result can be explained by the nature of the exchange market in Algeria. This is characterized by the domination of the black market that identifies the real currency value fluctuations, besides a fixed exchange rate regime applied by the Algerian monetary authorities that does not reflect the real value of the Algerian Dinar nor its competitiveness, which affect negatively the real economic growth in Algeria.

The last two variables (Loans and MMR) are financial stability indicators, the results proved a significant positive relationship between the financial variables and the economic growth in Algeria.

For the short-term impact if loans increase by one 1% leads to an increase in GDP by 1.95%, and the monetary market ratio causes a 0.17% increase in economic development. Moreover, the medium-term shows a greater impact on GDP by applying shocks to both variables.

Furthermore, the money market rate (MMR) is a true barometer of the financial health of a country, which corresponds to the rate at which banks borrow and lend each other money. It plays an essential role in financial activity and fluctuates according to inflation, unemployment, and the international economy.

The MMR and loans can be considered as monetary policy instruments. Therefore, finding a positive and significant relationship with GDP is articulate, as the fundamental objective of the monetary policy promotes price and financial stability and as a consequence economic welfare.

Finally, in this section, we tried to explain the factors that influence the Algerian economic stability. Therefore, we tested several variables, that represent the real economy variables and the financial stability variables (Inflation rate, the price of Brent oil, foreign exchange rate USD/DZD and EUR/DZD, foreign exchange reserves, money supply, the money market rate and the total loans to the economy).

The stationary test showed that all the variables of the study are nonstationary at level, but at the first difference I (-1), thus, we concluded the possibility the conducting a co-integration test because of having variables that are stationary at the same level. The second required test was identifying the optimal number of lags, which was determined, as P equals four (04). The third essential test was the Granger causality test.

At this stage, we identified no causality between GDP and inflation rate, foreign exchange rate EUR/DZD, and money supply. In addition, the Granger causality demonstrated was significant at a 0.05 confidence level. Accordingly, we established a Johanson co-integration test, where we concluded the existence of one stable equation between the non-stable variable of the research, and the equation reliability was proved by the ADF test applied to the residuals.

The fundamental objective of this part was to establish a Vector Error Correction Model (VECM), so we can be able to predict the future behavior of the GDP variation by applying innovations to the multiple variables (Reserves, loans, USD/DZD, Brent, and MMR).

The identified model showed a positive and significant relationship between GDP and reserves, loans, and MMR. However, the negative and significant association between the USD/DZD and Brent-oil price.

The conducted model was accepted after testing the residuals stationarity and non-autocorrelation, where we were able to apply the variance decomposition test, to forecast the future behavior of GDP by applying shocks on reserves, Brent, loans, MMR, and USD/DZD.

The results showed that the Algerian economic stability is venerable to Brent-oil price changes in the short-term greater than in the medium-term. Where we assumed that the higher oil prices get, the lower companies will purchase this energy, and the hydrocarbon productivity will be declined.

The second outcome concerns the USD/DZD exchange rate fluctuations that affect negatively the Algerian GDP, this can be explained by the nature of the Algerian exchange market and its dominance by the black market.

Thirdly, we concluded a positive and significant relationship between economic stability and foreign exchange reserves in Algeria, where a positive shock of 1% applied to the reserves variable would increase the positive fluctuations of the GDP by 31.84% in twenty-four months.

To close, the financial stability variables loans and MMR variables proved to have a positive and significant relationship with the GDP variations, also both showed a greater impact on the medium-term than the short-term.

This section provided our research with important results on the economic stability in Algeria and the factors that affect its variation over the short and medium term. The study at this part was conducted from December 2013 to March 2019.

We aimed to explain the fluctuations of the Algerian GDP so we can understand the results of the following section, where we will investigate the relationship between the risk ratios, economic stability (GDP and inflation), and the financial performance of the Algerian banking system. The period of the study will be starting from January 2010 to December 2019, using a sample of eighteen operating banks in Algeria that have different ownership structures (Privately owned banks and public-owned banks).

We will be using a balanced panel data of 180 observations, the dependent and independent variables will be explained forthcoming beside the expected results from the literature review and whether the risk ratios and economic stability have a greater impact on the bank profitability in state-owned banks or the private owed banks.

3. THE IMPACT OF RISK RATIO AND ECONOMIC GROWTH On PROFITABILITY OF ALGERIAN BANKS

This section analyses the impact of risk ratios and economic growth on bank profitability in Algeria. While scholars shown interest investigating the factors that influence profitability in banking, there are shortage on empirical studies on this topic in Algerian context. To fill this gap, we inspect this relationship using a sample of eighteen (18) banks during the period 2010-2019 with dynamic panel data approach.

The field of our research have a key position in the Algerian financial system, since the international financial authorities allowed commercial banks to serve several types of financial market activities[1], ever since the Algerian independency, commercial banks dominated the financial system.

However, there is an enquiry of these banks ability to achieve their financial performance goals. In our trial finding answers, we tested the impact of risk ratios, macro-economic and bank-specific factors on the profitability of banks in Algeria.

In complementary with the last two sections, where we studied the ownership structure of the Algerian banks in section one, than the factors that influence the economic growth in Algeria, we see essential to complete the research with an econometric model that study the different investigated factors plus the risk ratios and the bank specific variables.

3.1. LITERATURE REVIEW AND EMPIRICAL CONJECTURE

Different theories or hypotheses investigated the issue of bank profitability. In our research, we are interested in determining the influence of the macro-economic factors, risk management ratios and bank-specific determinants of the profitability of the banking sector.

Therefore, the next stage is to identify the performance measures that we will use as the dependent variables of our model, than the independent variables made of risk ratios, bank-specific and macroeconomic variables.

3.1.1. Performance Measures: ROA And ROE

The financial performance in banks can be measured using a wide range of financial ratios. The most used ratios as envisaged from prior literature are the return on assets (ROA), return on equity (ROE), net interest margin (NIM) and return on investment (ROI)[2]. The dependent variables that were chosen for this study are return on assets and return on equity.

[1] Zheng, et al. *Loan Loss Provision and Risk-Taking Behavior of Commercial Banks in Pakistan: A Dynamic GMM Approach*. Sustainability 11.2019.P-5209.

[2] Vallelado, Teyo, and Paolo Saona. *An integrated model of capital structure to study the differences in the speed of adjustment to target corporate debt maturity among developed countries*. International Journal of Banking, Accounting and Finance 3.2011. PP. 258–93.

From the theoretical framework in the previous chapters, we concluded that 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.

- 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.

- 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.

3.1.2. Risk Management Ratios

Risk management is the process by which managers satisfy their risk requirements by determining the key risks, having comprehensible, consistent, operational risk measures, selecting which risks to increase and which to reduce and by what technique, besides creating the essential procedures to monitor the resulting risk position[1].

Furthermore, risk management is the process that help managers evaluate the threats of a particular position, measuring its magnitude, and assess its exposure in order not to jeopardize the bank’s strategic goals.

In the recent times, risk management attracted enormous attention, specifically after the last great financial crisis. Thus, several mathematicians, actuaries, behavioral scientists and marketers developed new approaches to manage risk in banking.

In addition, the challenging banking environment, the changing world economy plus the dynamic nature of the banking activity obliged the adjustment of risk analysis and management[2]. The next points illustrates the risk ratios used in our econometric model analysis.

[1] Ozturk, M and Aktan, B. *The New Basel Capital Accord: In search of Excellence at Bank Risk Management ,Review of Social, Economic and Business Studies*, Vol.7/8. 2007. PP. 151-174.
[2] Neely, et al. *Why Does Bank Performance Vary Across States*? Federal Reserve Bank of St. Louis Review, March/April. 1997. PP. 27–40.

3.1.2.1. Credit Risk Ratios

Credit risk is the most critical threat of the bank's activity. It is created from the inability of the bank borrowers to honor their obligations. Several research studied the impact of credit risk on profitability in banking and reaching dissimilar results.

A study was conducted by Ruziqa (2013) on Indonesian conventional bank for the period 2007 to 2011, the results showed significant negative impact of credit risk on ROA and ROE indicators[1].

Another paper investigated this relationship by Ozili (2017), the results proved that if the lending quality is poor in given banking market, high loan loss provisions could appear that implies higher non-performing loans, which could lower the bank profitability[2].

In the present study, we will use the most common credit risk ratios to investigate the impact of it on bank profitability:

Non-Performing Loans (NPL) = NPL Divided To Total Loans

Provisions To Total Loans (PTL) = Loans Loss Provisions Divided To 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.

Funding liquidity ratio (FL): Total Loan / 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. Based on the mentioned studies we can formulate our first model hypothesis:

H1: Credit risk ratios significantly and negatively affect ROE and ROA **(+).**

3.1.2.2. Liquidity Risk Ratio

The nature of the banking activity is highly dependent to the fact that more than 85% of bank's liabilities consists of deposits from depositors. Consequently, the liquidity risk takes important place in risk management procedures in banking.

[1] Ruziqa, A. *The impact of credit and liquidity risk on bank financial performance: The case of Indonesian Conventional Bank with total asset above 10 trillion Rupiah*. International Journal of Economic Policy in Emerging Economies, 6(2). 2013. PP. 93–106. https://doi.org/10.1504/IJEPEE.2013.055791

[2] Ozili, P. K. *Bank profitability and capital regulation: Evidence from listed and non-listed banks in Africa*. Journal of African Business, 18(2). 2017. PP.143–168. https://doi.org/10.1080/15228916.2017.124732-9

Furthermore, the liquidity risk occur from the gap created from the absence of necessary liquidity to cover short-term obligations of the bank[1]. Due to the liquidity risk important impact Islam and Nishiyama (2016) established a study to investigate its impact on profitability, the results showed positive impact, reflecting that bank need to increase their liquidity to be more financially efficient[2].

Chen et al (2018) established study from 12 developed countries for the period 1994 to 2006, the outcome of the paper proved that higher liquidity reduces bank profitability[3]. In our research we will use the following liquidity risk ratio:

Loans To Total Deposits (LTD) = Total Loans Divided To Total Deposits

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 above-mentioned studies support the notion of positive relationship whiles others argue for negative relationship between banks level of liquidity and profitability. Therefore, we establish our second hypothesis,

H2: Liquidity risk significantly affect the bank's profitability **(+-).**

3.1.2.3. Interest Rate Risk Ratio

Interest rate risk is the most important market risk that threaten Algerian banks, as financial market is inactive to effect the shares value, and the exchange rate regime is fixed determined by the Central Bank (CB). Moreover, the interest rate unforeseen declines may reduce bank's earnings, as the bank's portfolio is sensitive to market rates volatility.

As the interest rate risk is market risk, it can not be completely diversified, however, it can be hedged beside the value of currencies. As a result, the bank financial performance can be effected by these operations[4]. We use the next ratio of interest rate risk:

Interest rate risk ratio (IRR) : Interest income / Total loans

[1] Diamond, D. W., & Rajan, R. G. *Liquidity shortages and banking crises.* The Journal of Finance, 60(2). 2005. PP. 615–647. https://doi.org/10.1111/j.1540-6261.2005. 00741.x

[2] Islam, M. S., & Nishiyama, S. I. *The determinants of bank net interest margins: A panel evidence from South Asian countries.* Research in International Business and Finance, 37(3). 2016. PP. 501–514. https://doi.org/ 10.1016/j.ribaf.2016.01.024

[3] Chen, Y.-K., et al. *Bank liquidity risk and performance*. Review of Pacific Basin Financial Markets and Policies, 21(1). 2018. PP.1–40. https://doi.org/10.1142/S0219091518500078.

[4] Santomero, A. M. *Commercial bank risk management: an analysis of the process*. Journal of Financial Services Research, 12(2-3). 1997. PP.83-115. https://doi.org/10.1023/A:1007971801810

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. Therefore, we formulate the following hypothesis, H3: interest rate risk effect positively and significantly the bank's performance.

3.1.2.4. Risk Management Efficiency Ratio

The Basel framework for risk management was focused on the used capital adequacy as risk management efficiency indicator, where capital increasing is suggested to protect the bank from the possible consequences of risk taking[1]. In regulatory words, the capital adequacy is to describe the adequacy of bank's aggregate capital in relation to the risks.

In this context, multiple researchers interested in studying the effect of risk management efficiency on profitability. Furthermore, Iannotta et al (2007) their study showed positive and important influence of bank capital over profitability, they explained this relationship is created from two possible reasons, the first that higher bank capitalization can be the result of higher management quality.

Alternatively, that higher capitalized banks could have lower bankruptcy cost, which imply to lower funding costs that create higher income[2]. On the other hand, other studies found negative and significant impact such as Naceur (2003) [3] and Francis (2013)[4].

Equity-ratio : Equity / Total assets

The equity ratio is expected to uncover the capital adequacy and capture the general average safety and soundness of the banks. Therefore, and from the results of the researches discussed above, we emerge the following hypothesis, H4: risk management efficiency ratio influence positively the bank profitability.

3.1.3. Bank Specific 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

[1] Ojo, A., *Efficiency of Capital Regulation for Nigerian Banks.* Nigerian Journal of Economics and Social Science vol. 51(2). 2008. PP.667-679.
[2] Iannotta, G., et al. *Ownership structure, risk and performance in the European banking industry*. Journal of Banking and Finance, 31 (7). 2007. PP.2127–2149. https://doi.org/10.1016/j.jbankfin.2006.07.013
[3] Naceur, S. B. *The determinants of the Tunisian banking industry profitability: Panel evidence*, Universite Libre de Tunis Working Papers. 2003. PP.1–17.
[4] Francis, M. E. *Determinants of commercial bank profitability in Sub-Saharan Africa*. International Journal of Economics and Finance, *5*(9). 2013. PP. 134–147.

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.

3.1.4. Macroeconomic Evidences

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.

Several research studied the effect of macroeconomic variables on the bank's profitability. According to Bikker and Hu (2002)[1] bank profitability variate in the same direction with the economic situation.

Another study conducted by Dietrich and Wanzenried (2009)[2] proposed that GDP growth and bank performance have a positive relationship, as in period of expansion lending expected to increase, and decrease in recessions periods.

The second macroeconomic variable would be used in our model is inflation, as it capture the economic risk. We will use the inflation as control variable measured by consumer price index (CPI) as applied in the literature review.

Different research interested in the effect of inflation on the bank's profitability, such as, McDonald and Schumacher (2009)[3], their study reached to the conclusion that if inflation rates are fully anticipated, this will influence positively the profitability, for the reason, that the bank managers and authorities will be able to adjust interest rate in order to increase revenue.

Otherwise, it could increase costs caused by wrong adjustment of the interest rate.

To mitigate the above-mentioned studies, we are planning to use GDP, inflation rate as control variables for macroeconomic risk.

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[1] Bikker, J.A. and H. Hu, *Cyclical Patterns in Profits, Provisioning and Lending of Banks and Pro-cyclicality of the New Basle Capital Requirements*. BNL Quarterly Review, 221, 2002. PP.143-175.

[2] Dietrich, A., and G. Wanzenried. *What Determines the Profitability of Commercial Banks? New Evidence from Switzerland.* Paper presented at the 12th Conference of the Swiss Society for Financial Market Research, Geneva, Switzerland, April 3, 2009.

[3] McDonald, and L. Schumacher. *The Determinants of Commercial Bank Profitability in Sub-Saharan Africa.* WorkingPaperNo.09/15.InternationalMonetaryFund,Washington,DC.2009.https://www.imf.org/external/pubs/ft/wp/2009/wp0915.pdf.

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

Table N°37: Variables description, and measurement

Variable		Apriori	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 Cyclicality	Selected From The World Bank Database
	INFLA	**(+)/(-)**	Domestic Rate Of Inflation	Selected From The World Bank Database
Liquidity Risk Ratio	LTD	**(+)(-)**	Unforeseen Liquidity Requirements	Total Loans Divided To Total Deposits
Credit Risk Ratio	FL	**(-)**	Funding Liquidity Ratio	Total Loans Divided To Total Assets
	NPL	**(-)**	Non-Performing Loans	Doubtful Loans Divided To Total Loans
	PTL	**(-)**	Credit Risk Coverage Ratio	Loss Provision Divided To Total Loans
Interest Rate Risk Ratio	IRR	**(+)**	Interest Rate Risk	Total Interest Income Divided To Total Loans
Risk Management Efficiency Ratio	Equity Ratio	**(+)**	Equity-Ratio	Equity Divided To Total Assets
Bank Specific Variables	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: Own computation, based on Eviews 8.1 results

3.2. DATA DESCRIPTION, MODEL SPECIFICATION AND EMPIRICAL STRATEGY

In the subsection of data description, model specification and empirical strategy, we are planning to present the data collected to establish our econometric model, first by presenting the different banks used in our sample, their key indicators, where the 18 banks are operating in the Algerian banking sector, and they have a financial history of at least 10 years. The sample is composed of 06 public owned banks, which are domestic banks also, and 12 private owned banks that they are foreign banks, except the case for ALBARAKA-bank that its ownership structure is mixt. Second characteristic of the data that would be presented is the descriptive statistics, this will provide the research with the main statistical description of the database, which are the mean, the median, minimum, maximum and the standard deviation of each variable used in our model, the descriptive statistic information is provided for the whole sample and by variable. These variables are classified as bank specific variables, economic growth evidence, risk and performance ratios. Detailed information about the computation of each variable is provided in the previous subsection. The third data description item would be the autocorrelation matrix among variables, this matrix would illustrate the correlation between the dependent and explanatory variables, and it offers some initial overview of the correlation between variables of interest. Moreover, to judge the soundness of our sample, this correlation matrix need to show relatively small correlation values among variables, which ensure that there is no significant concern of multi-collinearity. The last description element would be conducting a unit root test (ADF) to examine the stationarity of each variable, the procedure of testing the unit root became an essential procedure for any economic analysis[1], as it is fundamental in panel unit root test to identify the stationary proprieties of the variables.

3.2.1. Data Description

The database of this research was collected from the financial statement of 18 banks, to have a panel of 180 balanced observations, the main two financial statement that was used to resemble the sample are: the balance sheet and the income statement. During the collection of our sample we noticed some similar and dissimilar characteristics among the state owned banks and the private owned banks, we applied this descriptive analysis in the first section to distinguish between the two types of ownership structure in the Algerian banking system.

The following table provide information of the essential aggregate of the financial statement for each bank ownership structure, the total assets, total operating income, the interest income and the non-performing loans percentage for the year 2019. These information allow the analysis of the financial situation per bank not only per category of banks. For example, the BNA bank have the highest total assets among the entire sample with 3489629026MU. However, the BEA bank generated the highest income for the year 2019 that equals 81685994, 7MU. Then, the

[1] Huang, et al. *The causal relationship between energy consumption And GDP growth revisited: A dynamic panel data approach.* Ecological Economics 67. 2008. PP. 41–54.

BNA bank leads back the interest income with 139557528MU. The last indicator is the non-performing loans percentage and the most efficient bank is the CACIB bank with 0% of NPLs.

Table N°38: Algerian Banks Key Indicators

Bank	Ticker	Ownership	total assets	Total operating income	interest income	NPLs
Sociéte Générale Algérie	SGA	Private	384808749	7637435,36	22795734,2	0,13367725
Gulf Bank Algérie	AGB	Private	257068082	8167212	14913681	0,08244787
Arab Banking Corporation	ABC	Private	78764854,8	1779568,29	3609714,97	0,04094935
Trust Bank-Algeria	TRUST	Private	75422397	2628120	5714302	0,13183137
Al Salam Bank Algeria	AL SALAM	Private	131018967	5346675	7592690	0,05134305
Banque Al Baraka d'Algérie	AL BARAKA	Private	261568166	8614349,59	11568550,3	0,0429535
The Housing Bank For Trade and Finance-Algeria	HOUSING	Private	91129201,7	409239,05	3354767,66	0,0463693
Fransabank Al-Djazair	FRANSABANK	Private	66834891	2500751	3835578	0,05151359
Crédit agricole corporate et investissement Bank-Algérie	CACIB	Private	13359253,8	405077,286	716715,522	0
H.S.B.C-Algeria	HSBC	Private	80666472,4	1661092,62	2365800,25	0,00902394
BNP Paribas Al Djazair	BNP	Private	270264154	6515168,94	13776779,2	0,11780663
Citibank N.A Algeria	CITI	Private	188524875	7211158	4813114	0,24102969
Banque nationale d'Algérie	BNA	Public	3489629026	28369674,6	139557528	0,18769194
Banque extérieure d'Algérie	BEA	Public	3262369198	81685994,7	116903935	0,2018042
Banque de l'agriculture et du développement rural	BADR	Public	1575914095	5223842,21	59544173,2	0,23377061
Banque de développement Local	BDL	Public	1112152199	20636223,3	44379598,5	0,31674498
Crédit populaire d'Algérie	CPA	Public	2514424453	28666175	93123972	0,16313531
Caisse nationale d'epargne et de prévoyance	CNEP	Public	1538450076	7783747,67	62502885,8	0,13645449

Source: Own computation, based on Eviews 8.1 results

Table N°39 presents the descriptive statistics of the variables employed in this study. The mean values of ROA, ROE and the standard deviation were acceptable regarding the Algerian developing banking sector.

However, the mean liquidity risk ratio (LTD) value was 1.078046, which indicates that these Algerian banks were faced with high levels of liquidity risk, where the level of risk was based on the assets and liabilities management policy implemented by these banks. Moreover, the mean values of credit risk ratios (IRR- NPL- PTL) were low since these banks were facing a moderated credit risk, where the level of credit risk was based on the lending policy adopted by these banks.

The mean value of macroeconomic variables was 2.67 GDP and 4.64 for inflation with Std-Dev 1.08 and 1.87 consecutively, meaning that these Algerian banks are highly exposed to economic risks. In addition, the mean value of equity risk value was 0.13, which indicated that these banks used about 13% of their equity to finance their assets. Finally, for the bank specific variable in the sample the mean value was 18.70 for deposits and 19.18 for size with Std-Dev 1.78 and 1.56 sequentially, where there are the three size categories for banks in Algeria, large, medium and small.

Table N° 39: Data Descriptive Statistics

Variables	Mean	Median	Maximum	Minimum	Std. Dev.
ROE	0.359085	0.295475	1.134301	-0.005615	0.267880
ROA	0.025519	0.025224	0.095974	-0.003062	0.014652
DEPOSITS	18.70725	18.66789	21.61812	13.01313	1.787602
SIZE	19.18498	18.95812	21.97306	16.40772	1.563243
EQUITY_RATIO	0.134404	0.061473	0.748545	0.010348	0.146479
FL	0.545453	0.538975	0.854860	0.182579	0.151568
GDP	2.670000	3.050000	3.800000	0.800000	1.081014
INFLATION	4.649291	4.397101	8.891451	1.951768	1.873003
IRR	0.075191	0.071093	0.231675	0.027890	0.025181
LTD	1.078046	0.857966	26.33388	0.238165	2.104225
NPL	0.111083	0.082240	1.413536	0.000000	0.137153
PTL	0.056121	0.046215	0.240252	0.000000	0.047127

Source: Own computation, based on Eviews 8.1 results

Table N° (40) grants evidence on the dependent and independent variables and their correlation among each other. The results of this table provides a general sight of the correlation between variables of the study. In addition, most of the correlation values are relatively small, which suggests there is no significant concern of multi-collinearity.

Table N°40: Correlation Matrix Among Variables

Variables	ROE	ROA	DEPOSITS	SIZE	INFLATION	GDP	LTD	IRR	NPL	PTL	EQUITY_RATIO	FL
ROE	**1.000**	0.044	0.549	0.560	0.063	-0.020	-0.090	-0.131	0.138	0.158	-0.582	0.166
ROA	0.044	**1.000**	-0.548	-0.557	0.0756	0.109	0.089	0.454	-0.246	-0.366	0.394	-0.016
DEPOSITS	0.549	-0.548	**1.000**	0.974	-0.010	-0.121	-0.300	-0.478	0.392	0.539	-0.837	0.256
SIZE	0.560	-0.557	0.974	**1.000**	-0.032	-0.120	-0.113	-0.490	0.403	0.569	-0.797	0.246
INFLATION	0.063	0.0756	-0.010	-0.032	**1.000**	0.279	-0.090	0.103	-0.023	-0.011	-0.010	-0.154
GDP	-0.019	0.109	-0.121	-0.120	0.279	**1.000**	-0.002	0.113	0.006	0.069	0.088	-0.376
LTD	-0.090	0.089	-0.300	-0.113	-0.090	-0.002	**1.000**	0.027	-0.038	-0.014	0.186	0.024
IRR	-0.131	0.454	-0.478	-0.490	0.103	0.113	0.027	**1.000**	-0.305	-0.280	0.449	-0.284
NPL	0.138	-0.246	0.392	0.403	-0.023	0.006	-0.038	-0.305	**1.000**	0.446	-0.314	0.173
PTL	0.158	-0.366	0.539	0.569	-0.011	0.069	-0.014	-0.280	0.446	**1.000**	-0.348	0.202
EQUITY_RATIO	-0.582	0.394	-0.837	-0.797	-0.010	0.088	0.186	0.449	-0.314	-0.348	**1.000**	-0.235
FL	0.166	-0.016	0.256	0.246	-0.154	-0.376	0.024	-0.284	0.173	0.202	-0.235	**1.000**

Source: Own computation, based on Eviews 8.1 results

The last information that need to be revealed about our series and variables, is their stationarity, to provide this information, a panel unit root test was conducted, the detailed stationary test results are in appendix (N°04).

Table N° (41) shows results of the panel unit root test for each variable. Column 1 and 2 of table 41 presents the results of the Fisher-chi-square panel unit root test. Likewise, column 3 and 4 shows the results of Levin-Lin-Chu panel unit root test.

In table 41, there is a piece of clear evidence that ROA, ROE, Size, Deposits, Inflation, FL, IRR, NPL, PTL, LTD, Equity-ratio are statistically significant at the 5% level of significance, which reveals that these variables are stationary at level. However, we found contradictory results for the case of GDP.

The following table provides more illustration, concerning the T-statistic and the P-value for both the panel unit root test that was established.

Table N°41: Panel Unit Root Tests Results

Variables	PP-fisher-chi-square		Levin, Lin & Chu t*	
	T-statistic	P-value	T-statistic	P-value
Size	71.9983	0,0003	-5.73755	0,0000
Deposits	121.599	0,0000	-9.77647	0,0000
ROA	62.4873	0,0040	-5.69156	0,0000
ROE	98.5480	0,0000	-5.09904	0,0000
Equity ratio	75.6294	0,0001	-0.41501	0,3391
FL	57.6006	0,0126	-1.96343	0,0248
IRR	104.128	0,0000	-7.37685	0,0000
LTD	60.9202	0,0059	7.89416	1,0000
PTL	83.2842	0,0000	-15.2480	0,0000
NPL	58.3262	0,0058	-0.39216	0,3475
GDP	5.72035	1,0000	6.76729	1,0000
Inflation	64.8558	0,0022	-9.26777	0,0000

Note. We report adjusted t-statistics for the Levin–Lin–Chu unit root test. Levin–Lin–Chu Hypotheses: Ho: Panels contain unit roots. Ha: Panels are stationary. LR variance: Bartlett kernel, 7.00 lags average (chosen by Levin–Lin–Chu (LLC)).

Source: Own computation, based on Eviews 8.1 results

From the tests conducted above, we were able to conclude the following results. Firstly, we were able to identify the nature of our panel data. The descriptive statistics showed the mean, the maximum, the minimum and the Std-Dev of each variable in the sample.

In addition, the correlation matrix that examined the multi-collinearity between the variables of the study. Finally, a panel unit root test was established to judge the stationarity of the studied series. The subsequent phase will present our econometric model and the empirical strategy that suits the best the nature of our sample.

3.2.2. Model Specification

This research uses a balanced panel employing annual data for all 18 banks that operates in Algeria during the period 2010-2019. The main reason behind the chosen time-period lies in the availability of data. Precisely, the fundamental source of bank-specific information and risk ratios is the Algerian Central Bank (ACB) database, and for the macro-economic variables were available in the World Bank (WB) database.

The panel data includes 180 observations, we intended to collect as much data as possible in order to include at least the oil crisis of 2014 to study its impact on the Algerian banks profitability through the use of GDP that we prove in last section, that there is co-integration relationship between Brent-oil prices and GDP growth in Algeria. Furthermore, the banks included in the sample had to have at least ten (10) consecutive years of full reporting of their financial statements.

Due to the panel structure of our data, which is a combination of cross sectional and time series information, we will estimate our model using the Generalized Method of Moments (GMM). In this category of studies, two main problems can be controlled using panel data methodology, which are heterogeneity and endogeneity[1].

Specific characteristics of each bank can create the heterogeneity problem, which remains constant over time. Moreover, these specific characteristics are not observable, they became part of random component in the estimated model, such as the managerial style, the internal policy and the attitude toward risk.

As a result, to avoid the unobservable heterogeneity and endogeneity problems in the estimations, we are planning to employ the GMM estimator that can offer efficiency gains.

We present our empirical conjecture in four different equations as follows. First, we included all the macroeconomic, risk ratios and banks specific variables as explanatory variables to test their impact over return on assets (ROA) variations.

[1] Arellano, M. *Sargan's instrumental variables estimation and the generalized method of moments*. Journal of Business & Economic Statistics, 20(4), 2002. PP. 450–459.

Second, the equation would be to observe the impact of previously mentioned variables over return on equity (ROE). Therefore, we present the models in equations (1) and (2):

$$ROA_{i,t} = \alpha 0 + \alpha 1 Size_{i,t} + \alpha 2 Deposits_{i,t} + \alpha 3 Inflation_{i,t} + \alpha 4 GDP_{i,t} + \alpha 5 FL_{i,t} + \alpha 6 LTD_{i,t} + \alpha 7 PTL_{i,t} + \alpha 8 NPL_{i,t} + \alpha 9 IRR_{i,t} + \alpha 10\ Equity\text{-}ratio10_{i,t} + \varepsilon_{i,t} \quad \ldots\ldots (01)$$

And

$$ROE_{i,t} = \alpha 0 + \alpha 1 Size_{i,t} + \alpha 2 Deposits_{i,t} + \alpha 3 Inflation_{i,t} + \alpha 4 GDP_{i,t} + \alpha 5 FL_{i,t} + \alpha 6 LTD_{i,t} + \alpha 7 PTL_{i,t} + \alpha 8 NPL_{i,t} + \alpha 9 IRR_{i,t} + \alpha 10\ Equity\text{-}ratio10_{i,t} + \varepsilon_{i,t} \quad \ldots\ldots (02)$$

To test the ownership structure's impact over those last two equations, we add in the next two equations, a dummy variable, where 1 refers to state owned banks, and 0 to private owned banks:

$$ROA_{i,t} = \alpha_0 + \alpha_1 Size_{i,t} + \alpha_2 Deposits_{i,t} + \alpha_3 Inflation_{i,t} + \alpha_4 GDP_{i,t} + \alpha_5 FL_{i,t} + \alpha_6 LTD_{i,t} + \alpha_7 PTL_{i,t} + \alpha_8 NPL_{i,t} + \alpha_9 IRR_{i,t} + \alpha_{10}\ Equity\text{-}ratio_{10i,t} + \alpha_{11}\ Dummy_{11i,t} + \varepsilon_{i,t} \ldots\ldots (03)$$

And

$$ROE_{i,t} = \alpha_0 + \alpha_1 Size_{i,t} + \alpha_2 Deposits_{i,t} + \alpha_3 Inflation_{i,t} + \alpha_4 GDP_{i,t} + \alpha_5 FL_{i,t} + \alpha_6 LTD_{i,t} + \alpha_7 PTL_{i,t} + \alpha_8 NPL_{i,t} + \alpha_9 IRR_{i,t} + \alpha_{10}\ Equity\text{-}ratio_{10i,t} + \alpha_{11}\ Dummy_{11i,t} + \varepsilon_{i,t} \ldots\ldots (04)$$

ROA and ROE are the dependent variables, i refers to the cross-section (banks), and t is a symbol representative of the time. ROA, ROE, GDP, FL, LTD, PTL, NPL, IRR and Equity-ratio represent the return on assets, return on equity, Gross domestic product, liquidity-risk ratio, provision to total loans, non-performing loans, interest rate risk ratio and risk management efficiency ratio, respectively.

Concerning the model hypotheses, 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.

The subsequent phase is to estimate the models parameters using the GMM system estimator.

3.3. EMPIRICAL RESULTS AND DISCUSSION

The main objective of the research as defined before is to find the nature of the relationship between performance variables (ROE, ROA), risk ratios, bank specific variables and macro-economic risk evidence. In this study, a panel analysis was conducted to check the effect of the previously mentioned explanatory variables on bank profitability in Algeria.

The study has chosen to make use of panel data analysis as statistical instrument to analyze the impact of the economic and bank specific variables on profitability. Panel data model is a combination of time series and cross-sectional statistical analysis.

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.

As our sample is gathered from 18 banks (i=18) and for 10 years period (t=10), this give a dynamic nature of our model, which prevent the usage of standard OLS estimators that will produce biased and inconsistent coefficient. In order to solve the bias problem.

We are following the estimation method applied by Athanasoglou, Brissimis and Delis (2008)[1], which is Arellano-Bond General Method of Moments (GMM) approach.

The dynamic panel estimation (GMM system) employed in this research, for the reason that it reflects the direction of change in profitability for a given change in the explanatory variables, for any individual bank (i) from year to year (t).

Tables (42-44) show the estimated equations (1-4) using panel data estimation methods. Each table contains the results of the regression describing the relationship between bank profitability and explanatory variables, where the dependent variables are ROA and ROE respectively.

3.3.1. Empirical Results

Equation (01) investigate the impact of explanatory variables over the return on assets (ROA), without including the dummy variable to measure the influence of the ownership structure.

[1] Athanasoglou, et al. *Bank-Specific, Industry Related and Macroeconomic Determinants of Bank Performance*. Journal of International Financial Markets, Institutions and Money 18 (2), 2008. PP. 121– 36.

The results of this regression are showed in table 42.

Table N°42: Regression Results, The Dependent Variable Is ROA (Equation 01)

Variable	Coefficient	P-value
GDP	0.001415	0.1206
INFLATION	0.000308	0.5242
SIZE	0.004384	0.3877
DEPOSITS	-0.009427	0.0651(***)
IRR	0.171736	0.0000(*)
FL	0.023950	0.0004(*)
LTD	-0.001140	0.2031
PTL	-0.028293	0.2460
NPL	0.001158	0.8727
EQUITY_RATIO	-0.027770	0.0286(**)
C	0.092996	0.0001(*)
R-squared	0.421630	

*, ** 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.

Source: own computation, based on Eviews 8.1 results

Equation (02) investigate the impact of explanatory variables over the return on equity (ROE), without including the dummy variable to measure the influence of the ownership structure. The results of this regression are showed in table 43.

Table N°43: Regression Results, The Dependent Variable Is ROE (Equation 02)

Variable	Coefficient	P-value
GDP	0.020738	0.1907
INFLATION	0.007356	0.3817
SIZE	0.387738	0.0000 (*)
DEPOSITS	-0.307331	0.0006 (*)
IRR	2.496214	0.0005 (*)
FL	0.274436	0.0183 (**)
LTD	-0.044875	0.0044(*)
PTL	-1.055489	0.0136 (**)
NPL	-0.073555	0.5590
EQUITY_RATIO	-1.065314	0.0000 (*)
C	-1.498335	0.0003(*)
R-squared	0.475601	

*, ** 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.

Source: own computation, based on Eviews 8.1 results

Equation (03) investigate the impact of explanatory variables over the return on assets (ROA), including the dummy variable to measure the influence of the ownership structure. The results of this regression are showed in table 44.

Table N°44: Regression Results, The Dependent Variable Is ROA (Equation 03)

Variable	Coefficient	P-value
GDP	0.002000	0.0293 (**)
INFLATION	0.000424	0.3711
SIZE	0.009232	0.0791 (***)
DEPOSITS	-0.008652	0.0839 (***)
IRR	0.150462	0.0003 (*)
FL	0.023451	0.0004 (*)
LTD	-0.000961	0.2739
PTL	-0.010182	0.6792
NPL	0.004028	0.5729
EQUITY_RATIO	-0.000262	0.9866
DUMMY	-0.015769	0.0041(*)
C	-0.014707	0.7355
R-squared	0.449458	

*, ** 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.

Source: own computation

Equation (04) investigate the impact of explanatory variables over the return on equity (ROE), including the dummy variable to measure the influence of the ownership structure. The results of this regression are showed in table 45.

Table N°45: Regression Results, The Dependent Variable Is ROE (Equation 04)

Variable	Coefficient	P-value
GDP	0.044250	0.0019 (*)
INFLATION	0.012048	0.1000 (***)
SIZE	0.582397	0.0000 (*)
DEPOSITS	-0.276241	0.0004 (*)
IRR	1.642060	0.0090 (*)
FL	0.254397	0.0116 (**)
LTD	-0.037675	0.0058 (*)
PTL	-0.328314	0.3868
NPL	0.041675	0.7046
EQUITY_RATIO	0.039158	0.8699
DUMMY	-0.633129	0.0000 (*)
C	-5.822671	0.0000 (*)
R-squared	0.609808	

*, ** 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.

Source: own computation, based on Eviews 8.1 results

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

The regression results showed in tables (42-45) provide answers to the model hypotheses, each regression presents the significant or insignificant relationship between the explanatory variables and profitability in Algerian banks. For more illustration, we presented the summary of hypotheses in table 46.

Table N°46: Summary Of Hypotheses Results

Hypotheses	Results			
	Equation (01)	**Equation (02)**	**Equation (03)**	**Equation (04)**
There is a significant relationship between GDP and financial performance in Algerian banks	Rejected	Rejected	Accepted	Accepted
There is a significant relationship between inflation and financial performance in Algerian banks	Rejected	Rejected	Rejected	Accepted
There is a significant relationship between size and financial performance in Algerian banks	Rejected	Accepted	Accepted	Accepted
There is a significant relationship between Deposits and financial performance in Algerian banks	Accepted	Accepted	Accepted	Accepted
There is a significant relationship between Equity-ratio and financial performance in Algerian banks	Accepted	Accepted	Rejected	Rejected
There is a significant relationship between LTD ratio and financial performance in Algerian banks	Rejected	Accepted	Rejected	Accepted
There is a significant relationship between interest rate risk (IRR) and financial performance in Algerian banks	Accepted	Accepted	Accepted	Accepted
There is a significant relationship between liquidity ratio (FL) and financial performance in Algerian banks	Accepted	Accepted	Accepted	Accepted
There is a significant relationship between non-performing loans (NPL) ratio and financial performance in Algerian banks	Rejected	Rejected	rejected	rejected
There is a significant relationship between provisions to total loans (PTL) ratio and financial performance in Algerian banks	Rejected	Accepted	rejected	rejected
There is a significant relationship between ownership structure and financial performance in Algerian banks	-	-	Accepted	Accepted

Source: Own computation, based on Eviews 8.1 results

3.3.2. Results Discussion

The results in table 46 suggest that the GDP growth has no significant impact or relationship with bank profitability in Algeria for the ten years of the study. However, after including, the ownership structure in equations (03) and (04), both regressions in tables (44-45) proved a significant relationship between GDP growth, ROA, and ROE at 5% and 1% significant level. As a result, the GDP growth affects positively and significantly the financial performance measured using ROA and ROE in publicly owned banks.

The second macroeconomic variable is the inflation rate, from table 46, we can state that the inflation risk has no significant impact on bank profitability before including the dummy variable of the ownership structure. Furthermore, the findings of table 44 proved that the inflation rate also has an insignificant relationship with the ROA of publicly-owned banks in Algeria. However, this variable affects positively and significantly at a 10% significance level the ROE variation in state-owned banks.

For the bank-specific variables, we used to size and deposits. From table 46, the size variable has a significant relationship in equations (2-3-4) except the first equation. In addition, the size variable has a significant and positive impact on the ROE variation with and without using the ownership structure variable at a 0% significant level, and on ROA variation in state-owned banks at a 10% significant level. Concerning the results of the deposit, we found that deposits have a negative and significant relationship over ROA and ROE variation in the four equations, which means that this variable influence negatively the profitability of Algerian banks regardless of their ownership structure and their profitability measure.

In our research to measure the risk management efficiency, we have used the equity ratio, the results of this variable showed a significant and negative impact on ROA and ROE before including the ownership structure. Then the results showed an insignificant relationship between risk management efficiency variable over profitability in state-owned banks from tables 44-45.

For the liquidity risk ratio, table 46 showed a negative and significant impact over ROE variation at a 1% significance level in both state-owned banks and privately owned banks. However, the same variable has a negative but insignificant relationship over ROA fluctuation from equations 1 and 3.

Tables 42 to 45 proved the existence of positive and significant influence from interest rate risk ratio over ROA and ROE at a 1% significant level, for the domestic and foreign banks in Algeria.

The last type of risks included in this study was a credit risk. We applied three credit risk ratios, which are funding liquidity ratio that measures the counterparty exposures of banks, this ratio showed a positive and significant relationship to the ROA and ROE fluctuations for all bank types operating in Algeria. The second credit risk ratio was the non-performing loans, the results

of these variables showed an insignificant relationship to the ROA and ROE variation of Algerian banks. The third and last credit risk was the provision to total loans (PTL) ratio which showed one negative and significant relationship to the ROE fluctuations at a 5% significant level from the second equation. However, the hypothesis of a significant relationship between PTL and profitability was rejected for equations one, three, and four.

From table 46 outcome, we can rewrite equations (1-4) as follow that explains the ROA and ROE variations, using only the significant explanatory variables.

Model 01 that illustrate the ROA variation before using the dummy variable of the ownership structure:

Equation 01':

$$ROA_{i,t} = 0.092996 - 0.009427\ Deposits_{i,t} + 0.023950\ FL_{i,t} + 0.171736\ IRR_{i,t} - 0.027770\ Equity\text{-}ratio10_{i,t} + \varepsilon_{i,t} \quad \text{.....(01')}$$

Model 02 that illustrate the ROE variation before using the dummy variable of the ownership structure:

Equation 02':

$$ROE_{i,t} = -1.498335 + 0.387738\ Size_{i,t} - 0.307331\ Deposits_{i,t} + 0.274436\ FL_{i,t} - 0.044875\ LTD_{i,t} - 1.055489 PTL_{i,t} + 2.496214\ IRR_{i,t} - 1.065314\ Equity\text{-}ratio10_{i,t} + \varepsilon_{i,t} \quad \text{.....(02')}$$

If dummy variable equals one, which mean public banks, the equations 3 and 4 can be write as follow:

Model 03 that illustrate the ROA variation using the dummy variable of the ownership structure:

Equation 03':

$$ROA_{i,t} = + 0.009232\ Size_{i,t} - 0.008652\ Deposits_{i,t} + 0.002000 GDP_{i,t} + 0.023451\ FL_{i,t} + 0.150462 IRR_{i,t} - 0.015769\ Public_{i,t} + \varepsilon_{i,t} \quad \text{.....(03')}$$

Model 04 that illustrate the ROE variation using the dummy variable of the ownership structure:

Equation 04' :

$$ROE_{i,t} = -5.822671 + 0.582397\ Size_{i,t} - 0.276241\ Deposits_{i,t} + 0.012048\ Inflation_{i,t} + 0.044250\ GDP_{i,t} + 0.254397\ FL_{i,t} - 0.037675\ LTD_{i,t} + 1.642060\ IRR_{i,t} - 0.633129\ Public_{i,t} + \varepsilon_{i,t} \quad \text{.....(04').}$$

This research aimed to investigate the influence of credit risk, liquidity risk, interest rate risk, macro-economic risk, risk management efficiency, and bank-specific variables on bank profitability using ROA and ROE, employing empirical evidence from the Algerian banking sector. The present research covered the panel data from banks in an emerging banking market

(Algeria) in the years after the last great financial crisis (2008-2009), that is, between 2010 and 2019. The model was estimated through a GMM system as the dynamic panel data estimator.

The findings offered additional insights into causality between the explanatory variables of the study and profitability.

The macro-economic risk measured using GDP growth and inflation rate seems to have an impact on profitability in publicly-owned banks, where these two variables had no significant impact on ROA and ROE before adding the ownership dummy variable to the model. In addition, this study proposes that SOBs need to profit from the positive impact of the GDP growth variable. We concluded that if GDP increases by 1% then the ROE of public banks would increase by 4% and ROA by 0.2%.

In the previous section, we studied the factors that cause the GDP variations in Algeria, which are Brent-oil prices, foreign exchange reserves, monetary market interest rate (MMR), the foreign exchange rate of USD/DZD, and loans. Therefore, Algerian banks need to forecast the changes in each of these factors to make a profit from the positive GDP fluctuations. Concerning the inflation rate, the results showed that this variable has an impact of + 1.2% at a 10% significant level on ROE variations in state-owned banks.

From the literature review, we expected a negative impact from the inflation rate fluctuations on bank profitability. However, this positive influence may be explained by the fact that high inflation rates are associated with high loan interest rates, which implicate high-interest income1.

The bank-specific variables used in this study are size and deposits, from the literature review, we made hypotheses that size has an impact on bank profitability that may be negative or positive, and deposits have a positive impact on ROA and ROE variations. However, the outcome of the regression showed that size has a positive and significant impact on bank profitability of state-owned banks and ROE variations of privately owned banks. On the other hand, deposits proved to have a negative and significant influence on bank profitability in Algeria, contrary to the literature review.

The negative impact can be explained by the fact that state-owned banks can excessively use the depositors' funds to make loans due to the fact that government provides complete support when it is required, consequently, a great volume of loans made by the banks increases the bank exposure to credit risk, which lead to a decline of bank profitability.

The risk management efficiency ratio in the current study was measured using the equity ratio, which captures the ability of the bank to resist negative shocks. The results showed negative and significant impact of this variable on bank profitability in Algeria.

From the literature review, we suggested that high capitalization is associated with a decrease in bankruptcy costs. As a result, a bank with high capital to assets ratio might denote that it is operating with overcautious strategies. Overly conservative management might not be taking

advantage of the Algerian banking market opportunities and consequently, expect lower profitability.

The regression estimation of the four equations showed that the interest rate risk ratio (IRR) has a significant and positive impact on profitability in Algerian banks at a 1% significant level. As a result, profitability in Algerian banks increases if interest rate risk increases, therefore, Algerian banks profit from the interest rate variability.

The liquidity risk ratio in Algeria showed a negative and significant impact on ROE variation at a 1% significance level if the LTD ratio increase by one % then ROE decrease from 3% to 4%.

From the literature review, different studies reached the same results of a negative relationship between profitability and liquidity risk, this negative variation was explained by the fact that banks with large liquidity gap tend to be missing stable and cheap funds and will hence turn to use their liquid assets or external funding to compensate funding demands1.

The final explanatory variables were the credit risk ratios, FL, NPL, and PTL. The results of the study reveal that there is a positive and statistically significant relationship between the funding liquidity ratio (FL) and the profitability of Algerian banks. Due to this relation, financial performance will increase if (FL) ratio variates positively. This ratio illustrates the asset quality, where 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 the FL ratio and financial performance are positively related. As asset quality increases, ROA increases as well. The NPLs ratio was insignificantly related to the profitability ratio in this study. Furthermore, the PTL ratio showed a negative and significant relationship with ROE variations from equations 2 and 4, this result suggests that Algerian banks may not use the PTL in the right way it was designed (PTL is a coverage ratio; to make some reserves for potential credit risk that resulted by credit failure).

The present study showed important relationships, the GDP, inflation, size, deposits, credit risk ratios, the liquidity ratio, the interest rate risk ratio, and the risk management efficiency ratio proved to influence bank profitability in either a positive or negative way.

Thus, this study recommends that Algerian banks be required to modernize their lending policies, assets and liabilities management, and risk management strategies to make sure they are covered against these financial risks.

Conclusion of the Forth Chapter

This chapter aimed to examine the effect of ownership structure, risk ratio, economic growth and bank specific variables on profitability in Algerian banks, using empirical evidence for the period 2010-2019. The sample used in this research was collected mainly from the financial statement of eighteen (18) Algerian banks that have a financial history at least for ten years consecutively.

The empirical method that was employed in this chapter are: a comparative case study based on the ownership structure of the Algerian banks. Than a VAR model was applied in section two, to investigate the factors that determine the economic growth in Algeria. Finally a GMM system was estimated in section three to test the relationship between the explanatory variables used in this study and the profitability measures ROA and ROE of Algerian banks.

A comparative case study was conducted in the first section between the state owned banks and the private owned banks in Algeria, primarily we compared the financial statement aggregates of the two categories to detect the influence of the ownership structure on the lending policy, the financial performance and on the income generating strategy.

The results showed the subsequent outcomes. Firstly, the deposits collection and total assets share are dominated by the state owned banks. Furthermore, the SOBs are more able to generate more net operating income and net interest income than the POBs. In addition, the state owned banks dominates 88% of the loan market in Algeria, against 12% to the privet owned banks, however, SOBs have a NPLs of 20% and POB have 9%.

Finally, profitability measure ratios showed that SOBs have a high ROE ratio that decreases over the last ten years in contrary to the POB where the ROE ratio increases for the same period. Nevertheless, the ROA ratio illustrate that POBs are more financially efficient.

A VAR model was applied to define the variables that contribute in the variations of GDP growth in Algeria, the study used different financial and real economy variables, which are the foreign exchange reserves, the foreign exchange rate USD/DZD and EUR/DZD, the loan to the economy, the M2, the Brent-oil prices, the MMR, the inflation rate. After a granger causality test between these variables and GDP, we illuminated the inflation rate, M2 and EUR/DZD, due to the inexistence of a causality relationship to GDP. Than a VECM model was estimated to ensure the stability of the found relationships.

Furthermore, a variance decomposition was analysed to identify the short and medium term impact of the variables on GDP variations. The results showed that own shock on GDP explain 94.4% for the short-term and 62.52% for the medium term. In addition, shocks on reserves explains 2.42% the GDP variations in three months period and 31.84% variation in twenty four months. Moreover innovation on loans can cause 1.95% GDP fluctuations for the short-term and 4.49% for the medium term.

Finally, Innovation on the other variables (Brent, USD/DZD and MMR) affect approximatively by less than one percent (0.96%, 0.36% and 0.17%) the variation in GDP for the short run, and for the long run (0.14%, 0.28% and 0.72%).

A GMM system was estimated in section three to explain the relationships between the profitability measures in Algerian banks (ROA , ROE) and risk ratios, economic growth and bank specific variables.

The findings of the study elucidated the existence of significant relationships between profitability and risk ratios over the ten years of the study except for the non-performing loans variable. Consequently, the liquidity risk, credit risk and interest rate risk influence significantly the profitability of Algerian banks.

Therefore, this research propose that Algerian banks need to take into their strategy these relationships in either positive or negative way. The second result of this estimation was the significant positive impact of GDP variation on ROA and ROE fluctuations in state owned banks, thus, this bank category need to predict the economic changes to take profit of the positive vicissitudes of GDP.

Lastly, bank specific variables seems to have dissimilar impact over bank profitability, where size influence positively the financial performance measures in contrary to deposits that have significant negative impact on profitability of Algerian banks. These findings have noteworthy consequences for managers, stakeholders and banks as they can contribute in the creation of efficient financial system.

CONCLUSION

CONCLUSION

Similar studies in developed countries had always interested researchers, empirical research concerning risk management, economic stability, and their influence on bank profitability. The particularity of our research is the Algerian context, which was not the subject of large studies.

Our doctoral research aims to contribute to this insufficiency by first studying the quality of risk management, secondly, the economic instability factors, and finally, the financial performance of Algerian banks. From this perspective, we have conducted theoretical and empirical research to analyze the factors that influence banking profitability.

A better understanding of the research variables starts with a better comprehension of the conceptual frame research of these variables. To this end. We mobilized the theoretical concepts relating to risk management, banking management, and financial performance. Furthermore, we established an analytical study of these concepts in the Algerian context.

In addition, we performed a comparative study between the Algerian banks with different ownership structures, plus two empirical validations to capture the economic factors and risk ratios that influence profitability in the Algerian banking sector.

Furthermore, the risk management practices and the economic growth in the banking system showed to have a great influence on their profitability. Therefore, the present research aimed to investigate this impact using the following main problem the research: **What is the impact of risk management practices and the economic instability on the financial performance of Algerian Banks?** In terms to provide answers, we divided this research into four chapters. Moreover, in the present research, we focused our attention on understanding the financial performance in banking, we started with the organizational specificities of the bank, its management, its business model, and regulations and standards. Then financial performance measures and determinants.

Finally, we analyzed the banking sector in Algeria, we conducted a comparative study over time on performance indicators. The theoretical outcome of this chapter was that the Algerian banks have huge opportunities for growth in comparison to the financial and organizational potentials detained by the Algerian banking sector. Moreover, we tried to provide answers to our research questions, namely: What are the fundamental financial performance determinants that distinguish the financial institutions and especially the banks?

The fulfillment of this research allowed us to conclude the following points:

- Banking management requires the identification of three fundamental points, which are the bank's business model, the regulatory frame research that normalizes the bank's activity, and finally the financial and economic environment.

CONCLUSION

- There are three traditional financial performance measurements in banking: the return on assets (ROA) and return on equity (ROE) and the net interest margin (NIM). After presenting the limits of each indicator, we ended the section by conducting that NIM is less credible in terms of financial performance comparison between the different operators of the same sector, due to its characteristic of neglecting the operating costs of the bank.

- The financial determinants of a bank are made of two types, the internal size of the bank, and the capital level. Alternatively, external determinants like the macro-economic factors, and the competitiveness of the financial market.

- The analytical study of the Algerian banking sector showed that the system went through different stages, from the colonial phase to the liberalization phase, where the financial authorities in Algeria switched the national economy from a socialist to a market-oriented system.

- In addition, the system witnessed several regulatory changes in terms to adapt to international standards. However, after analyzing the performance indicators of the sector, we concluded that the banking sector in Algeria did not reach the maturity stage yet, and it has huge development potential.

- Additionally, the risks that jeopardize the banking activity are mostly financial: credit risk, liquidity risk, market risk, interest rate risk, and exchange rate risk. Besides the mentioned risks, the Algerian banks face a hydrocarbon risk that threatens the economic environment stability, due to the high dependency on petroleum income, which leads to GDP levels instability.

- In addition, the inflation rates are significantly increasing during the years of the study, besides the foreign exchange reserves notably declining. The economic factors' instability incited us to examine the originator causes, by establishing an empirical study to understand the factors that influence the economic stability in Algeria.

Moreover, after defining the research epistemology and methodology, we discovered that our way to reach knowledge is the hypothetico-deductive method, which refers to the method that relies on setting the study hypotheses from the start, followed by several tests applied to these hypotheses to the end up with predictions and conclusions.

In addition, we have presented the mathematical tools that were applied in the empirical part. Starting with the definition and the validation procedure of the vector autoregressive (VAR) model, then the dynamic panel data analysis. The use of these two models was decided according to the nature of our research sample, and the purpose of the study.

Finally, the empirical part was divided into three sections:

- we started with an analytical comparison between the state-owned banks and the private-owned banks, using financial performance indicators, and aggregates from the financial statement of our sample that was made of eighteen (18) Algerian banks for ten (10) years as a timeline, characterized with different ownership structures.

- Followed by an empirical examination of the factors that influence the economic and financial stability of the Algerian banks using a VAR model. After applying the validation tests, we reached four (04) causality relationships among the variables enquired, which allowed us to conduct a co-integration test that confirm the existence of a stable relationship between the unstable variables.

- The last section of the empirical part studied the influence of risk ratios and economic factors on the financial performance of Algerian banks. In this model, we used a dynamic panel regression analysis.

The theoretical and empirical studies of this research permitted us to answer the research problem through the verification of our hypotheses:

Hypothesis n°01 is confirmed**:** The Algerian economy has its distinctions from other countries in the region, high dependency on the hydrocarbon incomes, shortage of productive investment, and the dominance of the public sector.

The research's first hypothesis is indeed confirmed, by the findings of the literature review and the empirical parts. Moreover, the first chapter contributed to the confirmation of this hypothesis by analyzing the performance indicators of the sector and the economic signal variations.

The findings of the first chapter showed that the regulatory development of the banking sector in Algeria allowed the transformation from the socialist system to the market orientation system, which permitted the banks to collect more financial resources and contribute to the economic development.

Numerous variables that held back the economic development in Algeria were defined in the first chapter. Furthermore, Algeria as a hydrocarbon exporter country has the natural resources and potential for development, however, it does not reach its goals of prosperity and development, due to the reliance on the hydrocarbon incomes, also the financial resources availability of funding reduces the demand for finance, finally, the raw commodities prices booms are generally consequence busts that make lending riskier.

Hypothesis n°02 is confirmed: The Algerian state-owned banks dominate the banking activity, unlike the privately owned banks that are characterized by a lack of diffusion in the country.

The second hypothesis is confirmed due to a comparative study that we conducted in section one of the empirical part. The study went through three stages:

- Identification of the different operators of the banking sector in Algeria, and their ownership structure.

The banking system in Algeria contains six state-owned banks and twenty private-owned banks. It is notable that in terms of number the POB are dominant. Conversely, in terms of market share, which is controlled by the SOB. Moreover, most of the POBs are foreign banks that control only five percent (05%) of the equity share versus ninety-five percent (95%) held by the SOB.

- The balance sheet aggregates a comparison of the Algerian banks, based on their ownership structure.

The aggregate compared from the balance sheet are the total assets share and the total deposits share. The results proved the domination of the state-owned banks, however, it is notable that the financial authorities in Algeria are seeking to reduce the public bank's share to reach sixty-two percent (62%) in 2019. Similar to the deposit share, the state banks are controlling the market in terms of collecting financial resources, this was explained by several factors:

- ✓ The state-owned banks' are prevalent over the national territory, unlike the private-owned banks that operate only in large cities.
- ✓ The depositors' behavior of believing that their savings are more secure in the SOB.
- ✓ The state-owned banks are characterized by less costs in terms of deposit accessibility.

- Statement income comparison of the Algerian banks, based on their ownership structure.

The net operating income and the net interest income comparison showed that the income generation of the state-owned banks is related to the economic situation of the country. Where the years of the oil prices crisis, a deterioration of the income levels is proved, this might be explained by the fact that the foreign funds and investments were decreased in the apprehension of an economic collapse.

- Loans behavior comparison between the Algerian banks

The loan behavior was compared using the total loan share and the percentage of the non-performing loan. The results showed that the SOB is in needs to revise its loan granting policy, for the reason that the SOB controls the granting loans market, and recording a high percentage of non-performing loans (NPL).

Therefore, the financial authorities in Algeria are obliged to re-orientate the objectives of the granting loan, from supporting the governmental strategies even if they harm the bank's financial health, to more sound policies that rely on the banking development objectives.

- Performance measures comparison of the Algerian banks.

Unlike the other compared indicators, the financial performance measures (ROA) showed that the POB is more efficient than the SOB. However, the state-owned banks have more growing possibilities in the Algerian market due to the ROE comparison results.

Hypothesis n°03 is confirmed: various factors affect the GDP levels in Algeria, these factors are mainly financial and economic.

The empirical examination of the factors that influence the economic and financial stability in Algeria proved that the economic development (presented by the GDP fluctuations) is related to the variations in the foreign exchange reserves, the Brent-oil prices, Foreign exchange rate USD/DZD, and Monetary market rate MMR.

The proven relationships were the outcome of a VAR model, after identifying the nature of the variables, which were stationary at the first difference and accepting the application of the VECM model, to predict the future variation of the GDP levels by applying innovations to the proved causality relationships.

The results showed that the Algerian economic stability is venerable to Brent-oil price changes in the short-term greater than in the medium-term. Where we assumed that the higher oil prices get, the lower companies will purchase this energy, and the hydrocarbon productivity will be declined.

The second outcome concerns the USD/DZD exchange rate fluctuations that affect negatively the Algerian GDP, this can be explained by the nature of the Algerian exchange market and its dominance by the black market.

Thirdly, we concluded a positive and significant relationship between economic stability and foreign exchange reserves in Algeria, where a positive shock of 1% applied to the reserves variable would increase the positive fluctuations of the GDP by 31.84% in twenty-four months.

To close, the financial stability variables loans and MMR variables proved to have a positive and significant relationship with the GDP variations, also both showed a greater impact on the medium-term than the short-term.

Hypothesis n°04 is confirmed: Risk in banking is mainly financial, as the high level of uncertainty related to the financial activity of the bank, moreover, the bank's risk management could be influenced by their nature internal, external, financial, or non-financial risks.

To test this hypothesis, we applied a GMM system, to examine the impact of credit risk, liquidity risk, interest rate risk, the risk management efficiency ratio, and the macroeconomic variables (GDP and inflation rate) on the financial performance measure of Algerian banks using ROE and ROA.

The findings of this regression presented multiple results, starting with the macroeconomic variables, and GDP showed a positive and significant impact on the financial performance measures. Therefore, we recommend that state-owned banks take profit from this positive relationship.

The second result was a positive and significant influence of the inflation rate variations on the profitability measures in Algeria, this might be explained by the fact that high inflation rates are related to high loan interest rates, which implicate high-interest income.

Thirdly, the following variables proved significant relationships with the profitability variations according to this model:

- Size and deposits as bank-specific variables are related to profitability in Algerian banks;
- The risk management efficiency ratio is significantly and negatively related to the financial performance of Algerian banks;
- The regression estimation showed that the interest rate risk ratio (IRR) has a significant and positive impact on profitability in Algerian banks;
- The liquidity risk ratio in Algeria showed a negative and significant impact on ROE variation at a 1% significance level;
- The results of the study reveal that there is a positive and statistically significant relationship between the funding liquidity ratio (FL) and the profitability of Algerian banks;
- The results showed that the Algerian banks are not using the PTL in the right way that they are designed for, to the negative relationship proved.

The quantitative study conducted in the third section proved the significance of the relationships between multiple variables and the profitability of the Algerian banking sector, which are macroeconomic variables (GDP and inflation rates), bank-specific variables (size and deposits), risk management efficiency ratio (Equity ratio), and the risk ratios (liquidity risk ratio, credit risk ratios, interest rate risk ratio).

The hypotheses verification allowed us to recommend the professionals and academicians in the same field of research to take into consideration the following enlightenment:

The Algerian economy has its specificities, as a hydrocarbon exporting country, which influences the value of its currency, the stability of the inflation rates, and the

monetary market rate. Therefore, chocks on the oil prices might destabilize the complete financial system of the country, and by implication the banking financial performance.

The insights provided by our results clarify several interesting facts about the economic stability, risk management, and banking profitability in Algeria. Moreover, The Algerian financial authorities are required to review the regulatory dispositions that control the banking activity.

Precisely, the state-owned banks that control and dominate the banking sector need to reset their strategic objectives to achieve the bank's financial soundness, and not for the governmental goals.

The study also reviled numerous shortages in terms of the relationship between risk management and profitability in Algerian banks, starting with the result that showed the negative influence of the risk management efficiency ratio on the profitability.

Therefore we recommend the Algerian bank's management with high capitalization to be more extroverted in terms of strategy setting. As overly conservative management might not be taking advantage of the Algerian banking market opportunities and consequently expecting lower profitability.

Our results also shed light on the relationship between risk management using different risk ratios and the level of financial performance of Algerian banks. We observed dissimilar results depending on the bank ownership structure, which explains the mixed results presented in the context of the empirical studies that focus on this relationship.

- **Contributions And Limits Of The Study**

In the empirical phase, we presented the literature review that tried to analyze the impact of risk management and economic stability on the financial performance in banking.

Therefore, we can state that this research differs from other studies on numerous points, on one hand, the present research distinguished the sample based on the ownership structure and applied a data analysis on the different performance indicators of the state-owned banks and private-owned banks, which allowed us to compare the financial efficiency of the two categories.

Moreover, to comprehend the factors that determine the economic stability in Algeria, we conducted a VAR model on monthly macroeconomic collected data, which permitted the definition of the long-term and short-term relationships between the macroeconomic variables and the economic stability in Algeria presented by the GDP growth.

Then finally, we conducted a panel data analysis on several types of variables (internal, external, and macroeconomic) in the Algerian banking system for ten (10) years for the period 2010 to 2019.

In addition, our study contributed theoretically to ameliorate the comprehension of the banking financial performance determinants and indicators, also clarified the different concepts of banking risks and their management by the presentation of the most recent theoretical and empirical studies made on this subject and which constitute the major contribution of the study on the theoretical level.

Methodologically, this research conducted an econometric study, which is based on an analysis of econometric regressions on panel data and time series on the VAR model that have several advantages to test our research hypotheses. This is through the estimation of our research models, based on data from eighteen (18) Algerian banks for ten (10) years using Eviews 8.1 software.

Furthermore, the study is characterized by its attempt to make recommendations that will enable the financial authorities and academicians to take the necessary actions to improve the effectiveness of risk management in the Algerian banks, and consequently, increase their financial performance.

Moreover, different research pointed out that the presence of gaps in banking risk management leads to deterioration the bank profitability.

Therefore, this study can be useful for the Algerian banks, which will allow them to draw the necessary measures to improve in terms of their risk management practices and financial performance. In addition, it can help to expose the macroeconomic factors that most influence their profitability.

Despite the contributions mentioned above, certain limits should be underlined. This study is an attempt to analyze the impact of risk management and economic stability on the financial performance of Algerian banks.

However, one of the main limits of the research is the size of the sample, which is composed of only eighteen (18) banks given the unavailability of the data for the other banks. In addition, the lack of information prevented us from adding the 2020 year to our sample.

Moreover, in comparison to the factors that influence the banking performance cited in the theoretical phase, several variables were also neglected in our research because of the information unavailability. Therefore, this study is focused on analyzing some internal and external risk management variables of which information is available.

Another limitation of this study lies in the choice of our study period, which was limited to the years 2010 to 2019, due to the unavailability of data after the year 2019. In addition, we started with the year 2010 since the financial statements of the years before this year were governed by the old national chart of accounts.

Since these data cannot be mixed with the data of the following period, we have retained only the years after the year 2009 to avoid problems related to the PCN passage -SCF.

Finally, the last limit of this study lies in the fact that it is based on a quantitative study only. However, we wanted to integrate a qualitative study, which is based on the conduct of interviews with the various actors concerned with risk management in banks to know the reality of the application of risk management practices in Algerian banks.

- **Future Paths of Research**

After discussing the limits of our research. We propose the following new paths of research. It can incorporate other internal variables and other measures of financial performance can be used such as the RaRoC, SVA, ROEA, and ROAA.

Our study could be enriched by the use of a qualitative method. through the help of interviews and questionnaires, as it could also be extended by case studies, which will make it possible to highlight other factors which can influence the performance of banks in Algeria.

Alternatively, to keep the same mechanisms used in this study and make a comparison between the application of risk management practices in Algeria and other countries as well as the analysis of the relationship between these variables and the performance banks in these countries. Thus, other studies could be carried out on all the banks operating in the Algerian banking sector.

Finally, other lines of research are also interesting such as the analysis of the role of the Bank of Algeria in the application of the principles of risk management by the Algerian banks. Finally, the study of the impact of banking governance on banking risk management will be of great importance.

BIBLIOGRAPHY

BIBLIOGRAPHY

I. BOOKS

1. Aghrout, A., et al. Restructuring and privatization in Algeria. In Aghrout, A. (Ed.), Algeria in transition: Reforms and development prospects. London: RoutledgeCurzon. 2004.
2. Anolli, M. Risk-Adjusted Performance Measures. Retail Credit Risk Management. 2013.
3. Ayadi R. Banking Business Models. Definition, Analytical Framework and Financial Stability Assessment, Palgrave Macmillan. 2019.
4. BenHalima, A. Le Système Bancaire Algérien: Textes et Réalités. Algiers: Dahlab.1996.
5. Benachenhou, M. Réformes économiques : dette et démocratie. Algiers: Echrifa. 1993.
6. Bessis.J. Risk management in banks. A John Wiley and Sons, Ltd, Publication, third edition. 2011.
7. Blumberg, B and al .Business Research Methods. McGraw-Hill, Maidenhead. 2005.
8. Brigo, D., et al. Counterparty Credit Risk, Collateral and Funding: With Pricing Cases for All Asset Classes, John Wiley & Sons. 2013.
9. Canabarro, E., Duffie, D. Measuring and marking counterparty risk, in Asset/Liability Management for Financial Institutions, Institutional Investor Books, 2003.
10. Candy. P.C. Constructivism and the study of'self-direction in adult learning. Studies in the Education of Adults, 21(2), 1989.
11. Cohen, L., and al, K. Research methods in education (6th ed.). New York, NY: Routledge.2007.
12. Coyle. B. Framework for Credit Risk Management. Chartered Institute of Bankers, United Kingdom.2000.
13. Creswell, J. Research design: Qualitative, quantitative and mixed methods approaches (2nd ed.). Thousand Oaks, CA: SAGE Publications. 2003.
14. Creswell, J. W. Qualitative inquiry and research design: Choosing among five traditions. Thousand Oaks, CA: SAGE Publications. 1998.
15. Creswell, J. W., & Plano Clark, V. L. Designing and conducting mixed methods research. Thousand Oaks, CA: Sage. 2007.
16. Crotty, M. The foundations of social research. London: Sage, 1989.
17. Crotty, M. The Foundations of Social Research: Meaning and Perspectives in the Research Process, London: Sage Publications, 3rd edition, 2003.
18. Crotty, M., Foundations of social research: Meaning and Perspective in the Research Process, London: SAGE Publications Inc, 1998.
19. Danielsson, J.The Value at Risk Reference: Key Issues in the Implementation of Market Risk, Risk Publications, London.2007.
20. Fisher, Ronald A. Statistical Methods and Scientific Inference. New York: Hafner, 1956.
21. Fitelson, B and Hawthorne. J. How Bayesian Confirmation Theory Handles the Paradox of the Ravens. The Place of Probability in Science. Eds. E. Eells and J. Fetzer. New York: Springer, 2010.
22. Flick, U. A companion to qualitative research, constructivism. In U. Flick, E. von Kardorff, & I. Steinke (Eds.), Thousand Oaks, CA: Sage.2004.

BIBLIOGRAPHY

23. Frye, J. Principals of Risk: Finding VaR through Factor-Based Interest Rate Scenarios, in VaR: Understanding and Applying Value at Risk. Risk Publications, London.1997.

24. Gage, N. The paradigm wars and their aftermath: A historical sketch of research on teaching since 1989. In M. Hammersley (Ed.), Educational Research and Evidence-based Practice London, England: Sage. 2007.

25. Gall, M. D., Gall, J. P., & Borg, W. R. Educational research: An introduction (7th ed.). Boston, MA: Pearson. 2003.

26. Gregory, J. Counterparty Credit Risk and Credit Value Adjustment: A Continuing Challenge for Global Financial Markets, John Wiley & Sons. 2012.

27. Grix, J. The Foundations of Research. New York, NY: Palgrave Macmillan.2004.

28. Guba, E. G., & Lincoln, Y. S. Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), Handbook of qualitative research (Vol. 2). Thousand Oaks, CA: Sage.1994.

29. Guba, E. G., & Lincoln, Y. S. Paradigmatic controversies, contradictions, and emerging confluences. In N. K. Denzin & Y. S. Lincoln (Eds.), The Sage handbook of qualitative research (3rd ed).Thousand Oaks, CA: Sage.2005.

30. Hadj-Nacer, A.R. Les Ciels de la réforme. Algiers: E.N.A.G.1990.

31. Kincheloe, J. L., & McLaren, P. Rethinking critical theory and qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), The Sage handbook of qualitative research (3rd ed). Thousand Oaks, CA: Sage. 2005.

32. Leedy, P. & Ormrod, J. Practical research: Planning and design (7th ed.). Upper Saddle River, NJ: Merrill Prentice Hall. Thousand Oaks: SAGE Publications. 2001.

33. Meliani, H., Aghrout, A., and Ammari, A. Economic reforms and foreign direct investment in Algeria. In Aghrout, A., and Bougherira, R.M. (Eds.), Algeria in transition: Reforms and development prospects. London: Routledge.2004.

34. Oufriha, F.Z. La difficile transformation du système bancaire en Algerie. In Chenntouf, T. (Ed.), L'Algérie face à la mondialisation. Dakar: CODESRIA. 2008.

35. Osterwalder, A., & Pigneur, Y. Business model generation: a handbook for visionaries, game changers, and challengers. John Wiley & Sons. 2010.

36. Popper. K. R. The Logic of Scientific Discovery. London: Hutchinson. 1934.

37. Preissl B.et al. E-Life after the Dot Com Bust, Springer.2004.

38. Richards, K. Qualitative inquiry in TESOL. New York, NY: Palgrave Macmillan.2003.

39. Saad, M., Meliani, H., and Benosman, M. The Tortuous and Uncompleted Privatisation Process in Algeria. In Majumdar, A.M., and Saad, M. (Eds.), Transition and development in Algeria: economic, social and cultural challenges . London, UK: Intellect Ltd.2005.

40. Saunders, M and al. Research Methods for Business Students. 4th Edition, Financial Times Prentice Hall, Edinburgh Gate, Harlow.2007.

41. Schurz, Gerhard. Bayesian H-D Confirmation and Structuralistic Truthlikeness: Discussion and Comparison with the Relevant-Element and the Content-Part Approach. Logics of Scientific Discovery. Essays in Debate with Theo Kuipers. Ed. Roberto Festa. Amsterdam: Rodopi, 2005.

42. Schwandt, T.A. Dictionary of qualitative inquiry (2nd Ed.). Thousand Oaks: Sage. 2001.

43. Scott, D., & Usher, R. Researching Education (2nd ed.). London, England: Continuum. 2010.

44. Scott. D. & Usher, R. Researching education: Data, methods, and theory in educational enquiry. New York: Continuum. 2004.
45. Tashakkori, A. & Teddlie, C. Mixed methodology: Combining qualitative and quantitative approaches. Thousand Oaks, CA: SAGE Publications. 1998.
46. Tashakkori, A., & Teddlie, C. Major issues and controversies in the use of mixed methods in the socialand behavioral sciences. In A. Tashakorri & C. Teddlie (Eds.), Handbook of mixed methods in social & behavioral research. Thousand Oaks, CA: Sage. 2003.
47. Vogt, W. Dictionary of statistics and methodology: A nontechnical guide for the social sciences (2nd ed.). Thousand Oaks, CA: SAGE Publications. 1999.

II. ARTICLES

1. Abed, G.T., and Davoodi, H.R. Challenges of growth and globalization in the Middle East and North Africa. Washington, DC: International Monetary Fund.2003.
2. Achtenhagen, L., et al. Dynamics of business models – strategizing, critical capabilities and activities for sustained value creation. Long Range Planning, 46(6), 2013.
3. Adrian, T., Shin, H-S. Liquidity and leverage, Journal of Financial Intermediation, 19, 2010.
4. Afroune. N and Achouche. M. Les déterminants du taux d'intérêt interbancaire Algérien, Roa Iktissadia Review ISSN 2253-0088, V08(01). 2018.
5. Agarwal, S., & Mirza, N. A study on the risk-adjusted performance of mutual funds industry in India. Review of Innovation and Competitiveness, 3(1). 2017.
6. Altman, E.I., Sabato, G. Modelling credit risk for SMEs: Evidence from the US market, Abacus, 43 (3). 2007.
7. Andrianova, S., Demetriades, P., and Shortland, A. Government ownership of banks, institutions and economic growth. Economica, 79(315), 2012.
8. Arellano, M. & Bover, O. Another look at the instrumental variable estimation of error-components models. Journal of Econometrics 68(1). 1995.
9. Arellano, M. and Bond, S. Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. The Review of Economic Studies 58(2). 1991.
10. Arellano, M. Sargan's instrumental variables estimation and the generalized method of moments. Journal of Business & Economic Statistics, 20(4), 2002.
11. Arpa, M., et al. The influence of macroeconomic developments on Austrian banks: implications for banking supervision. BIS Papers, 1, 2001.
12. Athanasoglou, et al. Bank-Specific, Industry Related and Macroeconomic Determinants of Bank Performance. Journal of International Financial Markets, Institutions and Money 18 (2), 2008.
13. Barth J. R., et al. Bank regulation and supervision: what works best?, Journal of Financial Intermediation. 2004.
14. Becker, B., & Ivashina, V. Reaching for yield in the bond market. The Journal of Finance, 70(5), 2015.

BIBLIOGRAPHY

15. Beltratti A., Stulz R.M. The credit crisis around the globe: Why did some banks perform better?, Journal of Financial Economics, 2012.

16. Berger, A.N. and C.H.S. Bouwman. How does capital affect bank performance during financial crises? Journal of Financial Economics 109. 2013.

17. Bergmeir, C., et al. A note on the validity of cross-validation for evaluating autoregressive time series prediction. Computational Statistics & Data Analysis, 120, 2018.

18. Bikker, J.A. and H. Hu, Cyclical Patterns in Profits, Provisioning and Lending of Banks and Pro-cyclicality of the New Basle Capital Requirements. BNL Quarterly Review, 221, 2002.

19. Bikker, J.A., Hu, H. Cyclical patterns in profits, provisioning and lending of banks procyclicality of the new Basel capital requirements. BNL Quarterly Review, 221, 2002.

20. Birindelli.G and Ferretti.P. Operational Risk Management in Banks: Regulatory, Organizational and Strategic Issues. Palgrave Macmillan Studies in Banking and Financial Institutions, Springer. 2017.

21. Black, F., Derman, E., Toy, W. A one-factor model of interest rates and its application to Treasury bond options, Financial Analysts Journal, 46 (1), January–February, 1990.

22. Blaikie, N. Designing Social Research. Cambridge, England: Polity Press.2000.

23. Bonaccorsi. E., Gobbi, G. The changing structure of local credit markets: Are small business special?, Journal of Banking and Finance, 25: 2001.

24. Bouchetara Mehdi, Financial stability and Solvency of Algerian banks, application of stress tests from 2012 to 2016. Financial Markets, Institutions and Risks, Volume 2, Issue 4. 2018.

25. Brigo, D., Mercurio, F. Interest Rate Models – Theory and Practice: With Smile, Inflation and Credit, Springer.2007.

26. Brunnermeier, M.K. Deciphering the liquidity and credit crunch 2007–2008, Journal of Economic Perspectives, 23 (1), 2009.

27. Brunnermeier, M.K., Pedersen, L.H. Market liquidity and funding liquidity, Review of Financial Studies, 22. 2009.

28. Calmès C., Theoret R.The Impact of Off-Balance-Sheet Activities on Banks Returns: An Application of the ARCH-M to Canadian Data, Journal of Banking and Finance. 2010.

29. Campbell, J. Y., Bank insolvency and the problem of non-performing loans. Journal of Banking Regulation, vol. 9, n° 1, 2007.

30. Carbo Valverde S., Rodriguez Fernandez F. The determinants of bank margins in European banking, Journal of Banking and Finance, 2007.

31. Carr, L. T. The strengths and weaknesses of quantitative and qualitative research: What method for nursing? Journal of Advanced Nursing, 20(4),1994.

32. Carrie Williams,. Research methods, Journal of Business & Economic Research, Grand Canyon University, March 2007 Volume 5, Number 3, 2007.

33. Catherine.S.F.H, and Nurul.I.Y. A preliminary study of credit risk management strategies of selected financial institutions in Malaysia. Jurnal Pengurusan, 28. 2009.

34. Chen, Y.-K., et al. Bank liquidity risk and performance. Review of Pacific Basin Financial Markets and Policies, 21(1). 2018.

35. Chen.X, et al. Covariance and precision matrix estimation for high-dimensional time series", The Annals of Statistics, vol. 41, no. 6, 2013.

36. Chesbrough, H. Business model innovation: Opportunities and barriers. Long Range Planning, 43(2–3), 2010.
37. Christian Kalhoefer and Rania Salem, Profitability analysis in Egyptian banking sector. Faculty of Management Technology. GUC. Working Paper No. 7. 2008.
38. Chronopoulos D.K.,et al. The dynamics of US bank profitability, The European Journal of Finance, 2015.
39. Claessens, S. Competition in the financial sector: overview of competition policies. The World Bank Research Observer, 24(1), 2009.
40. Constancio V. Challenges for the European banking industry, conference "European Banking Industry: what's next?", University of Navarra, 7 July. 2016.
41. Cope, E.W., Carrivick, L. Effects of the financial crisis on banking operational losses. Journal of Operational Risk, 8 (3). 2013.
42. Cornett, M. et al. Liquidity risk management and credit supply in the financial crisis. Journal of Financial Economics, 101(2), 2011.
43. Creswell, J. W., & Tashakkori, A. Developing publishable mixed methods manuscripts. Journal of Mixed Methods Research, 1. 2007.
44. Crook, J.N., et al. Recent developments in consumer credit risk assessment, European Journal of Operational Research, 183 (3). 2007.
45. Davis, R. A., Zang, P., & Zheng, T. Sparse Vector Autoregressive Modeling. Journal of Computational and Graphical Statistics, 25(4), 2016.
46. Delis, M.D. Bank competition, financial reform, and institutions: The importance of being developed. Journal of Development Economics, 97(2). 2012.
47. Demirgüç-Knut, A., Huizinga H. Financial structure and bank profitability, World Bank Policy Research Working Paper, n 2430, August. 1999.
48. Demirgüç-Kunt A., Huizinga H. Financial Structure and Bank Profitability, World Bank Policy Research Working Paper, no. 2430, August. 2000.
49. Diamond, D. W., & Rajan, R. G. Liquidity shortages and banking crises. The Journal of Finance, 60(2). 2005.
50. Diamond, D. W., and P. H. Dybvig. Bank runs, deposit insurance, and liquidity. The Journal of Political Economy, 1983.
51. Diamond, D., Rajan, R.G. Fear of fire sales, illiquidity seeking and the credit freeze, Quarterly Journal of Economics,126 (2). 2011.
52. Diamond, D.W. Banks and liquidity creation: A simple exposition of the Diamond-Dybvig model, Fed Res Bank Richmond Economic Quarterly, 93 (2). 2007.
53. Diamond. DW and Raghuram. G Rajan. Fear of Fire Sales and the Credit Freeze, University of Chicago Booth School working paper. 2009.
54. Dietrich A., Wanzenried G.The determinants of commercial banking profitability in low-, middle, and high-income countries, The Quarterly Review of Economics and Finance, 2014.
55. Dietrich, A., and G. Wanzenried. What Determines the Profitability of Commercial Banks? New Evidence from Switzerland. Paper presented at the 12th Conference of the Swiss Society for Financial Market Research, Geneva, Switzerland, April 3, 2009.

56. Dietrich, A., Wanzenried, G. The determinants of commercial banking profitability in low-, middle-, and high-income countries. The Quarterly Review of Economics and Finance, 22, 2014.

57. El-hassar, C. Réformes et opportunités d'investissements dans le secteur bancaire Algerien. Média Bank, 48, 2000.

58. Ellis, B.,et al. Driving value from postcrisis operational risk management, McKinsey Working Paper, no. 34. 2012.

59. Ernst & Young. IFRS 7 in the Banking Industry, available at:www.ey.com/Publication.vw/ LUAssets/Industry_Banking_and_Capital_Markets_IFRS7_in_banking_industry/$FILE /Industry_Banking_and_Capital_Markets_IFRS7_in_banking_industry.pdf (accessed 18 June 2019).2008.

60. F. Han, H. Lu, and H. Liu, A direct estimation of high dimensional stationary vector autoregressions. Journal of Machine Learning Research, vol. 16, 2015.

61. Farazi Subika et al,. Bank Ownership And Performance In The Middle East And North Africa Region. January, The World Bank. 2011.

62. FERROUHI, El Mehdi. Moroccan Banks analysis using camel model. International Journal of Economics and Financial Issues, 43: 2014.

63. Fitelson, Branden. The Paradox of Confirmation. Philosophical Compass 1, 2006.

64. Frame, D.J.and all. Probabilistic climate forecasts and inductive problems. Philosophical Transactions of the Royal Society A (365). 2007.

65. Francis, M. E. Determinants of commercial bank profitability in Sub-Saharan Africa. International Journal of Economics and Finance, 5(9). 2013.

66. Fukuda, S., and Y. Kon . Macroeconomic Impacts of Foreign Exchange Reserve Accumulation: Theory and International Evidence. ADBI Working Paper 197. Tokyo: Asian Development Bank Institute. 2010.

67. Gambacorta L., van Rixtel A. Structural bank regulation initiatives: approaches and implications, BIS Working Papers. 2013.

68. Gelman. A and Shalizi. C.R. Philosophy and the practice of Bayesian statistics. British Journal of Mathematical and Statistical Psychology (66). 2013.

69. Gemes, K. Hypothetico-Deductivism, Content, and The Natural Axiomatization of Theories', Philosophy of Science 60. 1993.

70. Gemes, K. Hypothetico-Deductivism, the Current State of Play, the Criterion of Empirical Significance Endgame, Erkenntnis 49.

71. Glymour, C. Discussion: Hypothetico-Deductivism Is Hopeless', Philosophy of Science 47.1980.

72. Goddard J., et al. Dynamics of Growth and Profitability in Banking, Journal of Money, Credit and Banking. 2004.

73. Goddard J.,et al. Do Bank Profits Converge?, European Financial Management, 2013.

74. Goddard, J., et al. The profitability of European banks: a cross-sectional and dynamic panel analysis. Manchester School, 72(3), 2004.

75. Golub, B.W., Tilman L.M. Measuring yield curve risk using principal components, analysis, value at risk, and key rate durations, The Journal of Portfolio Management, 23 (4), 1997.

76. Nelson, C.R., Siegel, A.F.Parsimonious modeling of yield curves, Journal of Business, 60, 1987.
77. Goodhart.C. Liquidity risk management. Financial stability review, special issue liquidity 11. 2008.
78. Gordy,M.B. Acomparative anatomy of credit riskmodels, Journal ofBanking&Finance, 24 (1–2), 2000.
79. Gourieroux, C., & Jasiak, J. Noncausal vector autoregressive process: Representation, identification and semi-parametric estimation. Journal of Econometrics, 200(1),2017.
80. Griffin Wiersma NS. The wesleyan tradition and qualitative inquiry in contemporary counseling psychology: Heart and mind as art and science. Christian Scholar's Review, 36(2). 2007.
81. Hacini, I., Dahou, K., Comparison on Efficiency of Foreign and Domestic Banks Evidence from Algeria. Journal of Banking and Financial Economics. 2018a.
82. Härdle, W., Tsybakov, A. and Yang, L. Nonparametric vector autorgression, Journal of Statistical Planning and Inference 68: 1998.
83. Hartmann, P., et al. Melting Down: Systemic Financial Instability and the Macroeconomy. European Central Bank (ECB).
84. Hatemi-J.A. A new method to choose optimal lag order in stable and unstable VAR models. Applied Economics Letters (10:3), 2003.
85. Hempel, Carl G. A Purely Syntactical Definition of Confirmation. Journal of Symbolic Logic 8. 1943.
86. Huang, et al. The causal relationship between energy consumption And GDP growth revisited: A dynamic panel data approach. Ecological Economics 67. 2008.
87. Iannotta G.,et al. Ownership structure, risk and performance in the European banking industry, Journal of Banking and Finance,2007.
88. Iannotta, G., et al. Ownership structure, risk and performance in the European banking industry. Journal of Banking and Finance, 31 (7). 2007.
89. Ihaddaden. Mf and Bouhaba. M, a performance comparison between state-owned, mixed and private banks in Algeria, Les Cahiers du Cread, vol. 35 (n° 01), 2019.
90. Ishaq HACINI, Khadra DAHOU. The Evolution of the Algerian Banking System. Management Dynamics in the Knowledge Economy Vol.6 (2018) no.1, 2018.
91. Islam, M. S., & Nishiyama, S. I. The determinants of bank net interest margins: A panel evidence from South Asian countries. Research in International Business and Finance, 37(3). 2016. https://doi.org/ 10.1016/j.ribaf.2016.01.024.
92. Ivankova, N. V., and al. Using Mixed-Methods Sequential Explanatory Design: From Theory to Practice. Field Methods, 18(1), 2006.
93. James Scotland. Exploring the Philosophical Underpinnings of Research: Relating Ontology and Epistemology to the Methodology and Methods of the Scientific, Interpretive, and Critical Research Paradigms, Canadian Center of Science and Education, Vol. 5, No. 9; 2012.
94. Jobst A., Weber A. Profitability and Balance Sheet Repair of Italian Banks, IMF Working Paper, WP/16/175. 2016.
95. Johnson, R. B. & Onwuegbuzie, A. J. Mixed methods research: A research paradigm whose time has come. Educational Researcher, 33(7), 2004.

96. Jorion P, et al. Informational Effects of Regulation FD: Evidence from Rating Agencies. Journal of Financial Economics76. 2005.

97. Jorion, P. Risk2: Measuring the risk in value at risk, Financial Analysts Journal, 52 (6), 1996.

98. Kanas A., Vasiliou D., Eriotis N. Revisiting bank profitability: A semi-parametric approach, Journal of International Financial Markets, Institutions & Money, 2012.

99. Kealhofer, S. Quantifying credit risk I: Default prediction, Financial Analysts Journal, 3, 2003.

100. Kiefer K M. Default Estimation, Correlated Defaults, andExpert Information. Journal of Applied Econometrics 26. 2011.

101. Kithinji.A.M. Credit risk management and profitability of commercial banks in Kenya. School of business, university of nairobi, nairobi – kenya. 2010.

102. Kok C., Móré C., Pancaro C. Bank Profitability Challenges in Euro Area Banks: The Role of Cyclical and Structural Factors, Financial Stability Review, Volume 1, European Central Bank. 2015.

103. Labra. R, and Torrecillas. C. Estimating dynamic Panel data. A practical approach to perform long panels. Revista Colombiana de Estadística. Volume 41, Issue 1, January 2018.

104. Laeven, L. and Levine, R., Bank governance, regulation and risk taking. Journal of Financial Economics,vol. 93, 2009.

105. Lamarque, E. and Maurer, F., Le risque Opérationnel Bancaire: Dispositif d'évaluation et système de pilotage. Revue française de gestion, vol. 191, 2009.

106. Logan A. The United Kingdom's small banks' crisis of the early 1990s: what were the leading indicators of failure?, Bank of England Working Paper.2001. P.139.

107. Longin, F.M. From value at risk to stress testing: The extreme value approach, Journal of Banking & Finance, 24, 2000.

108. Lin, X., and Zhang, Y., 2009, Bank Ownership Reform and Bank Performance in China. Journal of Banking and Finance, Vol. 33, 2009.

109. Lutkepohl, H. New introduction to multiple time series analysis. Springer Science & Business Media. 2005.

110. Macey, J. R. and O'Hara, M., The corporate governance of banks. Economic Policy Review, vol. 9, n° 1, 2003.

111. Mackenzie, N. & Knipe, S. Research dilemmas: paradigms, methods and methodology. Issues In Educational Research, 16, 2006,

112. Mao, X.. Stationary distribution of stochastic population systems. Systems and Control Letters 60, 2011.

113. Marcia Millon Cornett et al., The impact of state ownership on performance differences in privately-owned versus state-owned banks: An international comparison, Journal of Financial Intermediation, January 2010.

114. Marija.K. Operational risk: challenges for banking industry. Procredit Bank, Belgrade, Serbia. Vol. 46, No. 1-2, 2013.

115. McDonald, and L. Schumacher. The Determinants of Commercial Bank Profitability in Sub-Saharan Africa. Working Paper No. 09/15. International Monetary

Fund, Washington, DC. 2009. https://www.imf.org/external/pubs/ft/wp/2009/wp0915.pdf.

116. Milanova. E. Market risk management in banks – Models for analysis and assessment. FACTA UNIVERSITATIS, Series: Economics and Organization Vol. 7, No 4, 2010.

117. Mirković, V. Soundness of market risk measurement techniques during global financial turmoil. Ekonomika, br. 1, 2013.

118. Mirzaei A., et al. Does market structure matter on banks' profitability and stability? Emerging vs. advanced economies, Journal of Banking and Finance, 2013.

119. Mishra, P., Montiel, P., Pedroni, P., and Spilimbergo, A. Monetary policy and bank lending rates in low-income countries: Heterogeneous panel estimates. Journal of Development Economics, 111(C), 2014.

120. Molyneux P., Thornton J. Determinants of European bank profitability: A note, Journal of Banking and Finance,1992.

121. Moody's investors service, banking account and ratio definitions, February 2011, PP.2-6.

122. Moretti, Luca. The Tacking by Disjunction Paradox: Bayesianism versus Hypothetico-Deductivism. Erkenntnis (64). 2006.

123. Moretti, Luca. The Tacking by Disjunction Paradox: Bayesianism Versus Hypothetico-Deductivism. Erkenntnis (64). 2006.

124. Musiega. M. et al. Influence of interest rate risk on performance of commercial banks in Kenya, Economics and Finance Review Vol. 5(02) ,June, 2017.

125. Naceur, S. B. The determinants of the Tunisian banking industry profitability: Panel evidence, Universite Libre de Tunis Working Papers. 2003.

126. Novickytė.L and Petraitytė.I. Assessment of banks asset and liability management: problems and perspectives (case of Lithuania). Social and Behavioral Sciences (110). Elsevier. 2014.

127. Ojo, A., Efficiency of Capital Regulation for Nigerian Banks. Nigerian Journal of Economics and Social Science vol. 51(2). 2008.

128. Olson, D., and Zoubi, T.A. Efficiency and bank profitability in MENA countries. Emerging markets review, 12(2), 2011.

129. Ozili, P. K. Bank profitability and capital regulation: Evidence from listed and non-listed banks in Africa. Journal of African Business, 18(2). 2017. https://doi.org/10.1080/15228916.2017.124732-9.

130. Ozturk, M and Aktan, B. The New Basel Capital Accord: In search of Excellence at Bank Risk Management ,Review of Social, Economic and Business Studies, Vol.7/8. 2007.

131. Panayiotis P. Athanasoglou. And al. Bank-specific, industry-specific and macroeconomic determinants of bank profitability. Int. Fin. Markets, Inst. and Money (18). 2008 .

132. Paola Sapienz. The Effects of Government Ownership on Bank Lending, Journal of Financial Economics, Northwestern University & CEPR, October 2002,

133. Park, S-J. Hypothetico-Deductivism Is Still Hopeless, Erkenntnis 60. 2004.

134. Patton, M. Q. Qualitative evaluation and research methods (2nd ed.). Sage Publications, Inc. 1990,

135. Patton, M. Q. Qualitative research and evaluation methods (3rd ed.). Thousand Oaks, CA: Sage. 2002.

136. Perold, A. Capital allocation in financial firms. J. Appl. Corp. Finance 17, 2005.

137. Pesaran, H. H., & Shin, Y. Generalized impulse response analysis in linear multivariate models. Economics Letters, 58(1),1998.

138. Poon, S-H., Granger, C. Forecasting volatility in financial markets: A review, Journal of Economic Literature, XLI, 2003.

139. Popkewitz, T. S., Tabachnick, B. R. and Zeichner, K. Dulling the Senses: Research in Teacher Education. Journal of Teacher Education, 30(5), 1979.

140. Prowse, S., Corporate control in commercial banks, Journal of Financial Research, Vol.20, 1997.

141. Rasiah D. Review of Literature and Theories on Determinants of Commercial Bank Profitability, Journal of Performance Management, 2010.

142. Rasiah D. Review of Literature and Theories on Determinants of Commercial Bank Profitability, Journal of Performance Management, 2010.

143. Reddy, K., et. al. Comparative risk adjusted performance of Islamic, socially responsible and conventional funds: Evidence from United Kingdom. Economic Modelling, 66. 2017.

144. Reinhart C.M., Rogoff K.S. This Time is Different. Eight Centuries of Financial Folly, Princeton University Press. 2009.

145. Robert Cull et al., Bank Ownership Trends and Implications, Policy Research Working Paper (8297), world bank group, 2018.

146. Roengpitya R., et al. Bank Business Models: Popularity and Performance, BIS Working Paper No. 682, December. 2017.

147. Ruíz-Porras, A. Econometric research with panel data: History, models and uses in Mexico, MPRA-paper 42909, University Library of Munich, Germany. 2012.

148. Ruppert, E. The Algerian Retrenchment System: a financial and economic evaluation. The World Bank Economic Review, 13(1), 1999.

149. Ruziqa, A. The impact of credit and liquidity risk on bank financial performance: The case of Indonesian Conventional Bank with total asset above 10 trillion Rupiah. International Journal of Economic Policy in Emerging Economies, 6(2). 2013.https://doi.org/10.1504/IJEPEE.2013.055791.

150. Salmon, W. C. The foundations of scientific inference. Pittsburgh: University of Pittsburgh Press.1967.

151. Samih.A.A and Aboukhodor.W. Foreign Exchange Reserves and the Macro-economy in the GCC Countries, Accounting and Finance Research Vol. 6, No. 3. Sciedu Press. 2017.

152. Santomero, A. M. Commercial bank risk management: an analysis of the process. Journal of Financial Services Research, 12(2-3). 1997. https://doi.org/10.1023/A:1007971801810.

153. Sanya S., Wolfe S. Can Banks in Emerging Economies Benefit from Revenue Diversification?, Journal of Financial Services Research, 2011.

154. Sargan, J. D. The estimation of economic relationships using instrumental variables. Econometrica: Journal of the Econometric Society 26. 1958.

155. Schulze, S. Views on the Combination of Quantitative and Qualitative Research Approaches. University of South Africa. Progressio 25(2), 2003.

156. Schwaiger, M.S., Liebig, D. Determinants of bank interest margins in Central and Eastern Europe. Financial Stability Report, 14, 2008.

157. Shashidhar, M. Market-implied risk-neutral probabilities, actual probabilities, credit risk and news, IIMB Management Review, 23 (3). 2011.

158. Shehzad C.T., et al. The relationship between size, growth and profitability of commercial banks, Applied Economics, 2013.

159. Singh, M. K. Value at risk using principal components analysis, The Journal of Portfolio Management, 24 (1), 1997..

160. Slavin, R. E. Research methods in education: A practical guide. Englewood Cliffs, NJ: Prentice-Hall.1984. Sprenger, J. Hypothetico-Deductive Confirmation. Philosophy Compass, 6(7), 2011.

161. Stiroh K.J. A Portfolio View of Banking with Interest and Noninterest Activities, Journal of Money, Credit, and Banking, 2006.

162. Stiroh K.J., Rumble A.The Dark Side of Diversification: The Case of U.S. Financial Holding Companies, Journal of Banking and Finance, 2006.

163. Stoughton, N. M., & Zechner, J. Optimal capital allocation using RARO and EVA. Journal of Financial Intermediation, 16(3), 2007.

164. Tregenna F. The fat years: the structure and profitability of the US banking sector in the pre-crisis period, Cambridge Journal of Economics. 2009.

165. Vallelado, Teyo, and Paolo Saona. An integrated model of capital structure to study the differences in the speed of adjustment to target corporate debt maturity among developed countries. International Journal of Banking, Accounting and Finance 3.2011.

166. Vazquez, F., Tabak, B.M. and Souto, M., A macro stress test model of credit risk for the Brazilian banking sector. Journal of Financial Stability, Vol. 8, Issue 2, 2012.

167. Wetmore, J. L., & Brick, J. R. Commercial bank risk: market, interest rate, and foreign exchange. Journal of Financial Research, 17(4), 1994.

168. Zhang, Z., Zhang, X., & Tong, J. Exponential ergodicity for population dynamics driven by α-stable processes. Statistics & Probability Letters (125). 2017.

169. Zimmerman, G. Factors influencing community bank performance in California. Federal Reserve Bank of San Francisco 1. 1996.

170. Zott, C., et al. The business model: Recent developments and future research, Journal of Management, 37(4), 2011.

III. DOCUMENTS AND REPORTS

1. Abreu M., Mendes V. Commercial bank interest margins and profitability: evidence for Some EU Countries, Proceedings of the Pan-European Conference Jointly organized by the IEFS-UK & University of Macedonia Economic and Social Sciences, Thessaloniki, Greece, 17–20 May.2001.

BIBLIOGRAPHY

2. Basel Committee on Banking Supervision. International convergence of capital measurement and capital standards: A revised framework – Comprehensive version, Bank for International Settlements, BCBS publications. 2006.

3. BCBS – Basel Committee on Banking Supervision, Basel III: Finalizing post-crisis reforms, December. 2017.

4. BCBS – Basel Committee on Banking Supervision. International Convergence of Capital Measurement and Capital Standards. A Revised Framework. Comprehensive Version, June. 2006.

5. BCBS (Basel Committee on Banking and Supervision). Basel III: The liquidity coverage ratio and liquidity risk monitoring tools, January. 2013.

6. BCBS (Basel Committee on Banking Supervision). Review of the Pillar 3 disclosure requirements, June 2014.

7. Beyond ROE – how to measure bank performance, European central bank report, 2011.

8. BIS – Bank for International Settlements, Annual Economic Report.2018.

9. CBA (2017). Annual Report of Central Bank of Algeria 2016. Algeria: Central Bank of Algeria.

10. CGFS – Committee on the Global Financial System. Structural changes in banking after the crisis, CGFS Papers No. 60, January. 2018.

11. Claessens S.,et al. Low-for-long Interest Rates and Net Interest Margins of Banks in Advanced Foreign Economies, IFDP Notes, Board of Governors of the Federal Reserve Board, Washington, DC. 2016.

12. Das, et al, Economics of Sovereign Wealth Funds: Issues for Policymakers. Washington: International Monetary Fund. 2010.

13. ECB Banking Supervision. SSM thematic review on profitability and business model. Report on the outcome of the assessment, September.2018.

14. ESRB – European Systemic Risk Board. A new database for financial crises in European countries. Occasional Paper Series, No 13/July. 2017.

15. FMI's Report No. 14/161. Financial System Stability Assessment. 2014.

16. Fontnouvelle, P, et al. Using loss data to quantify operational risk, Federal Reserve, April, 2003.

17. FSI – Financial Stability Institute. The identification and measurement of non-performing assets: a cross-country comparison, FSI Insights on policy implementation, Bank of International Settlements, No. 7, April. 2018.

18. IMF – International Monetary Fund. Spain: Financial Sector Assessment Report; Technical Note: Determinants of Bank Profitability, IMF Country Report No. 17/339, Washington, DC. 2017.

19. IMF Country Report No. 14/161, Algeria financial system stability assessment, 2014. Https://www.imf.org/external/pubs/ft/scr/2014/cr14161.pdf.

20. Krosner, S. Risk management and Basel II, speech at the Federal Reserve Bank of Boston, AMA Conference, Boston, May 14. 2008.

21. Kuhn, T. S. The structure of scientific revolutions.(1st Edn). Chicago, IL: University of Chicago Press.1962.

22. Latrach, T.Z. Banking techniques. Algeria: University Publications Offices. 2001.

23. Neely, et al. Why Does Bank Performance Vary Across States? Federal Reserve Bank of St. Louis Review, March/April. 1997. PP. 27–40.
24. Osterwalder, A., et al. Clarifying business models: Origins, present, and future of the concept. Communications of the association for Information Systems. 2005.
25. Roodman, D. How to do xtabond2: An introduction to difference and system GMM in Stata. 2006.
26. World Bank. Financial Sector Assessment : Algeria. Washington, DC. © World Bank. 2004. https://openknowledge.worldbank.org/handle/10986/15942 License: CC BY 3.0 IGO.
27. Zumbach, G. The Risk Metrics 2006 Methodology, Risk Metrics Group. 2007.

IV. LAWS

1. Loi 90/10 du 14/04/1990 relative à la monnaie et au crédit.

V. WEB-REFERENCES

1. CBA (2013). Banques et établissement financiers. Retrieved on April the 11, 2019, from: http://www.bank-of-algeria.dz/html/banque.htm.
2. Coface. For trade. https://www.coface.com/Economic-Studies-and-Country-Risks/Algeria.
3. HIS. Markit. Gabrielle Ventura. 18 March 2021. https://ihsmarkit.com/research analysis/algerias-banking-risk-rating veryhigh.risk.html#:~:text=Government%20deposit%20drawdown%20is%20the%20biggest%20liquidity%2risk%20to%20Algerian%20banks.&text=Government%20deposit%20data%20are%20released,%25%20 rom%202.1%25%20in%202019.
4. https://ihsmarkit.com/research-analysis/algerias-banking-risk-rating-very-high-risk.html. Visited: 25/04/2021 at 04:33AM.
5. https://doi.org/10.1016/j.jbankfin.2006.07.013.
6. Investopedia. https://www.investopedia.com/ask/answers/040815/what-level-return-equity-common-company-banking-sector.asp. Visited the 17/04/2020.
7. www.oenb.at/en/img/operational_risk_screen_tcm16-49652.pdf. (Accessed March 30, 2020).
8. Rao.M, et al, Estimation in autoregressive processes with partial observations: Proofs. Available: http://stanford.edu/~milind/reports/system_id_icassp_proof.pdf.
9. Rubi Ahmad and Bolaji Tunde Matemilola. Determinants of Bank Profits and Net Interest Margins. Researchgate. 2014. https://www.researchgate.net/publication/257811193.
10. Tesfaye. B. Research design and methodology, University of South Africa, https://www.researchgate.net/publication/329715052 , consulted the 30/11/2019, at 21:00h.

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APPENDIX N°01: FINANCIAL STATEMENT DATABASE OF THE ALGERIAN BANKS

Bank	Year	Size	Deposits	ROA	ROE	Equity ratio	FL	IRR	CR	LTD	PTL	NPL
BADR	2010	20,5196339	20,267007	0,01283261	0,31722303	0,04045295	0,40805453	0,05520591	1,0535E-09	0,52533056	0,23644074	0,35069863
BADR	2011	20,6463058	20,4222781	0,01069946	0,30020976	0,03563996	0,4645904	0,06114673	6,3788E-10	0,58125171	0,17787808	0,27440028
BADR	2012	20,7112536	20,4786947	0,00998008	0,29881545	0,0333988	0,49729649	0,05139646	4,3617E-10	0,62750097	0,15506077	0,21431622
BADR	2013	20,8378857	20,6443099	0,00494474	0,16803821	0,02942627	0,51750918	0,058074	3,1055E-10	0,62803953	0,14609725	0,18022854
BADR	2014	21,0432474	20,8746921	0,00492832	0,20566052	0,02396336	0,54203644	0,05132652	1,9488E-10	0,64155089	0,12156142	0,14546375
BADR	2015	20,9907279	20,7973038	0,00578549	0,22907794	0,02525554	0,6875952	0,04581156	1,8019E-10	0,83432619	0,12029027	0,16189265
BADR	2016	20,9648526	20,7216803	0,01070069	0,41287426	0,02591756	0,74358602	0,06113729	1,716E-10	0,94828654	0,12834037	0,1624664
BADR	2017	21,0218475	20,7533915	0,00789115	0,19697841	0,04006096	0,7487511	0,06399812	1,8706E-10	0,97932412	0,14195394	0,18879726
BADR	2018	21,1134002	20,8634824	0,0107886	0,29512395	0,03655616	0,73390626	0,05730952	3,7433E-10	0,94227681	0,14661823	0,4058129
BADR	2019	21,1781013	20,8342153	0,0033148	0,09673782	0,03426583	0,77757043	0,04859225	1,9077E-10	1,09669921	0,15250132	0,23377061
BDL	2010	19,7375036	19,5245089	0,00230492	0,05443611	0,04234169	0,49498645	0,0641985	1,3216E-09	0,61248534	0,15440553	0,2441025
BDL	2011	19,8882342	19,710593	0,00555564	0,15255524	0,03641722	0,53225119	0,05256053	1,2308E-09	0,63571903	0,15403568	0,28422344
BDL	2012	19,9294568	19,710593	0,00501573	0,14352596	0,03494652	0,67094238	0,04177963	7,1326E-10	0,83509631	0,12262283	0,21636576
BDL	2013	20,1565029	19,8620746	0,00531533	0,19086703	0,02784833	0,72997726	0,03662946	4,4835E-10	0,97989132	0,09409717	0,18568672
BDL	2014	20,3764403	20,1330202	0,00323954	0,14494473	0,0223502	0,72148057	0,04076013	3,4663E-10	0,92032382	0,08205592	0,17679303
BDL	2015	20,5103236	20,2449308	0,01262148	0,27719337	0,04553312	0,70744562	0,05102781	2,4723E-09	0,9224688	0,07953831	1,41353621
BDL	2016	20,5571236	20,3139032	0,02600608	0,59851136	0,04345127	0,77091242	0,06654421	3,3397E-10	0,98318297	0,08174765	0,21804928
BDL	2017	20,6204378	20,3315921	0,01877862	0,46042435	0,04078547	0,84781055	0,05988324	3,1094E-10	1,13173022	0,0867071	0,23786162
BDL	2018	20,77099	20,5166989	0,02069474	0,58984576	0,035085	0,79925521	0,06292815	3,2822E-10	1,03067719	0,09205194	0,27515474
BDL	2019	20,8295629	20,5010305	0,01855522	0,56076694	0,033089	0,8548595	0,04667931	3,3316E-10	1,18733847	0,09736224	0,31674498
BEA	2010	21,5851537	21,2425506	0,0108049	1,04416204	0,01034792	0,18356288	0,07127888	5,4736E-10	0,25856841	0,24025219	0,23788573
BEA	2011	21,6656611	21,5213866	0,0152321	0,51430809	0,02961669	0,20616768	0,07090766	5,5555E-10	0,23816513	0,20765043	0,29391321
BEA	2012	21,5359031	21,344775	0,02086719	0,61883424	0,03372017	0,29409988	0,0495948	3,477E-10	0,35604162	0,1568201	0,23047311
BEA	2013	21,4473635	21,2142044	0,01372361	0,28310001	0,04847618	0,40535642	0,03982749	2,159E-10	0,51179589	0,12189273	0,18053876

BEA	2014	21,6491782	21,4381329	0,01599756	0,4038055	0,03961698	0,38248352	0,04703393	1,8184E-10	0,47235501	0,10909675	0,17555856
BEA	2015	21,6506717	21,4020888	0,01813778	0,45851261	0,03955786	0,52451922	0,03203503	1,0839E-10	0,67254224	0,08185762	0,14371703
BEA	2016	21,6687294	21,3747506	0,01780965	0,30561432	0,05827492	0,66091392	0,02926767	8,0532E-11	0,88678486	0,07614505	0,13700129
BEA	2017	21,8617966	21,6068228	0,02467838	0,51366857	0,04804339	0,62711033	0,0490947	7,4308E-11	0,80924056	0,07670406	0,14549073
BEA	2018	21,9163774	21,6181186	0,03129405	0,68791108	0,04549142	0,6857747	0,05845767	6,4332E-11	0,92408856	0,07435789	0,14546825
BEA	2019	21,9057195	21,395608	0,02503886	0,3551565	0,07050091	0,72199406	0,04963207	8,5677E-11	1,20246438	0,08154619	0,2018042
CPA	2010	20,518381	17,1305739	0,02064771	0,35046948	0,05891442	0,41347406	0,05815919	4,5325E-10	12,2392322	0,09115682	0,15268674
CPA	2011	20,7135797	20,3512974	0,01758412	0,36280469	0,04846719	0,47019043	0,05978604	2,602E-10	0,67547769	0,07665002	0,12116305
CPA	2012	20,8647672	20,5676433	0,01765449	0,42370846	0,04166659	0,49407454	0,06600365	2,1383E-10	0,6650155	0,06471518	0,12170413
CPA	2013	21,0325414	20,6888272	0,01619038	0,45954973	0,03523097	0,50150742	0,06377628	1,5542E-10	0,70721349	0,05591584	0,10619181
CPA	2014	21,136734	20,832836	0,01654775	0,52127246	0,03174492	0,52563866	0,06147751	1,1915E-10	0,71230921	0,05517242	0,09470358
CPA	2015	21,2409432	20,96281	0,02264489	0,79168681	0,02860334	0,63138889	0,05615063	7,711E-11	0,83385136	0,04555394	0,08170143
CPA	2016	21,2577494	20,8598774	0,01999503	0,71089283	0,02812665	0,71188444	0,0592596	7,9803E-11	1,05974919	0,04428149	0,09695129
CPA	2017	21,3769098	20,9568048	0,02225053	0,89119571	0,02496705	0,64410563	0,06506458	9,0861E-11	0,98040691	0,04484317	0,11251442
CPA	2018	21,5379861	21,1043469	0,02408991	1,13350248	0,02125263	0,62052967	0,06070217	7,7896E-11	0,95739171	0,04040595	0,10917074
CPA	2019	21,6453098	21,0596015	0,01140069	0,59721198	0,01908986	0,62142644	0,0595982	1,044E-10	1,11624515	0,05787706	0,16313531
CNEP	2010	20,6197135	20,5233418	0,00246686	0,15887071	0,01552745	0,36786156	0,08326409	5,2848E-10	0,4050775	0,12524332	0,17528309
CNEP	2011	20,7243276	20,6383649	0,00222183	0,15887071	0,01398514	0,34432053	0,08012091	4,3042E-10	0,37522872	0,09236756	0,14836154
CNEP	2012	20,8168687	20,7355476	0,00187862	0,14735393	0,01274902	0,38422983	0,08079565	2,9069E-10	0,41678145	0,07445649	0,12265011
CNEP	2013	20,8819247	20,8042219	0,00041754	0,03495192	0,01194602	0,47010416	0,06645772	1,9838E-10	0,50808927	0,05779062	0,10929234
CNEP	2014	20,9515448	20,8705177	0,00240088	0,21546752	0,01114263	0,52833184	0,06772952	1,4646E-10	0,57292318	0,05498297	0,09722409
CNEP	2015	21,0119699	20,9046584	0,00564033	0,16365488	0,03446476	0,57068352	0,06062174	1,1043E-10	0,63533114	0,04955229	0,08411056
CNEP	2016	21,0630661	20,9502291	0,00689298	0,21048565	0,03274797	0,56045101	0,06551396	1,4351E-10	0,62739657	0,05523285	0,11298115
CNEP	2017	21,0751076	20,9609807	0,00839622	0,25949509	0,03235601	0,62916718	0,06475469	1,2846E-10	0,70522996	0,05794414	0,11490561
CNEP	2018	21,1164515	20,9939639	0,00861624	0,27753529	0,03104556	0,67887162	0,05374818	1,3071E-10	0,76733209	0,05633811	0,13147461
CNEP	2019	21,1540413	20,9853575	0,00505947	0,16921191	0,02990022	0,73074156	0,05559719	1,2138E-10	0,86501227	0,0640093	0,13645449
BNA	2010	21,0751089	20,3338127	0,03202533	1,09446986	0,02926105	0,5245357	0,07668004	3,0787E-10	1,10081892	0,13249043	0,22958516
BNA	2011	21,1905401	20,6112329	0,02893089	1,10969373	0,02607106	0,61455314	0,06531282	1,357E-10	1,0968553	0,08697737	0,13306455

BNA	2012	21,4460105	20,9543119	0,01760708	0,87192296	0,02019339	0,60610888	0,06037809	9,0743E-11	0,99104331	0,07284598	0,11330468
BNA	2013	21,5051989	21,0779502	0,01957056	1,02825111	0,01903286	0,65269452	0,06668653	7,0216E-11	1,00060286	0,06419092	0,10016976
BNA	2014	21,6866765	21,2321174	0,01522398	0,95904488	0,01587411	0,73115629	0,05822303	4,8905E-11	1,15192111	0,05499662	0,09370656
BNA	2015	21,7235599	21,222425	0,01533727	1,00248257	0,01529929	0,5985975	0,08613894	7,4474E-11	0,98804113	0,08287138	0,12121697
BNA	2016	21,7682562	21,188478	0,01541761	1,05379788	0,01463052	0,53591337	0,08477306	1,2966E-10	0,95694958	0,11165315	0,19758325
BNA	2017	21,7630595	21,2738804	0,0146235	0,99433911	0,01470675	0,62708687	0,0648857	1,041E-10	1,02276417	0,09843228	0,18465277
BNA	2018	21,8534822	21,3551152	0,01615988	0,33357515	0,04844451	0,6425162	0,06985313	9,0345E-11	1,05760165	0,09623118	0,17973504
BNA	2019	21,9730613	21,4166046	0,00812971	0,18913116	0,04298451	0,6424131	0,0622529	8,3724E-11	1,12067697	0,09898347	0,18769194
ABC	2010	17,5006887	16,8173137	0,03628786	0,1446152	0,25092704	0,45571196	0,07919137	4,7677E-09	0,90256074	0,05656717	0,08658606
ABC	2011	17,5535364	16,9102326	0,02977046	0,12508049	0,23801045	0,39838593	0,11434655	1,5862E-09	0,75803149	0,02622377	0,02655081
ABC	2012	17,6748635	17,1638031	0,0370954	0,17596072	0,21081635	0,43052886	0,07961278	9,8392E-10	0,71771662	0,01974465	0,02009369
ABC	2013	17,7429294	17,0793958	0,02656834	0,13490274	0,19694441	0,58492326	0,06713873	7,5303E-10	1,13571115	0,01611074	0,02236501
ABC	2014	17,8087047	17,2148021	0,03380172	0,18329936	0,18440718	0,57557724	0,07637165	1,025E-09	1,04239475	0,0200222	0,03199168
ABC	2015	18,009328	17,3999133	0,02582624	0,1711642	0,15088575	0,5929315	0,06772525	7,967E-10	1,09061121	0,01874023	0,0313077
ABC	2016	18,0673076	17,5289232	0,02461349	0,17286424	0,14238623	0,63695493	0,07066129	7,5455E-10	1,09125462	0,0180227	0,03375428
ABC	2017	18,3265086	17,7716027	0,02593308	0,23602373	0,10987489	0,50414469	0,07741411	6,8439E-10	0,87810764	0,01814866	0,03140238
ABC	2018	18,1246026	17,4985842	0,03212101	0,23889334	0,13445752	0,66338592	0,07506245	6,4991E-10	1,24063095	0,01886813	0,03206504
ABC	2019	18,1819775	17,616679	0,02259343	0,11863789	0,19044027	0,61735546	0,07423439	8,4213E-10	1,08652888	0,01971793	0,04094935
AGB	2010	17,8637366	17,5127499	0,04725295	0,2707392	0,17453309	0,46877906	0,12022992	1,7403E-09	0,66588586	0,01539076	0,046743
AGB	2011	18,1160095	17,8028272	0,04785723	0,3528828	0,13561791	0,61691597	0,05948917	1,2284E-09	0,84379966	0,02085191	0,05588067
AGB	2012	18,471747	18,1407806	0,05233549	0,5507748	0,09502157	0,63021707	0,06325213	5,1182E-10	0,87745941	0,0211195	0,03394581
AGB	2013	18,7497149	18,4407399	0,04741344	0,65886919	0,07196184	0,5980025	0,06778274	5,0084E-10	0,81449632	0,02299795	0,04162002
AGB	2014	18,9906397	18,6770933	0,0303492	0,53663291	0,05655486	0,58487584	0,07157372	5,0328E-10	0,80026744	0,02407515	0,05204749
AGB	2015	18,9937909	18,7002243	0,0276555	0,49054642	0,05637693	0,60585953	0,0932879	7,0113E-10	0,81258031	0,02577702	0,07534746
AGB	2016	19,0592789	18,7735348	0,01933247	0,36612301	0,05280321	0,63841859	0,07831921	5,3938E-10	0,84957669	0,02690714	0,06521448
AGB	2017	19,364045	19,1194524	0,01998722	0,5133934	0,03893159	0,61323734	0,08206027	3,468E-10	0,78316591	0,02454773	0,05462633
AGB	2018	19,3877209	19,1026572	0,02485156	0,6536327	0,03802067	0,66465503	0,0871896	3,5862E-10	0,88388928	0,03303442	0,06269228
AGB	2019	19,3648515	19,0281486	0,03177062	0,4083606	0,0778004	0,6321257	0,09177687	5,0737E-10	0,88518012	0,05575552	0,08244787

ELBARAKA	2010	18,6263255	17,9937248	0,03687907	0,4529918	0,08141223	0,473115	0,11524617	1,2225E-09	0,89063896	0,03979363	0,07104612
ELBARAKA	2011	18,6945921	18,1183545	0,03909356	0,51411872	0,07603995	0,46544092	0,118072	1,1945E-09	0,82817362	0,04090438	0,07311235
ELBARAKA	2012	18,8313846	18,2742984	0,01909361	0,28790849	0,06631833	0,40058209	0,05489863	1,0402E-09	0,6992476	0,04202777	0,06282959
ELBARAKA	2013	18,8722238	18,6360363	0,03471514	0,54528249	0,0636645	0,41369351	0,10237582	7,9015E-10	0,52390632	0,03646524	0,05134434
ELBARAKA	2014	18,9078655	18,6798173	0,03294441	0,5362451	0,06143535	0,49312821	0,08578648	4,2525E-10	0,61944093	0,02523809	0,034134
ELBARAKA	2015	19,0811656	18,8430828	0,02914552	0,5641787	0,05166008	0,49705709	0,08118852	3,8835E-10	0,63067312	0,02208328	0,0373663
ELBARAKA	2016	19,164253	18,9396339	0,02552597	0,5369225	0,04754126	0,5204287	0,07914005	2,9286E-10	0,65149648	0,01784674	0,03205914
ELBARAKA	2017	19,3314872	19,1393184	0,02007343	0,33272738	0,06032996	0,55775815	0,06896701	2,2284E-10	0,67593322	0,01576853	0,03090211
ELBARAKA	2018	19,417614	19,2131069	0,02686817	0,48541086	0,05535141	0,57977477	0,07446909	2,9032E-10	0,71133731	0,01902293	0,04561427
ELBARAKA	2019	19,3822055	19,1644425	0,03293348	0,57428997	0,05734643	0,80431607	0,05498792	2,0417E-10	1	0,01867255	0,0429535
Elsalam	2010	16,7244844	15,5572205	-0,00306194	-0,00561498	0,54531657	0,26320648	0,0278901	8,4517E-09	0,84573217	0,03564505	0,04079352
Elsalam	2011	17,027218	16,1605396	0,05185475	0,12871091	0,40287767	0,56023415	0,10030614	1,1292E-09	1,33279463	0,01342869	0,01570214
Elsalam	2012	17,3054061	16,5953944	0,04757839	0,15597396	0,30504059	0,63128641	0,09205345	1,8643E-09	1,28404602	0,0235204	0,03858114
Elsalam	2013	17,4930952	16,9907139	0,04455057	0,17620086	0,25283971	0,72752721	0,08652074	1,7622E-09	1,20234935	0,04359798	0,05070652
Elsalam	2014	17,4075787	16,7780865	0,03809828	0,13833139	0,27541313	0,65932458	0,09823587	3,4856E-09	1,23732624	0,06025074	0,08344398
Elsalam	2015	17,5186678	16,9734773	0,01176531	0,047738	0,24645592	0,57005937	0,07601517	5,6407E-09	0,98331643	0,09022534	0,13047111
Elsalam	2016	17,7877613	17,3509732	0,02828951	0,1502284	0,18831002	0,58086084	0,07333197	2,8444E-09	0,89901464	0,05493006	0,08773747
Elsalam	2017	18,267242	17,9795785	0,01897848	0,1627885	0,11658364	0,55306151	0,07017455	1,1795E-09	0,73740164	0,04232646	0,05595409
Elsalam	2018	18,5169819	18,2559133	0,03029693	0,3335966	0,09081905	0,70682641	0,06998153	5,7683E-10	0,91768453	0,03335002	0,0448938
Elsalam	2019	18,6908527	18,4489255	0,0408084	0,356445	0,11448724	0,75245409	0,07701609	5,208E-10	0,95840184	0,03202378	0,05134305
CACIB	2010	16,5233919	14,8993898	0,03162748	0,04743322	0,66677922	0,48374019	0,06034214	0	2,45418512	0	0
CACIB	2011	16,7677995	15,641224	0,03943469	0,07551639	0,5222004	0,3802645	0,14736655	0	1,17314396	0	0
CACIB	2012	16,9650418	16,2735303	0,0532731	0,12426019	0,42872219	0,20569632	0,23167467	0	0,41072028	0	0
CACIB	2013	17,1683122	16,6461998	0,02950403	0,08433047	0,34986198	0,43840036	0,08661513	0	0,73896088	0	0
CACIB	2014	17,3960084	16,9559131	0,03087772	0,11082448	0,27861825	0,18257926	0,17269517	0	0,28351915	0	0
CACIB	2015	16,9286565	16,0168409	0,02765544	0,06220176	0,44460863	0,27241287	0,13857716	0	0,67799126	0	0
CACIB	2016	16,7283751	15,7664105	0,02362821	0,04349825	0,54319904	0,19858015	0,17637431	0	0,51965099	0	0
CACIB	2017	16,7740212	15,8739544	0,00731614	0,01409766	0,51896152	0,399497	0,07252517	0	0,98266965	0	0

CACIB	2018	16,9504125	15,9737474	0,0245157	0,05635271	0,43504019	0,444265	0,08140077	0	1,17978369	0	0
CACIB	2019	16,4077199	14,5538793	0,03032185	0,04050773	0,7485448	0,52702981	0,1017957	0	3,36471226	0	0
CITI	2010	18,6569901	18,4376756	0,02779514	0,3520438	0,07895364	0,25818988	0,07349716	0	0,32150393	0	0
CITI	2011	18,7575414	18,4864669	0,03079318	0,43127198	0,07140084	0,39656379	0,05470531	0	0,52004295	0	0
CITI	2012	18,9395483	18,7516458	0,040876	0,6867674	0,05951942	0,34563653	0,06280025	0	0,41708511	0	0
CITI	2013	18,9757156	18,6658314	0,02927244	0,5099265	0,05740522	0,32692244	0,06446714	0	0,44568268	0	0
CITI	2014	18,8870019	18,4929309	0,02478949	0,3951739	0,06273058	0,40936155	0,05980894	7,451E-09	0,60708556	0,00859831	0,48622768
CITI	2015	18,7986887	18,3465314	0,03387311	0,4943355	0,0685225	0,52196531	0,05272264	5,3931E-09	0,82037244	3,9895E-05	0,41081838
CITI	2016	18,8912762	18,4735913	0,02876113	0,4604505	0,06246302	0,3973402	0,06653653	8,4088E-09	0,60333808	0,01221347	0,53490169
CITI	2017	18,9605173	18,6265448	0,03051933	0,5236282	0,05828435	0,40620664	0,06281772	6,2367E-09	0,56726949	0,01099846	0,43465704
CITI	2018	18,9066488	18,5370595	0,04142137	0,6734071	0,06151015	0,47134773	0,0624995	4,1134E-09	0,68210623	0,00878578	0,31520472
CITI	2019	19,0547405	18,6946831	0,03825043	0,48074387	0,0795651	0,43572277	0,0585932	2,9342E-09	0,62457014	0,00687499	0,24102969
FRANSBANK	2010	16,8316183	15,9027185	0,02615985	0,05339668	0,48991534	0,53352819	0,05714966	3,2311E-09	1,35074525	0,01759387	0,03518774
FRANSBANK	2011	16,7072944	15,5561073	0,0484421	0,087319	0,5547716	0,61514523	0,12660209	3,1167E-09	1,94505507	0,03455925	0,03455925
FRANSBANK	2012	16,9627877	16,0611642	0,06246347	0,1453688	0,42968967	0,51966032	0,13347658	3,0696E-09	1,28023494	0,0336877	0,03712366
FRANSBANK	2013	17,0677039	13,0131332	0,03768941	0,0974157	0,38689256	0,45670639	0,09057708	3,2963E-09	26,3338762	0,0379739	0,03891058
FRANSBANK	2014	17,0131185	16,2617887	0,01373115	0,0336055	0,40859826	0,50443209	0,07037131	9,2758E-09	1,06930372	0,08264605	0,11451372
FRANSBANK	2015	17,1411698	16,472404	0,02102067	0,0584739	0,35948813	0,47495842	0,08351232	6,1555E-09	0,92703656	0,07348006	0,08132636
FRANSBANK	2016	17,4169015	16,879298	0,0289654	0,1061558	0,27285742	0,64436285	0,06450147	2,7155E-09	1,10308435	0,03438634	0,06412794
FRANSBANK	2017	17,6847731	17,2782014	0,02690162	0,1288777	0,20873758	0,56031172	0,08449024	2,5555E-09	0,84139812	0,032038	0,06859675
FRANSBANK	2018	17,9535961	17,5817429	0,02887229	0,1809793	0,15953365	0,684079	0,06894878	1,0162E-09	0,99220185	0,02029803	0,04357627
FRANSBANK	2019	18,0177358	17,6038709	0,03741685	0,16671673	0,22443367	0,63261139	0,0907174	1,2184E-09	0,95692141	0,02229788	0,05151359
Housing	2010	17,0334534	16,3339616	0,02282412	0,0570071	0,40037337	0,27020246	0,08331676	1,3702E-08	0,54384449	0,06491487	0,09247089
Housing	2011	17,2261741	16,53550000	0,05123001	0,1551518	0,33019284	0,34380547	0,07130775	6,2473E-09	0,68591251	0,0468755	0,06504897
Housing	2012	17,5180539	16,7089926	0,04975575	0,2017611	0,24660726	0,30261783	0,07152363	4,7099E-09	0,6796188	0,04187969	0,05779625
Housing	2013	17,5267202	16,9331691	0,05125511	0,20965009	0,24447932	0,3970528	0,06774907	2,8566E-09	0,71882679	0,03115878	0,0463928
Housing	2014	17,8605987	16,6370655	0,03898553	0,2226706	0,17508161	0,31370764	0,07332615	1,8665E-09	1,0663477	0,03013909	0,03344335
Housing	2015	18,0707027	16,8344422	0,02994736	0,2110401	0,14190364	0,30033446	0,07353616	1,482E-09	1,03396606	0,02541761	0,03136606

Housing	2016	17,7901679	16,9951316	0,04166397	0,2217851	0,18785738	0,5110917	0,06829243	8,4605E-10	1,13182349	0,01870029	0,02301796
Housing	2017	18,2247281	17,6083617	0,02547249	0,2093969	0,12164693	0,45941356	0,05861493	4,4715E-10	0,8509192	0,0133141	0,01688731
Housing	2018	18,3808874	17,6458306	0,03707158	0,35625342	0,10405957	0,49384686	0,06763944	3,6964E-10	1,02996719	0,01609167	0,01754227
Housing	2019	18,3277889	17,6307819	0,00449076	0,0272826	0,16460146	0,45482189	0,08094006	1,1187E-09	0,91316161	0,02709757	0,0463693
BNP	2010	18,8701765	18,6166932	0,04340931	0,6804502	0,06379498	0,46127724	0,10216065	6,5395E-10	0,5943584	0,03182116	0,04728455
BNP	2011	18,9557155	18,6699505	0,03985048	0,68045	0,0585649	0,48068915	0,11818516	4,7409E-10	0,63969132	0,03088995	0,03891225
BNP	2012	19,1490247	18,8775201	0,03033388	0,62841094	0,04827077	0,4166479	0,11488792	6,3946E-10	0,54661576	0,04702592	0,05519518
BNP	2013	19,2702708	18,9949142	0,01958678	0,45807359	0,04275902	0,49040334	0,09167729	4,3313E-10	0,64586132	0,04197092	0,04967621
BNP	2014	19,3539677	19,0805814	0,02225155	0,56582443	0,03932589	0,47409178	0,09157378	5,0208E-10	0,62315003	0,04494355	0,06052832
BNP	2015	19,3477329	18,9961785	0,01938326	0,48982453	0,03957185	0,57768385	0,08115365	3,8631E-10	0,8210476	0,04721507	0,05639428
BNP	2016	19,3326141	19,0571121	0,01864519	0,46410307	0,04017467	0,61967576	0,07721155	4,632E-10	0,81623179	0,05230604	0,07144678
BNP	2017	19,3599572	19,0410771	0,01342475	0,34342257	0,03909106	0,67972871	0,07085085	4,4836E-10	0,93502557	0,05750983	0,07796221
BNP	2018	19,3838839	19,0480776	0,02799385	0,73345994	0,03816684	0,66772555	0,081876	5,0648E-10	0,9341934	0,06872743	0,08860872
BNP	2019	19,4149104	19,0772475	0,02410667	0,32575845	0,07400167	0,65377102	0,07797109	6,6674E-10	0,9163699	0,08496766	0,11780663
TRUST	2010	17,2437882	16,5232465	0,09597396	0,2958254	0,32442772	0,6395795	0,09594786	4,3317E-09	1,3146853	0,08001296	0,08539509
TRUST	2011	17,2205483	16,6414477	0,08238979	0,2481204	0,33205567	0,58952227	0,10039672	4,6206E-09	1,05196283	0,07605592	0,08203234
TRUST	2012	17,4110176	16,7070207	0,03864907	0,10831897	0,35680792	0,51473708	0,10237182	7,2236E-09	1,04070453	0,1246463	0,1354706
TRUST	2013	17,5288328	16,8206503	0,04586555	0,14461677	0,31715239	0,71887049	0,10321761	4,4641E-09	1,45952115	0,12465147	0,13154065
TRUST	2014	17,6155162	16,9411165	0,04780051	0,1643655	0,29081838	0,778318	0,09059401	3,3105E-09	1,52772486	0,10764371	0,11518014
TRUST	2015	17,6970871	17,0481818	0,0483334	0,18032308	0,26803782	0,78537649	0,09206412	3,963E-09	1,50277476	0,09499629	0,15095576
TRUST	2016	17,703283	17,0368066	0,0275078	0,10326438	0,26638222	0,82046814	0,08262427	3,8878E-09	1,5977498	0,09841916	0,15566925
TRUST	2017	17,992646	17,4569401	0,02555107	0,12810692	0,19945111	0,84003783	0,07318719	1,985E-09	1,43533402	0,07478152	0,10868562
TRUST	2018	18,202528	17,789734	0,03037758	0,18787423	0,16169102	0,83986775	0,07618653	1,6308E-09	1,26906845	0,06459278	0,11011791
TRUST	2019	18,1386148	17,6779158	0,03484535	0,15285099	0,22796942	0,83565679	0,09066401	2,0917E-09	1,32466782	0,07786286	0,13183137
SGA	2010	18,8795331	18,5855476	0,03101547	0,4907444	0,06320086	0,83837684	0,05922208	5,2127E-10	1,12490426	0,05618332	0,06914827
SGA	2011	18,9335459	18,6342597	0,03621283	0,60477944	0,05987775	0,69725792	0,07620594	4,5329E-10	0,94052825	0,0380148	0,05278407
SGA	2012	19,1261787	18,8514569	0,03470964	0,70281992	0,04938626	0,51320724	0,08435284	1,0268E-09	0,67546518	0,0660003	0,10669881
SGA	2013	19,2209118	18,9607859	0,02403482	0,53502835	0,04492252	0,54820469	0,07406347	8,2233E-10	0,71107267	0,07845944	0,10035163

SGA	2014	19,3099633	19,0389193	0,02842141	0,69160184	0,04109505	0,52300384	0,09442189	9,7474E-10	0,68583202	0,08508826	0,12405212
SGA	2015	19,3318297	19,0082099	0,0254083	0,63194979	0,0402062	0,66932977	0,07973629	5,7032E-10	0,92509516	0,07482543	0,09494378
SGA	2016	19,5097032	19,1970749	0,02697157	0,80142475	0,03365453	0,69890884	0,07764321	4,0309E-10	0,9554177	0,06669158	0,08371058
SGA	2017	19,6828967	19,3450302	0,02150092	0,75967964	0,02830261	0,68361406	0,07874966	3,6422E-10	0,95839501	0,06887582	0,08797168
SGA	2018	19,7461377	19,4040888	0,03013628	1,13430093	0,02656815	0,73000671	0,07972896	2,8052E-10	1,02772472	0,06566141	0,07707799
SGA	2019	19,768257	19,4031586	0,01984735	0,38187177	0,05197387	0,69221817	0,08557869	5,0184E-10	0,99724812	0,10029017	0,13367725
HSBC	2010	17,1783807	16,5893539	0,02239513	0,05722042	0,39138348	0,38226359	0,04646789	0	0,68892828	0	0
HSBC	2011	18,2746552	18,0782062	0,02417355	0,18486039	0,13076651	0,3123778	0,09657219	4,1506E-11	0,38018664	0,00032526	0,00112039
HSBC	2012	18,6491425	18,4410768	0,02863453	0,31844274	0,08992051	0,22700477	0,07903171	2,1264E-10	0,27950962	0,00304562	0,00606589
HSBC	2013	18,6158965	18,41331	0,03385745	0,36421425	0,09296026	0,33529208	0,07422574	8,8233E-11	0,41058729	0,00359092	0,00359612
HSBC	2014	18,6368985	18,4014556	0,02175263	0,23896566	0,09102827	0,40171069	0,06244926	6,2532E-11	0,50835247	0,00302469	0,00311828
HSBC	2015	18,3334514	17,983775	0,02998144	0,24315927	0,1232996	0,47967121	0,04898145	7,5964E-11	0,68046563	0,00332928	0,0033394
HSBC	2016	18,1156495	17,6914345	0,02078856	0,13560402	0,15330342	0,44696466	0,0723118	1,3538E-10	0,68313636	0,00444233	0,0044603
HSBC	2017	18,0481475	17,6922657	0,00247398	0,01508443	0,16400896	0,43632381	0,07858667	3,4731E-10	0,62282556	0,01044098	0,01044098
HSBC	2018	17,9265825	17,5288286	0,00596799	0,03222297	0,18520922	0,52563871	0,06904351	3,0518E-10	0,78240149	0,00978718	0,00978718
HSBC	2019	18,2058336	17,7616599	0,02059211	0,09919425	0,20759375	0,44117742	0,06647705	2,5357E-10	0,68788441	0,00902394	0,00902394

APPENDIX N°02: MACROECONOMIC DATABASE

		GDP	USD/DZD	EUR/DZD	inflation	Brent	Reserves	M2	TMM	Loan
2013	M12	1320,85	78,1524	106,893	3,26%	80,7	15 083,30	15 164,00	2,03%	5 156,30
2014	M1	1376,20833	78,01	105,7537	2,67%	108,12	14 992,00	15 100,12	2,03%	5 200,10
	M2	1431,56667	77,64	106,4855	2,27%	108,91	15 035,30	15 144,21	2,03%	5 260,50
	M3	1444,23333	78,50	107,998	1,98%	107,48	15 205,60	15 313,08	2,09%	5 314,00
	M4	1450,5667	78,60	108,531	1,78%	107,66	15 249,00	15 356,66	2,21%	5 457,70
	M5	1456,9	79,1476	107,7437	1,64%	109,52	15 258,00	15 367,52	2,40%	5 570,20
	M6	1454,6667	79,2669	108,2152	1,51%	111,8	15 233,50	15 345,30	2,40%	5 760,60
	M7	1453,55	79,8322	106,9472	1,49%	106,86	15 161,50	15 268,36	2,40%	5 948,30
	M8	1452,4333	80,3249	105,808	1,45%	101,66	15 107,10	15 208,76	2,44%	6 017,60
	M9	1429,5333	82,7168	104,8808	1,60%	97,29	15 232,60	15 329,89	2,40%	6 182,80
	M10	1418,0833	83,8414	105,33	2,10%	87,46	15 394,00	15 481,46	2,40%	6 287,20
	M11	1406,6333	85,9812	107,1928	2,58%	79	15 633,90	15 712,90	2,35%	6 520,20
	M12	1384,5833	87,9039	107,0538	2,92%	62,51	15 628,20	15 690,71	1,38%	6 510,90
2015	M1	1373,5583	92,9012	105,3268	3,25%	47,71	15 423,60	15 471,31	1,21%	6 615,00
	M2	1362,5333	94,926	106,4073	3,67%	58,1	15 577,00	15 635,10	1,21%	6 720,00
	M3	1370,3	97,5474	105,0683	4,06%	55,89	15 483,60	15 539,49	0,99%	6 786,20
	M4	1374,1833	97,2128	108,3631	4,48%	59,61	15 611,40	15 671,01	1%	6 866,30
	M5	1378,0667	99,5673	108,9914	4,83%	64,04	15 755,90	15 819,94	0,78%	6 942,00
	M6	1387,4333	99,0178	110,4494	4,97%	61,47	15 659,00	15 720,47	0,78%	7 070,60
	M7	1392,1167	99,5473	108,9098	5,00%	56,56	15 431,80	15 488,36	0,89%	7 193,80

	M8	1396,8	106,0997	118,9325	5,14%	46,52	16 331,00	16 377,52	0,90%	7 297,60
	M9	1395,0333	106,0524	119,1234	5,32%	47,62	16 071,70	16 119,32	0,98%	7 373,10
	M10	1394,15	106,7866	117,4439	5,11%	48,43	15 855,00	15 903,43	1,02%	7 476,60
	M11	1393,2667	108,425	114,7896	4,86%	44,29	15 629,50	15 673,79	0,98%	7 591,50
	M12	1394,8667	107,1317	117,0575	4,78%	38,05	15 305,40	15 343,45	2,44%	7 277,20
2016	M1	1395,6667	107,3252	116,9201	4,82%	30,69	15 006,10	15 036,79	1,28%	7 258,90
	M2	1396,4667	108,3279	118,5216	4,70%	32,2	14 867,50	14 899,70	2,45%	7 264,80
	M3	1419,55	108,7168	123,3175	4,69%	38,32	14 856,60	14 894,92	0,98%	7 403,20
	M4	1431,0917	109,1286	124,1666	4,77%	41,58	14 696,20	14 737,78	0,78%	7 498,10
	M5	1442,6333	110,6228	123,1011	4,87%	46,79	14 607,00	14 653,79	0,79%	7 573,30
	M6	1443,9667	**110,3718**	122,75	5,16%	48,25	14 160,80	14 209,05	0,78%	7 743,00
	M7	1444,6333	110,4325	122,5083	5,53%	44,95	13 933,00	13 977,95	0,87%	7 862,80
	M8	1445,3	109,6457	122,0467	5,77%	45,67	13 552,80	13 598,47	0,98%	7 983,20
	M9	1481,6	109,7371	122,73	5,72%	46,57	13 304,20	13 350,77	1,12%	8 079,10
	M10	1499,75	109,9685	120,531	5,84%	49,52	12 976,60	13 026,12	1,93%	8 162,30
	M11	1517,9	110,7609	117,7665	6,18%	44,73	12 781,90	12 826,63	2,35%	7 931,40
	M12	1545,5333	110,5274	116,3743	6,40%	53,31	12 533,40	12 586,71	2,59%	7 907,80
2017	M1	1559,35	109,6906	117,3799	6,65%	54,58	12 253,20	12 307,78	3,17%	7 968,60
	M2	1573,1667	110,1784	116,6239	6,94%	54,87	12 033,40	12 088,27	1,64%	8 051,90
	M3	1553,1333	110,014	117,627	7,07%	51,59	11 862,10	11 913,69	0,91%	8 171,00
	M4	1543,1167	109,3475	119,0576	7,03%	52,36	11 750,30	11 802,66	2,04%	8 226,70
	M5	1533,1	108,5771	121,3675	6,88%	50,32	11 573,10	11 623,42	3,09%	8 331,00
	M6	1545,9667	107,8459	123,0576	6,55%	46,37	11 415,40	11 461,77	2,62%	8 470,80
	M7	1552,4	108,4355	127,1461	6,12%	48,48	11 429,80	11 478,28	3,82%	8 609,90
	M8	1558,8333	110,8852	131,5653	5,88%	51,7	11 418,00	11 469,70	3,99%	8 704,80
	M9	1593	113,2077	133,3078	5,87%	56,15	11 550,10	11 606,25	4,22%	8 661,20
	M10	1610,0833	115,2205	133,9669	5,98%	57,5	11 408,70	11 466,20	4,34%	8 778,70

	M11	1627,1667	115,0396	136,2932	5,76%	62,73	11 262,30	11 325,03	4,37%	8 931,10
	M12	1642,3333	114,9327	137,4883	5,59%	64,38	11 142,00	11 206,38	3,45%	8 880,00
2018	M1	1649,9167	113,4278	141,0702	5,22%	69,09	11 062,00	11 131,09	2,96%	8 925,50
	M2	1657,5	114,4395	139,7535	4,88%	65,32	10 865,10	10 930,42	2,83%	8 945,70
	M3	1670,8833	114,0777	140,5495	4,57%	66,02	10 714,40	10 780,42	2,23%	9 042,40
	M4	1677,575	114,8873	139,2205	4,33%	72,06	10 606,10	10 678,16	2,64%	9 128,40
	M5	1684,2667	116,4508	136,3872	4,37%	76,98	10 472,20	10 549,18	1,91%	9 252,80
	M6	1698,4	117,6749	136,7912	4,58%	74,4	10 354,00	10 428,40	2,36%	9 424,20
	M7	1705,4667	117,7024	137,8472	4,81%	74,25	10 329,40	10 403,65	3,41%	9 524,20
	M8	1712,5333	117,8824	137,669	4,82%	72,44	10 216,30	10 288,74	3,56%	9 613,90
	M9	1694,0333	118,1587	137,3123	4,69%	78,89	10 112,80	10 191,69	3,64%	9 792,60
	M10	1684,7833	118,9897	135,1247	4,53%	81,03	9 925,20	10 006,23	3,78%	9 915,00
	M11	1675,5333	118,4693	134,8596	4,46%	64,75	9 664,60	9 729,35	3,79%	10 146,10
	M12	1682,4833	118,2906	135,3836	4,27%	57,36	9 384,80	9 442,16	4,34%	9 976,30
2019	M1	1685,9583	117,9972	135,6968	4,18%	59,41	9 165,00	9 224,41	4,40%	10 066,90
	M2	1687,6958	118,4283	134,8662	4,11%	63,96	8 920,70	8 984,66	3,15%	10 188,20
	M3	1689,4333	119,3178	134,1311	4,08%	66,14	8 765,50	8 831,64	2,87%	10 300,80

APPENDIX N°03: VAR MODEL ESTIMATION PROCESS

a. GDP

At level

Null Hypothesis: GDP has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.283587	0.9208
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

*MacKinnon (1996) one-sided p-values.

1st difference

Null Hypothesis: D(GDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.801531	0.0002
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

*MacKinnon (1996) one-sided p-values.

b. inflation

at level
Null Hypothesis: INFLATION has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.785322	0.0662
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

1st difference

Null Hypothesis: D(INFLATION) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.149790	0.0280
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

*MacKinnon (1996) one-sided p-values.

Foreign exchange reserves

At level

Null Hypothesis: FOREIGN_EXCHANGE_RESERVE has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.054737	0.9999
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

*MacKinnon (1996) one-sided p-values.

1st difference

Null Hypothesis: D(FOREIGN_EXCHANGE_RESERVE) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.228013	0.0000
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: EUR_DZD has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.773948	0.8194
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(EUR_DZD) has a unit root

Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.886212	0.0000
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LOAN_TO_PRAVITE_SECTOR_L has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.730611	0.9920
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

*MacKinnon (1996) one-sided p-values.

1st difference
Null Hypothesis: D(LOAN_TO_PRAVITE_SECTOR_L) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.015625	0.0000
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: LOANS_TO_PULIC_SECTOR_LP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.246423	0.6490
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(LOANS_TO_PULIC_SECTOR_LP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.595695	0.0000
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: M2 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.044900	0.9999
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(M2) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.257314	0.0000
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: P_BRENT has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.613788	0.0957
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(P_BRENT) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.299331	0.0000
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: TMM has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.120093	0.2377
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(TMM) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.928785	0.0000
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: USD_DZD has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.066242	0.2588
Test critical values:	1% level	-3.538362	
	5% level	-2.908420	
	10% level	-2.591799	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(USD_DZD) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic		-6.394840	0.0000
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

*MacKinnon (1996) one-sided p-values.

Null Hypothesis: D(MONEY) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.743768	0.0000
Test critical values:	1% level	-3.540198	
	5% level	-2.909206	
	10% level	-2.592215	

*MacKinnon (1996) one-sided p-values.

Optimal number of lags

VAR Lag Order Selection Criteria
Endogenous variables: GDP INFLATION RESERVES LOAN MONEY TMM USD_DZD EUR_DZD BRENT
Exogenous variables: C
Date: 01/01/21 Time: 11:04
Sample: 2013M12 2019M03
Included observations: 59

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1711.498	NA	1.72e+14	58.32197	58.63888	58.44568
1	-1088.570	1034.694	1867948.	39.95152	43.12064*	41.18861
2	-981.1146	145.7019	915928.0	39.05473	45.07607	41.40522
3	-888.5122	97.31099	1051210.	38.66143	47.53498	42.12531
4	-709.7143	133.3408	130218.8	35.34625	47.07201	39.92351
5	-467.6525	106.6713*	9070.966*	29.88653*	44.46450	35.57718*

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Causality test

Pairwise Granger Causality Tests
Date: 01/01/21 Time: 11:37
Sample: 2013M12 2019M03
Lags: 5

Null Hypothesis:	Obs	F-Statistic	Prob.
INFLATION does not Granger Cause GDP	59	2.18103	0.0718
GDP does not Granger Cause INFLATION		1.83052	0.1247
RESERVES does not Granger Cause GDP	59	2.55467	0.0396
GDP does not Granger Cause RESERVES		0.22746	0.9488
LOAN does not Granger Cause GDP	59	1.92910	0.1068
GDP does not Granger Cause LOAN		1.99032	0.0970
MONEY does not Granger Cause GDP	59	0.32748	0.8939
GDP does not Granger Cause MONEY		1.72246	0.1475
TMM does not Granger Cause GDP	59	0.93436	0.4673
GDP does not Granger Cause TMM		2.29975	0.0594
BRENT does not Granger Cause GDP	59	2.04520	0.0890
GDP does not Granger Cause BRENT		3.18704	0.0145
USD_DZD does not Granger Cause GDP	59	1.29731	0.2808
GDP does not Granger Cause USD_DZD		2.78391	0.0275
EUR_DZD does not Granger Cause GDP	59	1.37488	0.2504
GDP does not Granger Cause EUR_DZD		0.39021	0.8531
RESERVES does not Granger Cause INFLATION	59	1.98106	0.0984
INFLATION does not Granger Cause RESERVES		0.61630	0.6879
LOAN does not Granger Cause INFLATION	59	0.31109	0.9039
INFLATION does not Granger Cause LOAN		1.42101	0.2337
MONEY does not Granger Cause INFLATION	59	0.89693	0.4908
INFLATION does not Granger Cause MONEY		1.58680	0.1818
TMM does not Granger Cause INFLATION	59	0.87158	0.5072
INFLATION does not Granger Cause TMM		0.84960	0.5217
BRENT does not Granger Cause INFLATION	59	1.14945	0.3477
INFLATION does not Granger Cause BRENT		0.90490	0.4858
USD_DZD does not Granger Cause INFLATION	59	1.19844	0.3242
INFLATION does not Granger Cause USD_DZD		0.55802	0.7315
EUR_DZD does not Granger Cause INFLATION	59	1.81517	0.1277
INFLATION does not Granger Cause EUR_DZD		1.36983	0.2523
LOAN does not Granger Cause RESERVES	59	1.02179	0.4154
RESERVES does not Granger Cause LOAN		3.36627	0.0110
MONEY does not Granger Cause RESERVES	59	0.39739	0.8482
RESERVES does not Granger Cause MONEY		0.75722	0.5851
TMM does not Granger Cause RESERVES	59	0.33814	0.8873

RESERVES does not Granger Cause TMM		3.08861	0.0170
BRENT does not Granger Cause RESERVES	59	0.68939	0.6339
RESERVES does not Granger Cause BRENT		0.58789	0.7091
USD_DZD does not Granger Cause RESERVES	59	2.07883	0.0844
RESERVES does not Granger Cause USD_DZD		1.08102	0.3828
EUR_DZD does not Granger Cause RESERVES	59	1.74216	0.1431
RESERVES does not Granger Cause EUR_DZD		1.92185	0.1081
MONEY does not Granger Cause LOAN	59	1.25779	0.2975
LOAN does not Granger Cause MONEY		0.47755	0.7912
TMM does not Granger Cause LOAN	59	0.32258	0.8970
LOAN does not Granger Cause TMM		3.68528	0.0067
BRENT does not Granger Cause LOAN	59	1.85017	0.1209
LOAN does not Granger Cause BRENT		0.63954	0.6706
USD_DZD does not Granger Cause LOAN	59	1.63224	0.1696
LOAN does not Granger Cause USD_DZD		0.47789	0.7909
EUR_DZD does not Granger Cause LOAN	59	2.73362	0.0298
LOAN does not Granger Cause EUR_DZD		1.74608	0.1422
TMM does not Granger Cause MONEY	59	2.09928	0.0817
MONEY does not Granger Cause TMM		0.58993	0.7076
BRENT does not Granger Cause MONEY	59	1.76907	0.1372
MONEY does not Granger Cause BRENT		0.33420	0.8898
USD_DZD does not Granger Cause MONEY	59	1.63060	0.1700
MONEY does not Granger Cause USD_DZD		0.49934	0.7752
EUR_DZD does not Granger Cause MONEY	59	0.97414	0.4432
MONEY does not Granger Cause EUR_DZD		1.12276	0.3611
BRENT does not Granger Cause TMM	59	1.06025	0.3940
TMM does not Granger Cause BRENT		0.91573	0.4789
USD_DZD does not Granger Cause TMM	59	0.56983	0.7227
TMM does not Granger Cause USD_DZD		0.20768	0.9577
EUR_DZD does not Granger Cause TMM	59	1.46355	0.2193
TMM does not Granger Cause EUR_DZD		0.34379	0.8837
USD_DZD does not Granger Cause BRENT	59	0.55355	0.7348
BRENT does not Granger Cause USD_DZD		1.39891	0.2416
EUR_DZD does not Granger Cause BRENT	59	0.76739	0.5779
BRENT does not Granger Cause EUR_DZD		0.89170	0.4942
EUR_DZD does not Granger Cause USD_DZD	59	0.48075	0.7888
USD_DZD does not Granger Cause EUR_DZD		1.67392	0.1590

Co-integration test

Date: 01/01/21 Time: 12:22
Sample (adjusted): 2014M03 2019M03
Included observations: 61 after adjustments
Trend assumption: Linear deterministic trend
Series: GDP RESERVES BRENT LOAN TMM USD_DZD
Lags interval (in first differences): 1 to 2

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.648046	112.6964	95.75366	0.0021
At most 1	0.239147	48.99691	69.81889	0.6807
At most 2	0.219364	32.32469	47.85613	0.5942
At most 3	0.144998	17.21827	29.79707	0.6239
At most 4	0.117211	7.662558	15.49471	0.5022
At most 5	0.000946	0.057761	3.841466	0.8100

Trace test indicates 1 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

We accept that there are at least five cointegration relationships between variables
results shows that the null hypothesis of no co-integration relationship is being rejected, as we found that the probability is less than 5%. Furthermore, the findings identified the existence of at least five co-integration results, as the related probabilities are more than 5%.

Residuals stationarity

Null Hypothesis: RESID01 has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=10)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.535458	0.0000
Test critical values:	1% level	-3.542097	
	5% level	-2.910019	
	10% level	-2.592645	

*MacKinnon (1996) one-sided p-values.

VECM

Vector Error Correction Estimates
Date: 01/01/21 Time: 13:29
Sample (adjusted): 2014M03 2019M03
Included observations: 61 after adjustments
Standard errors in ( ) & t-statistics in [ ]

LIST OF APPENDICES

Cointegrating Eq:	CointEq1
GDP(-1)	1.000000
RESERVES(-1)	0.055627 (0.00352) [15.8019]
LOAN(-1)	0.105715 (0.01198) [8.82376]
BRENT(-1)	-4.002487 (0.22387) [-17.8790]
TMM(-1)	182.5777 (342.435) [0.53317]
USD_DZD(-1)	-13.73937 (1.07479) [-12.7834]
C	-1386.769

Error Correction:	D(GDP)	D(RESERVES)	D(LOAN)	D(BRENT)	D(TMM)	D(USD_DZD)
CointEq1	-0.012775 (0.08403) [-0.15203]	2.340038 (1.58288) [1.47835]	-1.517751 (0.71285) [-2.12912]	-0.032864 (0.04050) [-0.81147]	-0.000113 (4.9E-05) [-2.30148]	0.043673 (0.00920) [4.74812]
D(GDP(-1))	0.286977 (0.15451) [1.85729]	0.549505 (2.91044) [0.18880]	0.864878 (1.31073) [0.65985]	0.179511 (0.07447) [2.41062]	0.000138 (9.0E-05) [1.53247]	-0.014895 (0.01691) [-0.88073]
D(GDP(-2))	0.068893 (0.13120) [0.52511]	1.496674 (2.47126) [0.60563]	-2.581667 (1.11294) [-2.31968]	0.025534 (0.06323) [0.40384]	-6.88E-05 (7.6E-05) [-0.89928]	0.024911 (0.01436) [1.73473]
D(RESERVES(-1))	-0.014384 (0.00945) [-1.52259]	0.059655 (0.17795) [0.33524]	0.145528 (0.08014) [1.81592]	-0.004734 (0.00455) [-1.03979]	-9.16E-07 (5.5E-06) [-0.16632]	-0.000759 (0.00103) [-0.73404]
D(RESERVES(-2))	-0.007828 (0.00977) [-0.80123]	0.242061 (0.18404) [1.31529]	0.246237 (0.08288) [2.97097]	-0.000173 (0.00471) [-0.03677]	4.51E-07 (5.7E-06) [0.07921]	-0.000345 (0.00107) [-0.32267]
D(LOAN(-1))	-0.006789 (0.01677) [-0.40490]	0.285525 (0.31584) [0.90400]	-0.014463 (0.14224) [-0.10168]	-0.003112 (0.00808) [-0.38512]	1.82E-05 (9.8E-06) [1.86364]	0.000135 (0.00184) [0.07350]
D(LOAN(-2))	-0.002954 (0.01667) [-0.17721]	0.038000 (0.31395) [0.12104]	0.000366 (0.14139) [0.00259]	-0.007422 (0.00803) [-0.92402]	3.93E-06 (9.7E-06) [0.40424]	0.001755 (0.00182) [0.96179]
D(BRENT(-1))	0.408396 (0.37043) [1.10250]	1.402155 (6.97740) [0.20096]	1.483508 (3.14229) [0.47211]	0.149861 (0.17852) [0.83944]	-0.000507 (0.00022) [-2.35065]	0.096637 (0.04055) [2.38343]

D(BRENT(-2))	0.109833	2.896195	-4.151432	-0.328453	-0.000290	0.043570
	(0.36324)	(6.84208)	(3.08135)	(0.17506)	(0.00021)	(0.03976)
	[0.30237]	[0.42329]	[-1.34728]	[-1.87621]	[-1.36898]	[1.09584]
D(TMM(-1))	474.2940	1789.584	-1732.143	-37.83155	-0.152379	-2.574398
	(247.357)	(4659.22)	(2098.30)	(119.211)	(0.14414)	(27.0746)
	[1.91745]	[0.38409]	[-0.82550]	[-0.31735]	[-1.05717]	[-0.09509]
D(TMM(-2))	212.3144	-2364.706	-1499.693	-108.8926	0.027475	-5.266661
	(253.555)	(4775.98)	(2150.88)	(122.198)	(0.14775)	(27.7531)
	[0.83735]	[-0.49513]	[-0.69725]	[-0.89111]	[0.18595]	[-0.18977]
D(USD_DZD(-1))	1.752688	4.082618	-5.856682	1.129636	0.000145	0.034590
	(1.35486)	(25.5202)	(11.4931)	(0.65296)	(0.00079)	(0.14830)
	[1.29363]	[0.15998]	[-0.50958]	[1.73002]	[0.18310]	[0.23325]
D(USD_DZD(-2))	0.949544	-32.13548	-24.12803	-0.232123	0.000240	0.003688
	(1.37807)	(25.9574)	(11.6900)	(0.66415)	(0.00080)	(0.15084)
	[0.68904]	[-1.23801]	[-2.06399]	[-0.34951]	[0.29866]	[0.02445]
C	-0.665898	-90.63091	153.3586	-1.960435	-0.002711	0.411313
	(3.85434)	(72.6006)	(32.6959)	(1.85756)	(0.00225)	(0.42188)
	[-0.17277]	[-1.24835]	[4.69045]	[-1.05538]	[-1.20724]	[0.97495]
R-squared	0.415595	0.195697	0.298325	0.362485	0.192463	0.442246
Adj. R-squared	0.253951	-0.026770	0.104245	0.186151	-0.030898	0.287974
Sum sq. resids	5214.620	1850132.	375240.3	1211.182	0.001771	62.47434
S.E. equation	10.53325	198.4049	89.35232	5.076400	0.006138	1.152927
F-statistic	2.571048	0.879667	1.537122	2.055670	0.861668	2.866657
Log likelihood	-222.2299	-401.3120	-352.6509	-177.7038	232.0870	-87.28365
Akaike AIC	7.745241	13.61679	12.02134	6.285372	-7.150394	3.320775
Schwarz SC	8.229704	14.10125	12.50580	6.769835	-6.665932	3.805238
Mean dependent	4.227322	-102.7836	82.62787	-0.701148	0.000138	0.683310
S.D. dependent	12.19491	195.8014	94.40851	5.627089	0.006045	1.366325

Determinant resid covariance (dof adj.)	12046082
Determinant resid covariance	2520310.
Log likelihood	-968.8982
Akaike information criterion	34.71797
Schwarz criterion	37.83238

Residuals normality test

VEC Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 01/01/21 Time: 13:33
Sample: 2013M12 2019M03
Included observations: 61

Component	Skewness	Chi-sq	df	Prob.
1	0.232045	0.547422	1	0.4594
2	2.060863	43.17943	1	0.0000
3	-1.364853	18.93870	1	0.0000

4	-0.171367	0.298562	1	0.5848
5	-0.480500	2.347282	1	0.1255
6	0.040788	0.016914	1	0.8965
Joint		65.32831	6	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	5.053928	10.72232	1	0.0011
2	11.94541	203.3852	1	0.0000
3	6.661939	34.08324	1	0.0000
4	3.134799	0.046184	1	0.8298
5	3.016667	0.000706	1	0.9788
6	2.950996	0.006103	1	0.9377
Joint		248.2438	6	0.0000

Component	Jarque-Bera	df	Prob.
1	11.26974	2	0.0036
2	246.5647	2	0.0000
3	53.02194	2	0.0000
4	0.344746	2	0.8417
5	2.347988	2	0.3091
6	0.023017	2	0.9886
Joint	313.5721	12	0.0000

aurocorrelaton test

VEC Residual Serial Correlation LM Tests
Null Hypothesis: no serial correlation at lag order h
Date: 01/01/21 Time: 13:36
Sample: 2013M12 2019M03
Included observations: 61

Lags	LM-Stat	Prob
1	39.49638	0.3165
2	40.19446	0.2897
3	41.48196	0.2440
4	29.62796	0.7644
5	38.55842	0.3546

Probs from chi-square with 36 df.

Varian
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Decom

position of GDP:

Period	S.E.	GDP	BRENT	USD_DZD	LOAN	RESERVES	TMM
1	11.05083	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	19.82410	97.48697	0.092628	0.057673	0.992323	1.157262	0.213140
3	29.67882	94.39743	0.692360	0.361267	1.951578	2.422512	0.174853
4	38.83890	90.66062	0.584508	0.212190	3.723499	4.710009	0.109174
5	46.83710	87.78039	0.615013	0.146732	4.024721	7.356017	0.077125
6	54.36995	85.51366	0.620490	0.108891	3.855193	9.802461	0.099308
7	61.23335	82.12679	0.607359	0.088193	3.829429	13.12798	0.220248
8	67.61062	79.40500	0.528383	0.072826	3.995072	15.69939	0.299333
9	73.37142	77.17931	0.455624	0.069647	4.000432	17.94035	0.354646
10	79.18565	75.08858	0.392463	0.096016	4.018443	19.96566	0.438843

GDP = F(Inflation, reserves, loan, money, Brent , TMM, usd/dzd, eur/dzd)

Vector Autoregression Estimates
Date: 01/01/21 Time: 11:00
Sample (adjusted): 2014M02 2019M03
Included observations: 62 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	GDP	INFLATION	RESERVES	LOAN	MONEY	TMM	USD_DZD	EUR_DZD	BRENT
GDP(-1)	0.983735	3.40E-05	2.970433	-1.633080	-1.358647	5.01E-05	0.030903	-0.016776	0.146696
	(0.14993)	(2.1E-05)	(3.16268)	(1.60942)	(2.19616)	(8.4E-05)	(0.01968)	(0.03531)	(0.07757)
	[6.56126]	[1.65016]	[0.93921]	[-1.01470]	[-0.61865]	[0.59352]	[1.57041]	[-0.47508]	[1.89113]
GDP(-2)	-0.306108	-1.48E-05	-1.834483	1.296832	0.029790	-3.97E-05	-0.006648	-0.012317	-0.065075
	(0.10807)	(1.5E-05)	(2.27965)	(1.16007)	(1.58298)	(6.1E-05)	(0.01418)	(0.02545)	(0.05591)
	[-2.83251]	[-0.99408]	[-0.80472]	[1.11789]	[0.01882]	[-0.65338]	[-0.46871]	[-0.48392]	[-1.16388]
INFLATION(-1)	841.7522	1.549022	706.2255	11055.07	-4509.351	-0.825095	69.11157	-183.3070	-149.0363
	(748.644)	(0.10291)	(15792.1)	(8036.28)	(10966.0)	(0.42129)	(98.2596)	(176.319)	(387.330)
	[1.12437]	[15.0517]	[0.04472]	[1.37565]	[-0.41121]	[-1.95851]	[0.70336]	[-1.03963]	[-0.38478]
INFLATION(-2)	-700.6718	-0.701088	7084.263	-8318.201	-12232.34	0.331470	-49.76303	272.4683	1.039787
	(700.135)	(0.09625)	(14768.9)	(7515.56)	(10255.5)	(0.39399)	(91.8928)	(164.894)	(362.233)
	[-1.00077]	[-7.28439]	[0.47968]	[-1.10680]	[-1.19276]	[0.84132]	[-0.54153]	[1.65238]	[0.00287]
RESERVES(-1)	-0.021577	-8.65E-07	0.806063	-0.057388	-0.136088	1.07E-05	0.001336	0.000454	-0.008712
	(0.01721)	(2.4E-06)	(0.36302)	(0.18473)	(0.25208)	(9.7E-06)	(0.00226)	(0.00405)	(0.00890)
	[-1.25378]	[-0.36582]	[2.22043]	[-0.31065]	[-0.53986]	[1.10097]	[0.59168]	[0.11198]	[-0.97842]
RESERVES(-2)	0.008987	8.80E-07	0.258740	0.021533	0.104951	-1.24E-05	0.000182	-0.001788	0.007697
	(0.01802)	(2.5E-06)	(0.38015)	(0.19345)	(0.26398)	(1.0E-05)	(0.00237)	(0.00424)	(0.00932)
	[0.49869]	[0.35530]	[0.68063]	[0.11131]	[0.39758]	[-1.21780]	[0.07698]	[-0.42119]	[0.82546]
LOAN(-1)	-0.026321	1.65E-06	0.279661	0.878111	0.006423	1.88E-05	0.003477	0.002166	-0.008299
	(0.01729)	(2.4E-06)	(0.36470)	(0.18559)	(0.25325)	(9.7E-06)	(0.00227)	(0.00407)	(0.00894)
	[-1.52242]	[0.69482]	[0.76682]	[4.73147]	[0.02536]	[1.93570]	[1.53214]	[0.53189]	[-0.92782]
LOAN(-2)	0.021342	1.71E-07	-0.218614	-0.041844	0.554233	5.63E-06	0.000650	-0.006018	-0.000203
	(0.02039)	(2.8E-06)	(0.43002)	(0.21883)	(0.29860)	(1.1E-05)	(0.00268)	(0.00480)	(0.01055)
	[1.04692]	[0.06095]	[-0.50838]	[-0.19122]	[1.85609]	[0.49111]	[0.24308]	[-1.25336]	[-0.01926]
MONEY(-1)	0.012223	-2.14E-06	0.152917	-0.030065	0.256507	-1.68E-05	-0.000260	0.001186	0.004072
	(0.01050)	(1.4E-06)	(0.22157)	(0.11275)	(0.15386)	(5.9E-06)	(0.00138)	(0.00247)	(0.00543)
	[1.16369]	[-1.48284]	[0.69014]	[-0.26664]	[1.66715]	[-2.83453]	[-0.18840]	[0.47955]	[0.74935]
MONEY(-2)	-0.014285	-8.64E-09	0.052393	0.151476	0.095913	-1.01E-05	0.000178	0.001137	-0.001912

	(0.01144)	(1.6E-06)	(0.24126)	(0.12277)	(0.16753)	(6.4E-06)	(0.00150)	(0.00269)	(0.00592)
	[-1.24905]	[-0.00549]	[0.21717]	[1.23381]	[0.57252]	[-1.57552]	[0.11827]	[0.42224]	[-0.32305]
TMM(-1)	382.8707	0.003254	1993.197	-644.0791	-7789.878	0.401612	-13.58486	70.30034	0.597411
	(281.084)	(0.03864)	(5929.27)	(3017.28)	(4117.27)	(0.15818)	(36.8923)	(66.2002)	(145.426)
	[1.36212]	[0.08422]	[0.33616]	[-0.21346]	[-1.89200]	[2.53903]	[-0.36823]	[1.06194]	[0.00411]
TMM(-2)	-388.2168	-0.061489	-1921.968	117.3789	9141.731	0.047170	-11.25496	26.37148	-129.0436
	(236.024)	(0.03245)	(4978.75)	(2533.58)	(3457.23)	(0.13282)	(30.9781)	(55.5877)	(122.113)
	[-1.64482]	[-1.89514]	[-0.38603]	[0.04633]	[2.64424]	[0.35514]	[-0.36332]	[0.47441]	[-1.05676]
USD_DZD(-1)	2.373276	0.000350	5.785908	5.215539	-30.27157	-0.000871	0.446291	0.388773	1.363333
	(1.82659)	(0.00025)	(38.5307)	(19.6074)	(26.7556)	(0.00103)	(0.23974)	(0.43019)	(0.94503)
	[1.29929]	[1.39289]	[0.15016]	[0.26600]	[-1.13141]	[-0.84744]	[1.86156]	[0.90372]	[1.44263]
USD_DZD(-2)	-2.133592	-0.000416	-34.44747	-2.174758	31.79300	4.09E-06	-0.028623	-0.080130	-1.394012
	(1.68426)	(0.00023)	(35.5283)	(18.0796)	(24.6707)	(0.00095)	(0.22106)	(0.39667)	(0.87139)
	[-1.26678]	[-1.79753]	[-0.96958]	[-0.12029]	[1.28869]	[0.00431]	[-0.12948]	[-0.20200]	[-1.59975]
EUR_DZD(-1)	1.226661	-4.89E-05	5.910611	9.894908	32.03655	-0.000978	-0.017723	0.812734	0.672480
	(1.21273)	(0.00017)	(25.5816)	(13.0180)	(17.7638)	(0.00068)	(0.15917)	(0.28562)	(0.62744)
	[1.01149]	[-0.29303]	[0.23105]	[0.76010]	[1.80347]	[-1.43363]	[-0.11135]	[2.84552]	[1.07179]
EUR_DZD(-2)	0.104332	-6.63E-05	-9.304069	-5.497342	-35.43271	0.000953	0.096103	0.098525	-0.665973
	(1.29853)	(0.00018)	(27.3917)	(13.9390)	(19.0207)	(0.00073)	(0.17043)	(0.30583)	(0.67183)
	[0.08035]	[-0.37128]	[-0.33967]	[-0.39438]	[-1.86285]	[1.30445]	[0.56388]	[0.32216]	[-0.99128]
BRENT(-1)	0.779454	-1.71E-05	0.175742	3.750988	6.070598	-0.000385	-0.047825	-0.070135	0.953867
	(0.31646)	(4.4E-05)	(6.67548)	(3.39701)	(4.63544)	(0.00018)	(0.04154)	(0.07453)	(0.16373)
	[2.46305]	[-0.39414]	[0.02633]	[1.10420]	[1.30961]	[-2.15993]	[-1.15144]	[-0.94101]	[5.82592]
BRENT(-2)	-0.393228	-6.70E-05	-2.639043	-1.599467	0.439601	0.000244	-0.076649	0.121974	-0.314515
	(0.32674)	(4.5E-05)	(6.89245)	(3.50742)	(4.78610)	(0.00018)	(0.04289)	(0.07695)	(0.16905)
	[-1.20347]	[-1.49155]	[-0.38289]	[-0.45602]	[0.09185]	[1.32775]	[-1.78730]	[1.58503]	[-1.86049]
C	497.2670	0.011915	-2047.269	49.85259	5103.953	0.219854	-28.46467	37.83527	-32.84655
	(156.852)	(0.02156)	(3308.69)	(1683.72)	(2297.54)	(0.08827)	(20.5869)	(36.9414)	(81.1515)
	[3.17029]	[0.55260]	[-0.61876]	[0.02961]	[2.22148]	[2.49081]	[-1.38266]	[1.02420]	[-0.40476]
R-squared	0.995805	0.995196	0.995225	0.996297	0.981153	0.857017	0.993857	0.977342	0.963476
Adj. R-squared	0.994048	0.993185	0.993227	0.994746	0.973264	0.797164	0.991286	0.967857	0.948186
Sum sq. resids	3509.451	6.63E-05	1561598.	404388.0	752982.7	0.001111	60.45589	194.6638	939.4002
S.E. equation	9.034110	0.001242	190.5682	96.97615	132.3300	0.005084	1.185728	2.127690	4.674026
F-statistic	567.0102	494.8749	497.9298	642.6640	124.3636	14.31866	386.4942	103.0443	63.01657
Log likelihood	-213.0927	338.2193	-402.1308	-360.2471	-379.5187	250.8350	-87.19236	-123.4425	-172.2355
Akaike AIC	7.486861	-10.29740	13.58487	12.23378	12.85544	-7.478548	3.425560	4.594920	6.168887
Schwarz SC	8.138725	-9.645532	14.23673	12.88564	13.50731	-6.826685	4.077424	5.246784	6.820751
Mean dependent	1516.246	0.046042	13116.23	7882.847	9913.398	0.022598	105.0661	121.6020	63.29274
S.D. dependent	117.1022	0.015043	2315.502	1337.932	809.2969	0.011288	12.70182	11.86775	20.53381

Determinant resid covariance (dof adj.)	75422.81
Determinant resid covariance	2800.229
Log likelihood	-1037.829
Akaike information criterion	38.99448
Schwarz criterion	44.86125

APPENDIX N°04: GMM SYSTEM ESTIMATION PROCESS

1. Variables Stationary test

Panel unit root test: Summary
Series: DEPOSITS
Date: 04/04/21 Time: 11:44
Sample: 2010 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-9.77647	0.0000	18	144
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.05037	0.0202	18	144
ADF - Fisher Chi-square	59.3487	0.0085	18	144
PP - Fisher Chi-square	121.599	0.0000	18	162

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: FL
Date: 04/04/21 Time: 11:45
Sample: 2010 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-1.96343	0.0248	18	144
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	1.07952	0.8598	18	144
ADF - Fisher Chi-square	23.5651	0.9450	18	144
PP - Fisher Chi-square	57.6006	0.0126	18	162

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: GDP
Date: 04/04/21 Time: 11:47
Sample: 2010 2019
Exogenous variables: Individual effects
User-specified lags: 1

Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	6.76729	1.0000	18	144
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	4.32078	1.0000	18	144
ADF - Fisher Chi-square	3.38982	1.0000	18	144
PP - Fisher Chi-square	5.72035	1.0000	18	162

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(GDP_ANNUAL_GROWTH)
Date: 04/04/21 Time: 11:49
Sample: 2010 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	6.34720	1.0000	18	126
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.49928	0.6912	18	126
ADF - Fisher Chi-square	22.3010	0.9641	18	126
PP - Fisher Chi-square	86.3905	0.0000	18	144

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: INFLATION
Date: 04/04/21 Time: 11:50
Sample: 2010 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-9.26777	0.0000	18	144
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.37839	0.0000	18	144
ADF - Fisher Chi-square	87.9885	0.0000	18	144

PP - Fisher Chi-square	64.8558	0.0022	18	162

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: IRR
Date: 04/04/21 Time: 11:51
Sample: 2010 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-7.37685	0.0000	18	144
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-3.16862	0.0008	18	144
ADF - Fisher Chi-square	71.1432	0.0004	18	144
PP - Fisher Chi-square	104.128	0.0000	18	162

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: LTD
Date: 04/04/21 Time: 11:51
Sample: 2010 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	7.89416	1.0000	18	144
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.77743	0.7815	18	144
ADF - Fisher Chi-square	30.1423	0.7428	18	144
PP - Fisher Chi-square	60.9202	0.0059	18	162

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: NPL
Date: 04/04/21 Time: 11:52
Sample: 2010 2019
Exogenous variables: Individual effects

User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.39216	0.3475	17	136
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.07828	0.4688	17	136
ADF - Fisher Chi-square	39.3585	0.2424	17	136
PP - Fisher Chi-square	58.3262	0.0058	17	153

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: PTL
Date: 04/04/21 Time: 11:52
Sample: 2010 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-15.2480	0.0000	17	136
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-2.55197	0.0054	17	136
ADF - Fisher Chi-square	62.8689	0.0019	17	136
PP - Fisher Chi-square	83.2842	0.0000	17	153

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: ROA
Date: 04/04/21 Time: 11:53
Sample: 2010 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.69156	0.0000	18	144
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.49617	0.0673	18	144
ADF - Fisher Chi-square	51.5025	0.0453	18	144
PP - Fisher Chi-square	62.4873	0.0040	18	162

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: ROE
Date: 04/04/21 Time: 11:54
Sample: 2010 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.09904	0.0000	18	144
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-1.71816	0.0429	18	144
ADF - Fisher Chi-square	57.8680	0.0119	18	144
PP - Fisher Chi-square	98.5480	0.0000	18	162

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: SIZE
Date: 04/04/21 Time: 11:54
Sample: 2010 2019
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.73755	0.0000	18	144
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.02346	0.4906	18	144
ADF - Fisher Chi-square	38.1310	0.3727	18	144
PP - Fisher Chi-square	71.9983	0.0003	18	162

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: EQUITY_RATIO
Date: 04/04/21 Time: 12:05
Sample: 2010 2019
Exogenous variables: Individual effects
User-specified lags: 1

Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-0.41501	0.3391	18	144
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.01743	0.4930	18	144
ADF - Fisher Chi-square	31.4757	0.6836	18	144
PP - Fisher Chi-square	75.6294	0.0001	18	162

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

2. Descriptive statistics

	ROE	ROA	DEPOSITS	SIZE	CR	EQUITY_RATIO	FL	GDP_ANNUAL_GROWTH	INFLATION	IRR	LTD	NPL	PTL
Mean	0.359085	0.025519	18.70725	19.18498	1.26E-09	0.134404	0.545453	2.670000	4.649291	0.075191	1.078046	0.111083	0.056121
Median	0.295475	0.025224	18.66789	18.95812	4.51E-10	0.061473	0.538975	3.050000	4.397101	0.071093	0.857966	0.082240	0.046215
Maximum	1.134301	0.095974	21.61812	21.97306	1.37E-08	0.748545	0.854860	3.800000	8.891451	0.231675	26.33388	1.413536	0.240252
Minimum	-0.005615	-0.003062	13.01313	16.40772	0.000000	0.010348	0.182579	0.800000	1.951768	0.027890	0.238165	0.000000	0.000000
Std. Dev.	0.267880	0.014652	1.787602	1.563243	2.04E-09	0.146479	0.151568	1.081014	1.873003	0.025181	2.104225	0.137153	0.047127
Skewness	1.001980	0.965076	-0.173695	0.196478	2.867829	1.705573	-0.190280	-0.670112	0.836738	2.293368	10.52524	5.314097	1.199980
Kurtosis	3.479495	5.936606	2.335630	1.824164	12.89236	5.540688	2.600421	1.798666	3.286966	12.69983	121.0431	47.21722	4.762090
Jarque-Bera	31.84327	92.61858	4.215498	11.52754	980.6742	135.6826	2.283669	24.29552	21.62154	863.4370	10782.96	15510.91	66.48578
Probability	0.000000	0.000000	0.121511	0.003139	0.000000	0.000000	0.319233	0.000005	0.000020	0.000000	0.000000	0.000000	0.000000
Sum	64.63535	4.593429	3367.304	3453.296	2.26E-07	24.19266	98.18157	480.6000	836.8723	13.53432	194.0482	19.99488	10.10180
Sum Sq. Dev.	12.84501	0.038428	571.9980	437.4275	7.44E-16	3.840622	4.112123	209.1780	627.9573	0.113504	792.5698	3.367163	0.397554
Observations	180	180	180	180	180	180	180	180	180	180	180	180	180

3. Autocorrelation matrix

	ROE	ROA	DEPOSITS	SIZE	INFLATION	GDP	LTD	IRR	NPL	PTL	EQUITY_RATIO	FL
ROE	1.000000	0.044342	0.548733	0.560201	0.063475	-0.019515	-0.089983	-0.130786	0.138189	0.158406	-0.582852	0.166479
ROA	0.044342	1.000000	-0.548493	-0.557409	0.075649	0.109012	0.088642	0.454549	-0.246370	-0.366303	0.393603	-0.015569
DEPOSITS	0.548733	-0.548493	1.000000	0.974013	-0.010337	-0.121549	-0.300549	-0.478395	0.392213	0.538573	-0.837354	0.255844
SIZE	0.560201	-0.557409	0.974013	1.000000	-0.032320	-0.119984	-0.112702	-0.490311	0.403109	0.568551	-0.797547	0.246499
INFLATION	0.063475	0.075649	-0.010337	-0.032320	1.000000	0.279118	-0.089646	0.103014	-0.023134	-0.011385	-0.009956	-0.154216
GDP	-0.019515	0.109012	-0.121549	-0.119984	0.279118	1.000000	-0.002538	0.113092	0.006306	0.069374	0.088073	-0.375853
LTD	-0.089983	0.088642	-0.300549	-0.112702	-0.089646	-0.002538	1.000000	0.026765	-0.037846	-0.014311	0.185704	0.024313
IRR	-0.130786	0.454549	-0.478395	-0.490311	0.103014	0.113092	0.026765	1.000000	-0.305312	-0.279687	0.449505	-0.283707
NPL	0.138189	-0.246370	0.392213	0.403109	-0.023134	0.006306	-0.037846	-0.305312	1.000000	0.445658	-0.314115	0.172933
PTL	0.158406	-0.366303	0.538573	0.568551	-0.011385	0.069374	-0.014311	-0.279687	0.445658	1.000000	-0.348443	0.201922
EQUITY_RATIO	-0.582852	0.393603	-0.837354	-0.797547	-0.009956	0.088073	0.185704	0.449505	-0.314115	-0.348443	1.000000	-0.234649
FL	0.166479	-0.015569	0.255844	0.246499	-0.154216	-0.375853	0.024313	-0.283707	0.172933	0.201922	-0.234649	1.000000

4. GMM estimation

Dependent Variable: ROE
Method: Panel Generalized Method of Moments
Date: 04/14/21 Time: 01:09
Sample: 2010 2019
Periods included: 10
Cross-sections included: 18
Total panel (balanced) observations: 180
2SLS instrument weighting matrix
Instrument specification: C GDP INFLATION SIZE DEPOSITS IRR FL LTD PTL NPL EQUITY_RATIO
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	0.020738	0.015786	1.313723	0.1907
INFLATION	0.007356	0.008388	0.877015	0.3817
SIZE	0.387738	0.088135	4.399362	0.0000
DEPOSITS	-0.307331	0.088391	-3.476948	0.0006
IRR	2.496214	0.705904	3.536197	0.0005
FL	0.274436	0.115143	2.383425	0.0183
LTD	-0.044875	0.015537	-2.888186	0.0044
PTL	-1.055489	0.423108	-2.494606	0.0136
NPL	-0.073555	0.125624	-0.585517	0.5590
EQUITY_RATIO	-1.065314	0.219019	-4.864023	0.0000
C	-1.498335	0.406937	-3.681982	0.0003

R-squared	0.475601	Mean dependent var	0.359085
Adjusted R-squared	0.444571	S.D. dependent var	0.267880
S.E. of regression	0.199643	Sum squared resid	6.735914
Durbin-Watson stat	0.695562	J-statistic	3.86E-14
Instrument rank	11		

Dependent Variable: ROA
Method: Panel Generalized Method of Moments
Date: 04/14/21 Time: 01:12
Sample: 2010 2019
Periods included: 10
Cross-sections included: 18
Total panel (balanced) observations: 180
2SLS instrument weighting matrix
Instrument specification: C GDP INFLATION SIZE DEPOSITS IRR FL LTD PTL NPL EQUITY_RATIO DUMMY
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	0.002000	0.000910	2.198853	0.0293
INFLATION	0.000424	0.000473	0.896851	0.3711
SIZE	0.009232	0.005226	1.766645	0.0791
DEPOSITS	-0.008652	0.004975	-1.739012	0.0839
IRR	0.150462	0.040344	3.729448	0.0003
FL	0.023451	0.006474	3.622105	0.0004
LTD	-0.000961	0.000876	-1.097725	0.2739
PTL	-0.010182	0.024581	-0.414221	0.6792
NPL	0.004028	0.007130	0.564901	0.5729
EQUITY_RATIO	-0.000262	0.015513	-0.016872	0.9866
DUMMY	-0.015769	0.005411	-2.914083	0.0041
C	-0.014707	0.043465	-0.338364	0.7355

R-squared	0.449458	Mean dependent var	0.025519
Adjusted R-squared	0.413411	S.D. dependent var	0.014652
S.E. of regression	0.011222	Sum squared resid	0.021156
Durbin-Watson stat	0.770120	J-statistic	3.42E-17
Instrument rank	12		

Dependent Variable: ROE
Method: Panel Generalized Method of Moments
Date: 04/14/21 Time: 01:10
Sample: 2010 2019
Periods included: 10
Cross-sections included: 18
Total panel (balanced) observations: 180
2SLS instrument weighting matrix
Instrument specification: C GDP INFLATION SIZE DEPOSITS IRR FL LTD PTL NPL EQUITY_RATIO DUMMY
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	0.044250	0.014003	3.160073	0.0019
INFLATION	0.012048	0.007283	1.654190	0.1000
SIZE	0.582397	0.080436	7.240491	0.0000
DEPOSITS	-0.276241	0.076582	-3.607145	0.0004
IRR	1.642060	0.620971	2.644341	0.0090
FL	0.254397	0.099653	2.552838	0.0116
LTD	-0.037675	0.013476	-2.795793	0.0058
PTL	-0.328314	0.378350	-0.867753	0.3868
NPL	0.041675	0.109737	0.379772	0.7046
EQUITY_RATIO	0.039158	0.238780	0.163992	0.8699
DUMMY	-0.633129	0.083289	-7.601570	0.0000
C	-5.822671	0.669005	-8.703473	0.0000

R-squared	0.609808	Mean dependent var	0.359085
Adjusted R-squared	0.584260	S.D. dependent var	0.267880
S.E. of regression	0.172724	Sum squared resid	5.012021
Durbin-Watson stat	0.984333	J-statistic	9.23E-16
Instrument rank	12		

Dependent Variable: ROA
Method: Panel Generalized Method of Moments
Date: 04/14/21 Time: 01:12
Sample: 2010 2019
Periods included: 10
Cross-sections included: 18
Total panel (balanced) observations: 180
2SLS instrument weighting matrix
Instrument specification: C GDP INFLATION SIZE DEPOSITS IRR FL LTD PTL NPL EQUITY_RATIO
Constant added to instrument list

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GDP	0.001415	0.000907	1.560339	0.1206
INFLATION	0.000308	0.000482	0.638273	0.5242
SIZE	0.004384	0.005063	0.865971	0.3877
DEPOSITS	-0.009427	0.005077	-1.856640	0.0651
IRR	0.171736	0.040548	4.235345	0.0000
FL	0.023950	0.006614	3.621096	0.0004
LTD	-0.001140	0.000892	-1.277754	0.2031
PTL	-0.028293	0.024304	-1.164141	0.2460
NPL	0.001158	0.007216	0.160414	0.8727
EQUITY_RATIO	-0.027770	0.012581	-2.207335	0.0286

C	0.092996	0.023375	3.978427	0.0001

R-squared	0.421630	Mean dependent var	0.025519
Adjusted R-squared	0.387407	S.D. dependent var	0.014652
S.E. of regression	0.011468	Sum squared resid	0.022225
Durbin-Watson stat	0.672693	J-statistic	1.82E-15
Instrument rank	11		

5. Central Bank reports

Monetary situation for Algerian banks 2012-2015

3.1 Monetary survey (Cont)
(Values in billions of dinars- End of period)

	MONEY SUPPLY (BROAD MONEY (M2))							IMPORT DEPOSITS (*)	STATES' FUNDS LOANS	MEDIUM AND LONG TERM FOREIGN LIABILITIES	OTHER ITEMS (NET)
		NARROW MONEY (M1)					QUASI MONEY				
			Currency in circulation outside CBA	Demand Deposits	Deposits at the Treasury	Deposits at post offices					
2012	**11 015,1**	**7 681,5**	2952,3	3 380,2	758,7	590,3	**3 333,6**	325,2	24,4	3,8	4 525,1
2013	**11 941,5**	**8 249,8**	3204,0	3 564,5	860,2	621,1	**3 691,7**	366,7	25,2	3,7	4 809,0
2014	**13 686,8**	**9 603,0**	3658,9	4 460,8	788,8	694,5	**4 083,7**	391,6	27,1	3,6	6 137,7
2015	**13 704,5**	**9 261,1**	4108,1	3 908,5	537,2	707,4	**4 443,4**	627,5	25,1	3,7	8 859,4
2016 Jan	**14 138,6**	**9 598,9**	4190,4	4 139,6	549,7	719,2	**4 539,6**	701,3	24,5	3,8	8 768,6

Credit distribution to the economy 2011-2016

3.2 Credit to the economy by maturity (Net repurchasing)
(Values in billions of dinars- End of period)

	Total credits	Short term credits	Medium and long term credits
2011	**3 726,5**	1 363,0	2 363,5
2012	**4 287,6**	1 361,7	2 926,0
2013	**5 156,3**	1 423,4	3 732,9
2014	**6 504,6**	1 608,7	4 895,9
2015 Oct	**7 476,6**	1 823,9	5 652,7
Nov	**7 591,5**	1 897,7	5 693,8
Dec	**7 277,2**	1 710,6	5 566,6
2016 Jan	**7 258,9**	1 710,4	5 548,5

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Banking diposit structure 2011-2016

3.4 Banking deposits structure
(Values in billions of dinars- End of period)

	DEMAND DEPOSITS				TERM DEPOSITS		
		DEPOSITS AT BANKS	DEPOSITS AT TREASURY	DEPOSITS AT POST OFFICE		DEPOSITS IN DINARS	DEPOSITS IN FOREIGN CURRENCY
2011	**4 570,2**	3 536,2	518,7	515,3	**2 787,7**	2 483,8	303,9
2012	**4 729,1**	3 380,2	758,7	590,3	**3 333,6**	2 994,4	339,2
2013	**5 018,7**	3 537,5	860,2	621,1	**3 691,7**	3 321,7	370,0
2014	**5 918,0**	4 434,8	788,8	694,5	**4 083,7**	3 678,9	404,8
2015	**5 136,3**	3 891,7	537,2	707,4	**4 443,4**	3 947,3	496,0
2016 Jan	**5 386,3**	4 117,3	549,7	719,2	**4 539,6**	4 043,9	495,7

Bank of Algeria balance sheet 2015-2020

2.LIABILITIES	TOTAL LIABILITIES	BROAD MONEY			FOREIGN LIABILITIES			STATE DEPOSITS			OTHER LIABILITIES' ITEMS
		Currency in circulation	Commercial banks deposits* at CBA	Other financial institutions' deposits **	Short term borrowings	International Payments	Loans from IMF	Treasury	Ministries	Other State Deposits	
2015	**15 773,0**	**4 183,8**	**1 019,9**	**16,8**	**0,7**	**1,6**	**0,0**	**2 151,6**	**1,1**	**5,1**	**8 392,4**
2016	**13 492,5**	**4 566,9**	**820,9**	**13,2**	**0,7**	**1,6**	**0,0**	**864,2**	**1,0**	**7,0**	**7 216,9**
2017	**14 185,3**	**4 781,7**	**1 380,6**	**14,4**	**0,6**	**1,5**	**0,0**	**512,8**	**1,3**	**6,8**	**7 485,5**
2018	**15 528,3**	**4 986,8**	**1 179,6**	**39,4**	**0,7**	**1,6**	**0,0**	**1 694,4**	**1,4**	**5,1**	**7 619,2**
2019	**14 769,7**	**5 508,9**	**1 085,9**	**38,1**	**0,7**	**1,3**	**0,0**	**1 774,4**	**1,2**	**1,5**	**6 357,6**
2020 Jan	**14 632,6**	**5 582,8**	**1 083,2**	**29,7**	**0,7**	**1,4**	**0,0**	**1 515,9**	**1,1**	**1,3**	**6 416,5**
Feb	**14 602,1**	**5 617,8**	**1 153,9**	**24,5**	**0,6**	**1,5**	**0,0**	**1 373,6**	**1,1**	**3,2**	**6 425,9**
Mar	**14 560,8**	**5 739,1**	**980,8**	**36,0**	**0,7**	**1,3**	**0,0**	**1 144,6**	**1,1**	**4,7**	**6 652,5**
Apr	**14 855,4**	**5 882,6**	**1 027,8**	**32,9**	**0,7**	**1,1**	**0,0**	**935,2**	**1,1**	**9,7**	**6 964,2**
May	**14 599,2**	**5 935,8**	**916,7**	**33,7**	**0,7**	**1,2**	**0,0**	**1 471,6**	**1,1**	**4,9**	**6 233,4**
Jun	**14 403,0**	**5 972,0**	**759,6**	**33,0**	**0,6**	**1,3**	**0,0**	**1 244,8**	**1,2**	**4,9**	**6 385,5**
Jul	**14 738,4**	**6 039,1**	**839,9**	**42,5**	**0,5**	**1,4**	**0,0**	**1 195,1**	**1,1**	**4,6**	**6 614,2**
Aug	**14 610,9**	**6 067,3**	**761,1**	**44,0**	**0,6**	**1,4**	**0,0**	**1 060,7**	**1,2**	**4,9**	**6 669,6**
Sept	**14 181,7**	**6 105,4**	**461,8**	**46,4**	**0,7**	**1,4**	**0,0**	**901,7**	**1,2**	**5,9**	**6 657,3**
Oct	**14 632,6**	**5 582,8**	**1 083,2**	**29,7**	**0,7**	**1,4**	**0,0**	**1 515,9**	**1,1**	**1,3**	**6 416,5**
Nov	**14 602,1**	**5 617,8**	**1 153,9**	**24,5**	**0,6**	**1,5**	**0,0**	**1 373,6**	**1,1**	**3,2**	**6 425,9**
Dec	**14 560,8**	**5 739,1**	**980,8**	**36,0**	**0,7**	**1,3**	**0,0**	**1 144,6**	**1,1**	**4,7**	**6 652,5**

* Other Depository corporations

** Includes other banking institutions and insurance companies from July 2007

QUARTERLY STATISTICAL BULLETIN - March 2021 7

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1.2 Detailed Balance sheet of the Bank of Algeria

(Values in billions of dinars- End of period)

1. Assets		TOTAL ASSETS	FOREIGN ASSETS					CLAIM ON CENTRAL GOVERNMENT			CLAIM ON DEPOSIT TAKERS* AND ON OBFI**	OTHER CLAIMS	OTHER ASSETS' ITEMS
			Reserve position in the Fund	Monetary gold	Payments agreements assets	SDR Holdings	Foreign Assets	Advances to Treasury	Deposits to post offices	Other advances			
2015		15 773,0	58,3	1,1	0,4	159,6	15 305,4	0,0	1,5	0,0	0,0	1,7	245,0
2016		13 492,5	27,9	1,1	0,4	133,5	12 533,4	0,0	1,7	0,4	432,6	2,1	359,2
2017		14 185,3	32,4	1,1	0,4	147,0	11 142,0	0,0	3,0	0,3	0,0	2 487,2	371,9
2018		15 528,3	40,8	1,1	0,5	147,5	9 384,8	0,0	2,6	0,0	0,0	5 558,5	392,5
2019		14 769,7	64,7	1,1	0,5	147,8	7 426,5	0,0	3,3	0,0	160,0	6 558,4	407,4
2020	Jan	14 632,6	64,8	1,1	0,5	148,1	7 369,7	0,0	3,3	0,0	50,0	6 558,3	436,8
	Feb	14 602,1	64,7	1,1	0,5	147,9	7 225,5	0,0	3,3	0,0	150,0	6 558,4	450,8
	Mar	14 560,8	66,7	1,1	0,5	152,9	7 292,9	0,0	3,4	0,3	0,0	6 558,4	484,7
	Apr	14 855,4	68,7	1,1	0,5	157,6	7 387,7	0,0	3,4	0,0	134,3	6 558,4	543,7
	May	14 599,2	83,8	1,1	0,5	158,5	7 169,9	0,0	3,3	0,3	70,0	6 558,4	553,4
	Jun	14 403,0	84,4	1,1	0,5	159,8	6 978,4	0,0	3,3	0,7	15,5	6 558,4	600,9
	Jul	14 738,4	86,0	1,1	0,5	162,8	6 967,3	0,0	4,0	0,3	340,0	6 558,4	617,9
	Aug	14 610,9	86,3	1,1	0,5	163,3	6 819,2	0,0	4,0	0,3	366,7	6 558,4	611,0
	Sept	14 181,7	86,4	1,1	0,5	163,5	6 538,9	0,0	4,0	0,0	212,0	6 558,4	617,0
	Oct	14 632,6	64,8	1,1	0,5	148,1	7 369,7	0,0	3,3	0,0	50,0	6 558,3	436,8
	Nov	14 602,1	64,7	1,1	0,5	147,9	7 225,5	0,0	3,3	0,0	150,0	6 558,4	450,8
	Dec	14 560,8	66,7	1,1	0,5	152,9	7 292,9	0,0	3,4	0,3	0,0	6 558,4	484,7

- Monetary situation of Algerian banks 2015-2020

3.1 Monetary survey (Cont)

(Values in billions of dinars- End of period)

	MONEY SUPPLY (BROAD MONEY (M2))						QUASI MONEY	IMPORT DEPOSITS (*)	STATES' FUNDS LOANS	MEDIUM AND LONG TERM FOREIGN LIABILITIES	OTHER ITEMS (NET)
		NARROW MONEY (M1)									
			Currency in circulation outside CBA	Demand Deposits	Deposits at the Treasury	Deposits at post offices					
2015	13 704,5	9 261,1	4108,1	3 908,5	537,2	707,4	4 443,4	627,5	25,1	3,7	8 859,4
2016	13 816,3	9 407,0	4497,2	3 745,4	405,0	759,4	4 409,3	719,6	20,6	3,5	8 628,1
2017	14 974,6	10 266,1	4716,9	4 513,3	261,3	774,5	4 708,5	811,1	16,0	3,8	8 993,9
2018	16 636,7	11 404,1	4926,8	5 371,8	241,9	863,6	5 232,6	582,0	19,6	3,7	8 545,6
2019	16 506,6	10 975,2	5437,6	4 351,2	273,3	913,1	5 531,4	559,8	13,3	3,6	8 195,5
2020 Jan	16 660,3	11 078,7	5517,2	4347,7	296,9	917,0	5581,6	517,7	13,3	3,6	8 220,3

- Credit distribution to the economy 2015-2020

3.3 Credit to the economy by sector (Net repurchasing)
(Values in billions of dinars- End of period)

	Total	Public sector	Private sector	Local Government
2015	**7 277,2**	3 688,2	3 588,3	0,7
2016	**7 909,9**	3 952,2	3 957,1	0,6
2017	**8 880,0**	4 311,3	4 568,3	0,5
2018	**9 976,3**	4 943,6	5 032,2	0,6
2019	**10 857,8**	5 636,0	5 221,3	0,6
2020 Jan	**10 848,5**	5 672,0	5 176,0	0,5

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