Impact of Prudential Regulation on Banking Sector Resilience: Evaluation of Algeria's Banking Soundness indicators under the Basel Frameworks (2002-2024)

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Abstract: This study analyzes the implications of prudential policies and regulatory frameworks on the development of financial soundness indicators of Algerian banking system.

The research spans from 2002 to 2024, with a particular emphasis on the period from 2009 to 2018. The study finds that Algeria's banking system has generally adhered to and exceeded international capital adequacy requirements, demonstrating high levels of liquidity and capital, particularly following the global financial crisis of 2008. However, the introduction of Basel II and Basel III provisions in 2014 marked a shift toward more comprehensive regulatory frameworks, including the integration of market and operational risks into capital adequacy calculations.

The study concludes that, despite challenges, Algeria's regulatory framework has played a significant role in strengthening the banking system's resilience to financial shocks.

Mots clés:
Mot clé.1: Système Bancaire Algérien
Mot clé.2: Stabilité Financière
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Résumé : Cette étude examine l'impact des politiques prudentielles et des cadres réglementaires sur le système bancaire algérien. Elle se concentre des normes de suffisance du capital de Bâle I à Bâle III, ainsi que les changements réglementaires ayant orienté la supervision financière en Algérie. Couvrant la période de 2002 à 2024, avec une attention particulière à 2009–2018, la recherche révèle que les banques algériennes ont généralement respecté, voire dépassé, les exigences internationales en matière de fonds propres, tout en maintenant des niveaux élevés de liquidité et de capital, notamment après la crise financière mondiale de 2008. L'introduction des normes de Bâle II et III en 2014 a marqué une étape clé vers un cadre réglementaire plus complet. L'étude conclut que le cadre prudentiel algérien a joué un rôle déterminant dans le renforcement de la résilience du système bancaire face aux chocs financier

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1. Introduction.

Prudential regulation has become one of the most important goals that economic policies seek to realize in order to achieve financial and economic stability. Prudential regulation began to emerge in the last decade in response to banking crises and failures. Governments recognized the need to mitigate risks associated with banking activities, leading to the introduction of basic regulatory measures such as reserve requirements and limits on lending. Although the term 'macroprudential' dates from the 1970s, but the global adoption of the macroprudential policies is more recent, the underlying approach has a long history. It began decades ago in the advanced economies and later in the emerging market economics faced with excessive capital inflows. The United States was probably the first country that implemented macroprudential policies to control credit growth in aggregate or in a major economic sector such as housing. In fact, especially major central banks in developed economies played a significant role in subsequent decades in managing credit accumulation and enhancing financial stability. (Kenç, 2016, p. 2).

That increases the growing significance of prudential regulation in maintaining financial stability globally, and particularly in light of recent financial crises. It emphasizes that Algeria, as a developing economy, must also prioritize prudential regulation due to the pivotal role of its financial sector in supporting economic growth and stability. Recognizing the critical importance of effective regulatory measures in mitigating systemic risks, the study highlights the need for a deeper understanding of how prudential regulation operates within the Algerian context to promote financial stability.

This paper aims to delve into the intricate relationship between prudential regulation and financial stability within the Algerian context. By employing rigorous empirical analysis and drawing insights from relevant theoretical frameworks, this study seeks to shed light on the effectiveness of prudential measures implemented by Algerian regulatory authorities.

Research Problem:

The Algerian banking system has undergone significant regulatory changes to align with international prudential standards, particularly those set by the Basel Committee. However, despite the implementation of these frameworks (Basel I, II, and III), there are concerns regarding the effectiveness of these regulations in maintaining financial stability and ensuring the proper absorption of financial shocks. The core problem lies in understanding the evolution of prudential capital regulation in Algeria and its impact on the stability and soundness of the banking system, as well as identifying gaps in the implementation of Basel frameworks and their real-world implications for the Algerian financial sector.

Forthat, considering many other potential bank stability determinants, we examine how prudential regulation influences the financial stability. Accordingly, the main research problem can be formulated as follow: what is the impact of prudential regulation on the stability of financial system in the Algeria for the period 2009-2024?

Research Hypothesis:

Our main hypothesis is that the implementation of Basel I, II, and III regulations has significantly contributed to enhancing the financial stability and resilience of the Algerian banking system by improving the capital adequacy and liquidity ratios.

Secondary hypothesis despite regulatory improvements, the Algerian banking system faces challenges in fully aligning with Basel III requirements, particularly in terms of market and operational risk management, which may impact the long-term stability of the banking sector.

Study Methodology

To achieve the objectives of the study and address the research problem, two methodologies were adopted; a descriptive approach, by presenting the conceptual framework of financial stability and prudential regulation, as well as mentioning key previous studies, including the determinants of measuring both financial stability and prudential regulation, focusing on capital-based prudential regulation measurement. Analytical approach was performed by analyzing the progress towards achieving financial stability in Algeria from the perspective of macroprudential regulation based on capital. We analyze two financial soundness indicators in the Algerian banking system: "the ratio of capital set by supervisory authorities to risk-weighted assets" (overall solvency), and "the ratio of core capital set by supervisory authorities to risk-weighted assets" (core solvency).

This study cover the period from 2002 to 2024, as this was the period during which the Bank of Algeria intensified its efforts to develop and direct macroprudential regulation through certain regulatory instructions. This followed the establishment of the Financial Stability Committee in 2002.

2. Financial stability and prudential regulation.

This section presents various definitions of financial stability and prudentialregulation while exploring the mechanisms through which a prudential regulation could impact financial stability.

2.1. Financial Stability.

Financial stability has garnered significant research attention, particularly following the Asian financial crisis of 1997-1999 and the global financial crisis of 2008. In response, the International Monetary Fund and the World Bank introduced the financial sector assessment program in 1999

to evaluate member states. The aftermath of these crises, especially the 2008 global financial crisis, has led to ongoing recovery efforts in many economies, underscoring the enduring impact and importance of financial stability. (Schinasi, October 2004 , p. 8) defined that financial stability can be described as a mechanism through which economic processes are optimized, risks are mitigated, and shocks are absorbed.

Economist Knut Wellinck's definition of financial stability involves a system's ability to efficiently allocate resources, absorb shocks without affecting the real economy or other financial systems. The stable financial system should not generate shocks itself and should effectively perform tasks such as mobilizing savings, diversifying risks, and allocating resources.

In 2017, the European Central Bank articulated its definition of financial stability as the prevention of the accumulation of systemic risks)Qatafi(2020 ،. Systemic risk, in turn, is characterized as the risk stemming from an event leading to a substantial loss in economic value or confidence. This risk is associated with a high level of uncertainty across a significant portion of the financial system, potentially exerting a significant impact on the real economy. Such events tied to systemic risk may manifest suddenly and unexpectedly, or their likelihood may accumulate over time without appropriate prudential responses (G10, 2001). The International Monetary Fund also defines systemic risk as the risk of a disruption in financial services resulting from the deterioration of all or part of the financial system, with severe and adverse consequences for the real economy (IMF, Octobre 2009).

Financial stability is achieved when the financial system functions efficiently and effectively without interruption and the financial risks are measured and sufficiently controlled to minimize the impact of systemic crises (Morgan, 2018, p. 113).

The notion of financial stability may vary between developed and developing economies. In well-established economies with sophisticated financial systems, financial stability is primarily determined by the condition of non-banking financial institutions such as retirement funds, brokerage houses, and investment funds. In contrast, developing economies often feature underdeveloped stock markets, with insurance companies playing a limited role, and investments predominantly relying on bank loans. Consequently, in these developing economies, banks are regarded as the central pillar of financial stability and a gateway to economic stability (Kabiraj, 2018, p. 35).

Financial stability refers to the ability of an individual, household, business, or an entire economy to maintain a consistent and predictable state of financial well-being over time. It involves effective management of financial resources, meeting financial obligations, and withstanding

economic shocks or unexpected expenses without experiencing significant negative consequences.

While financial stability is a crucial prerequisite for achieving various goals of financial sector regulation, as well as promoting growth and maintaining macroeconomic stability, it alone is not enough to fulfill these objectives (Sinha, 2011, p. 47).

2.2. Prudential Regulation.

There are multiple definitions of prudential regulation provided by various researchers and institutions:

Table 1. Prudential Regulation Framework

Authors	Definition
(Polizatto, 1990, p. 2)	Prudential regulation encompasses a collection of laws, rules, and regulations crafted to reduce the risks taken on by banks and guarantee the stability and well-being of both individual financial institutions and the overall system. Illustrative measures encompass lending limits, minimum capital adequacy guidelines, liquidity ratios, and more.
(OCDE, 2010)	Prudential regulation covers: capital standards, liquidity and diversification standards, accounting and provisioning standards, external audit and reporting standards, market entry and ownership rules of capital, market exit rules and disciplinary mechanisms, protection of depositors, as well as the power of the supervisory authority.
(Redrigo & Restoy, April 2023, p. 3)	Prudential regulation comprise macro-prudential and micro-prudential regulation. The objective of macro-prudential regulation is to detect and prevent the build-up of vulnerabilities in the financial system as a whole which may culminate in systemic risk. Micro-prudential regulation are focused on ensuring the safety and soundness of individual financial institutions. Together, macro- and micro-prudential regulation aim to ensure the stability of the financial system, aiding it in efficiently allocating resources to the real economy.
(Law No. 23-09 of to June 21, 2023)	Macro-prudential regulation aims to ensure that the resilience of the financial system by addressing and containing systemic vulnerabilities which could threaten it and by reinforcing the robustness of the financial system in the face of shocks aggregated.

Source: Prepared by the researchers

The global banks have witnessed many financial crises that have had a clear impact on the overall global financial stability. Therefore, efforts have been made by international regulatory bodies to establish precautionary rules. Algeria has worked towards this by issuing a series of systems that align with these rules. The Central Bank, established under Law 90-10 on banking and credit, specifies its tasks and powers. It acts as a regulatory body and an independent administrative authority responsible for issuing monetary and banking standards. The Central Bank is considered a

regulatory entity with governmental intervention, serving as an advisory body to the government and unable to issue independent judgments without its supervision. As for regulatory tasks, they are entrusted to another independent administrative body, the Banking Committee, which regulates and ensures their implementation.

Prudential regulation measurement involves regulatory techniques to ensure the stability of financial institutions, especially banks, and mitigate systemic risks. It includes various benchmarks like capital adequacy ratios, liquidity ratios, and asset quality metrics, stress testing, governance and risk management evaluation, market discipline measures, and macroprudential indicators. These assessments aim to enhance stability and resilience in the financial system by identifying and addressing risks promptly.

3. Literature Review.

The existing body of literature examining the impact of prudential regulation on the risks, and the stability of the financial system does not employ a consistent set of variables that can be used as a proxy for financial inclusion .Earlier research that explored the study's topic or one of its facets included.

The study of banking regulations, particularly those established by the Basel Committee, has become increasingly important in understanding the evolution of the global financial system and its stability. Over the years, various research studies have explored the impact of these standards, focusing on their implementation, challenges, and the ways they affect different banking systems worldwide, especially in developing countries like Algeria. The previous studies in this field reflect diverse perspectives on the adaptation and compliance with Basel standards, the obstacles faced by banks, and the methods to improve risk management and financial stability.

In this section, the previous studies will be grouped into specific categories to provide a clearer understanding of the different themes explored in the literature. These studies will be organized into four main groups as below.

3.1. Basel Standards and Algerian Banking System.

This group focuses on the application and challenges of Basel standards, particularly within the Algerian banking system, and their implications for financial stability and regulatory compliance.

(Laaraf, 2010) aimed to study developments and amendments to the Basel Committee standards and evaluate the challenges faced by the Algerian banking sector in complying with Basel II standards. It discovered that the implementation of the Basel I agreement was delayed in Algeria until 1999, despite the deadline being set for 1992, with a transition period. Its duration is 3 years. Algerian banks were given a period of up to 5 years

to comply, but Basel II standards were not applied by banks and financial institutions in the Algerian banking system. Therefore, the study focused only on Basel I**.**

(Suleiman, 2014) analyzed global precautionary standards and their potential application to the Algerian banking system, aiming to evaluate their implementation and adherence within Algerian banking regulations. It concluded that Algerian regulations were not fully aligned with Basel III, but showed partial alignment by increasing the overall capital adequacy ratio, though not meeting the agreement's specified extent. Furthermore, banks were required to maintain a short-term liquidity ratio, rather than a long-term one.

(Ben Al-Shaykh SIham, 2014) focused on identifying the challenges facing Algerian banks in implementing Basel III standards and to devise mechanisms for the development of these banks to enable them to overcome these challenges. The study has identified a range of challenges hindering the implementation of these standards by Algerian banks. Additionally, the study has proposed some suggested mechanisms to assist these banks in overcoming the challenges they face in implementing these standards.

Also (Berrish, 2017) aimed to analyze the opportunities and challenges posed by the Basel III agreement for banks, developed by the Basel Committee on Banking Supervision in 2010. The committee aimed to address vulnerabilities exposed by the 2008 financial crisis and strengthen banks' resilience to prevent future crises. The study focused on Algerian banks, emphasizing the importance of aligning with global standards, particularly those set by the Basel Committee, to compete effectively in the global banking sector. Non-compliance with these standards would likely result in the exclusion of Algerian banks from the global market.

(Zghashu, 2018) highlights the effectiveness of the Basel accords in improving banking risk management by establishing fundamental rules aimed at ensuring stability in the overall financial system. It notes that the Algerian banking system has adopted legislative frameworks inspired by the Basel accords, indicating a commitment to international precautionary standards. However, the study also acknowledges the practical challenges faced in adhering to these standards, including delays in implementation and a lack of clear enforcement mechanisms.

3.2. The Global Impact of Basel Standards and Financial Stability.

This group covers studies that explore the broader impact of Basel standards globally, especially focusing on financial stability, regulatory frameworks, and systemic risks.

Study of (Ait Akash, 2013) introduced the Basel Committee and its precautionary standards, while also analyzing the changes observed in banks. It highlights that banks were the main catalyst for the global financial crisis, particularly due to subprime mortgages, resulting in the collapse of major American banks. Additionally, it emphasizes the importance of staying updated with risk assessment methods for contemporary financial products.

(Norzitah Abdul Karim, 2019) paper of investigates the concept of "stability" as defined in academic research and by various regulatory bodies such as the International Monetary Fund, the Basel Committee for Banking Supervision (BCBS), and central banks in selected countries with dual banking systems. It critically examines the indicators used to measure financial and banking stability. The review concludes that there is no standardized acceptable definition and framework for financial and banking stability. In academic research, the z-score is commonly used as a measure of bank stability, assessing the distance from insolvency relative to volatility, profitability, and leverage. However, in practical application, a study of reports from central banks of dual banking systems indicates that while some monitor the stability of Islamic banking, most focus on the overall system, primarily conventional banks.

Research of (Bendin, 2019) aims to evaluate the necessity of banking and financial regulation for achieving stability and to identify the entities responsible for such regulation. It also examines the mechanisms, objectives, and effectiveness of these regulations in maintaining system safety and stability. The study suggests that partial precautionary regulation has not effectively prevented crises. Post-crisis, there's a shift towards applying both partial and comprehensive precautionary measures to address systemic risk and maintain global financial stability. Central banks are tasked with enforcing liquidity ratios, particularly focusing on Algerian banks, to emphasize financial stability and supervision, thus mitigating financial crises.

Paper of (Daoud, 2022)explores the influence of regulatory pressures on the relationship between changes in capital and bank risk-taking. It focuses on capital regulation, a key aspect of prudential regulation in the banking sector. The study examines empirical evidence specifically for Islamic banks, utilizing data from the Islamic banking sector between 2010 and 2014. Findings suggest that Islamic banks exhibit varying behavior based on their capital adequacy levels, with some evidence indicating a

positive relationship between changes in capital and risk for highly capitalized Islamic banks.

3.3. Risk Management, Capital Adequacy, and Regulatory Mechanisms.

Research of (Al-Khatimi, 2020) aims to emphasize the Bank of Algeria's role in adopting global precautionary measures established by the Basel Committee on Banking Supervision. It finds that banks and financial institutions in Algeria are committed to following the prudential rules issued by the Bank of Algeria. However, despite this commitment, these measures fall short in financial risk mitigation compared to global banking standards.

Study of (Hafeez, 2022) was clarified thatThe traditional z-score method for assessing bank risk is criticized for its backward-looking nature. In response, this study proposes a forward-looking approach by incorporating analyst forecasts. Empirical findings demonstrate that the forward-looking z-score predicts changes in the standard z-score one quarter in advance, with better predictive ability for downward risk in banks. Particularly, post the Dodd-Frank Act of 2010, this method shows enhanced predictive power, especially for large banks, indicating the impact of regulatory strengthening. The forward-looking z-score correlates significantly with default probability and market-based risk measures, offering predictive insights into banks' future profitability. Overall, this method addresses the limitations of the standard z-score, serving as a reliable early warning signal for banks' future risk and performance.

3.4. International Banking Evaluations and Risk Assessments.

Study of (Gouini, 2020) aimed to assess commercial banks in Saudi Arabia, specifically Alahli Bank and Saudi Investment Bank, in 2019 using the CAMLS banking evaluation system. It evaluated six key indicators using data from financial statements and Basel III disclosures. Results showed Alahli Bank and Riyadh Bank were classified in the first category, reflecting their strength and risk management capabilities. Conversely, Saudi Investment Bank was categorized in the third category, suggesting it requires more regulatory attention due to identified weaknesses.

Study of (Batahat, 2021) examined financial stability in a selection of Kuwaiti commercial banks spanning 2008 to 2019. Utilizing a multiple regression model with time series data, it found no statistically significant correlation between Return on Assets (ROA), leverage rate, and Capital Adequacy Ratio (CAR). Additionally, variations in the fixed value of the Basel index among banks were observed, suggesting bank-specific factors influenced these variations, while the relationship between CAR and independent variables remained consistent.

Literature reviewed the Basel Committee's standards for achieving banking stability and their application within the framework of Algerian

banking regulations. From previous research, we found that each study examined an aspect of our topic without delving into the actual state of financial soundness in Algeria's banking sector. What distinguishes our study from previous ones is that it is not merely descriptive but also analytical in its applied aspect. Relying on official reports from the Bank of Algeria, we evaluated the prudential policy framework based on capital within the Algerian banking system over the period 2009-2022. This evaluation served as a tool to enhance financial stability, improve supervision, and thus mitigate financial crises. Furthermore, our study highlights that there have been national developments in this area, as the Bank of Algeria has implemented several measures in prudential regulation. We attempted to encompass these measures and assess their impact on the Algerian banking sector. Unlike previous studies, we also provided recommendations to avoid future financial crises.

4. Framework of Financial Stability and Overall Prudential regulation in Algeria.

Like other countries, Algeria seeks to ensure the stability of its financial system since the early 1990s, through various international prudential standards, particularly the Basel Committee standards for banking supervision. This was in line with the partial prudential regulation evolution and its subsequent integration with the overall prudential regulation. However, despite serving the implicit goal of financial stability, these efforts were considered as mere reforms that identified legal frameworks and necessary measures to strengthen the regulatory framework of the banking system, in line with international standards on one hand, and with the reality and nature of the Algerian banking system on the other.

Considering financial stability as a formal task and objective of the Bank of Algeria was only defined since the issuance of Order No. 10 04 dated August 26, 2010, which served as a significant legal reinforcement for the financial stability framework in the previous period, following the amendment of the Banking Law through Order No. 03-11 dated August 26, 2003, which in turn included the legal framework for banking activity. Article 35 of Law 10-04 dated August 26,2010 stated that "the mission of the Bank of Algeria is to ensure price stability as an objective of monetary prudential , to establish and maintain the most suitable conditions in the areas of money, credit, and exchange to achieve sustainable economic development, while ensuring monetary and financial stability." (ALGERIA, Economic and Monetary Developments for the Year 2012, 2013)

Since that period, coinciding with increased global interest in financial stability following the global financial crisis of 2008, the Bank of Algeria's focus on its new objective became more concentrated on systemic risk monitoring (ALGERIA, Economic and Monetary Developments for the

Year 2011, 2012). It reinforced its overall prudential policies thereafter, and even in a preceding step, in 2009, it established a specialized and high-level committee concerned with financial stability and overall prudential policies, namely the "Financial Stability Committee," acting as the banking supervisory authority, is specifically responsible for monitoring the compliance of banks and financial institutions with the legislative and regulatory provisions applicable to them, examining the operating conditions of banks and financial institutions, ensuring the quality of their financial positions. whose duties are as follows (Gasmia & Faidi, 2022, p. 37):

- Reviewing financial safety indicators for banks primarily through what has been termed "minimum indicators", which represent (11 indicators) of the core indicators issued by the International Monetary Fund. The Bank of Algeria has been using them to monitor the safety of the banking system since 2009 and reports them to the IMF.
- Examining and evaluating reports on the stability assessment of the banking sector prepared by the Bank of Algeria since 2009.
- Periodically assessing the safety and resilience of the banking sector, especially through stress tests developed since 2007 with the assistance of the International Monetary Fund, where their results help in avoiding risks of banking sector fragility.

Consequently, it is evident that the Bank of Algeria's concern for financial stability from the perspective of overall prudential regulation through the tasks of the Financial Stability Committee has focused on quantitative assessments through continuous examination of financial safety indicators and qualitative assessments through the development of stress tests. In this general context of guiding its overall prudential regulation since 2010, the Bank has issued several instructions and regulatory frameworks to develop its capital-based prudential tools, especially under the general framework for adapting financial safety indicators (minima) to new international prudential standards mainly within Basel III provisions.

The details of these instructions and their role in influencing the overall prudential regulation based on capital will be elaborated in the following section. As for the significant measures taken to develop stress tests, they can be summarized as follows:

- After conducting stress tests in 2009 by the Bank of Algeria using the methodology developed by the IMF since 2007, the Bank showed dedicated interest in a new project to implement stress tests with technical assistance from the World Bank in September 2012.

- Alongside the development of the project, the "Banking Rating System" (Système de Notation Bancaire - SNB) was launched after its design and testing in 2012, It is one of the most important modern mechanisms for managing systemic risks in Algeria. It was developed in collaboration with experts from the World Bank and representatives of the U.S. Treasury. This mechanism enables the enhancement of financial resilience and the identification of vulnerabilities to take appropriate measures. Work on it has been ongoing since 2012. It is representing a unified supervisory method inspired by the "CAMELS" method as best international practices for evaluating performance indicators and financial soundness of financial institutions. SNB helps in the rapid response to authorities by taking appropriate corrective measures to deal with difficulties facing financial institutions.
- In 2011, the Bank of Algeria updated prudential supervision by launching "SYNOBA," the Algerian Banking Evaluation Model, to align with Basel Committee principles. It also developed an integrated stress-testing system, with support from the World Bank, IMF, and U.S. Treasury, to enhance financial forecasting and macro-level risk assessment (ABBES Bouhrirat, 2017)
- In 2015, the use of SYNOBA was expanded after modifying all inputs and outputs of the system and adapting them to the new prudential system No. 14-01 compliant with Basel (II) requirements established in 2014, after its initial launch in 2013.
- In 2016, the first stress tests were conducted as a risk management tool. These tests are applied to banks to assess their ability to withstand potential future losses under specific economic conditions. The tests were carried out on two banks over a three-year period to evaluate liquidity and solvency. This followed the integration and coordination of efforts between the Stress Testing Project and the (SNB) Project teams since 2014, along with continued efforts in 2015 to adapt stress tests to Algeria's accounting and prudential standards in 2015.
- In 2017, stress tests were conducted on 20 banks, as the Bank of Algeria continued to develop and adapt them to Basel 3 provisions thereafter.

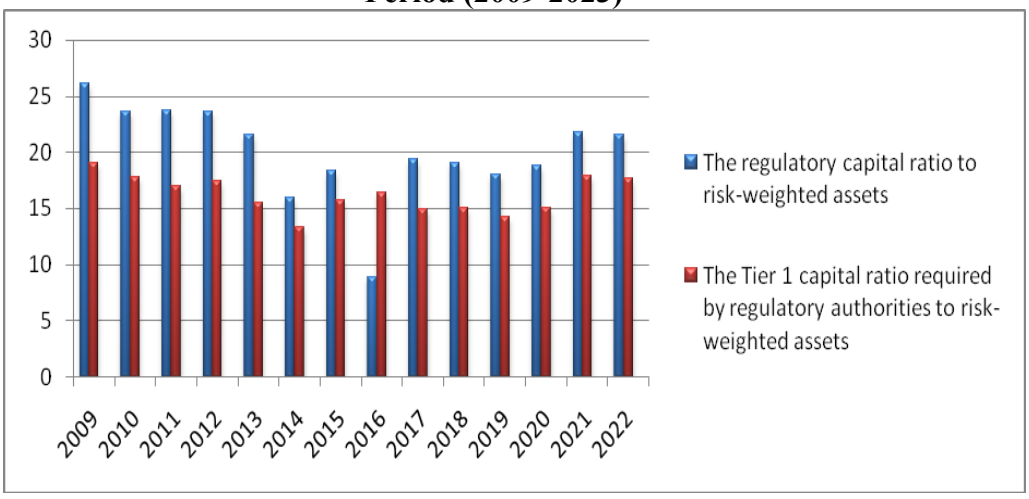
Similar to what the Bank of Algeria has done to develop stress tests within the framework of enhancing its overall prudential regulation and evaluating the adequacy and liquidity of banks against financial forecasting models and scenarios prepared within the framework of these tests, it has

also, in the context of developing and setting its overall prudential regulation, focused on its capital-based tools by enhancing its adequacy.

5. Analyzing the implications of prudential policies and regulatory frameworks on the development of financial soundness indicators.

The evaluation of the overall prudential regulation in Algeria based on capital-based tools can be assessed by tracking the development and evaluation of capital adequacy indicators at the level of the banking system, given their fundamental role in absorbing shocks. This includes total adequacy indicators to assess the level of capital and core adequacy indicators to evaluate the level of high-quality capital. However, it is worth noting that these regulatory ratios have also evolved in the context of the development of overall prudential regulation through Basel I, II, and III provisions, which Algerian authorities have kept pace with by issuing some regulatory frameworks and instructions and gradually applying them to enhance their capital-based prudential tools by transitioning from Basel I to II and III. The focus will be on the evolution of these indicators and the impact of Bank of Algeria instructions on them, primarily during the period from 2009 to 2018, as will be detailed later.

Figure 1. Liquidity Indicators in the Algerian Banking System for the Period (2009-2023)



Source : Prepared by the researcher based on reports from the Bank of Algeria (ALGERIA, Economic and Monetary Evolution, 2023)**.**

Through the above table, it is evident that the liquidity ratios in Algerian banks are considered very good to excellent throughout the study period from 2009 to 2018. Additionally, they exceed the regulatory limits for capital requirements set by Basel I (8%), Basel II (8%), and even Basel III (10.5%), varying according to their characteristics.

However, what can be observed from the figure below is a significant decrease in these ratios during the year 2014, both in terms of total liquidity ratios and Tier 1 liquidity ratios.

The total liquidity was estimated to exceed (20%) throughout the period from 2009 to 2013, then decreased in 2014 recording a rate of (15.98%), including (13.27%) Tier 1 capital ratio. It gradually increased again from 2015 to 2018 with rates exceeding (18%). Generally, it can be said that the overall prudential tools based on capital in the Algerian banking system are good and strong in terms of level, quality, and type, especially since the Tier 1 capital ratios did not exceed (13%) during the study period. These developments can be attributed to the framework of policies or instructions followed by the Bank of Algeria in developing its overall prudential regulation and specifically its capital-based prudential , and interpreting the results based on it, as follows:

•During the period from 2009 to 2013, the banking system was characterized by high rates of total and Tier 1 liquidity, even with a significant difference exceeding double that of the international regulatory standards within the Basel agreements. During this period, the Bank of Algeria had not yet moved to implement Basel III regulations, nor had it issued any explicit instructions regarding the application of Basel II regulations, even though the Basel Committee had issued the pillars of its second agreement (Basel II) since 2004. Nevertheless, the Bank of Algeria worked on strengthening its prudential framework in general and supporting the flexibility of its banking system towards shocks, especially after the global financial crisis of 2008 and considering its repercussions. It issued Instruction No. 08-04 issued on December 23, 2008, aimed at raising the minimum capital requirement for banks to (10 billion DZD) and for financial institutions to (3.5 billion DZD), after it had been set at (2.5 billion DZD) and (500 million DZD) for banks and financial institutions respectively according to the previous Instruction No. 04-01 dated March 4, 2004 (Bank of Algeria, 2022). In implementation thereof, the Treasury immediately began to increase the capital level for two (02) public banks, leading to a direct increase in the liquidity rate in 2009, estimated at (26.15%) compared to (16.54%) in 2008 (Bank of Algeria, 2010, p. 149), and at the same time, the rest of the public banks continued to allocate a portion of their profits to reserves, leading, according to that regulatory framework, to the continuation of achieving high rates until 2013.

If those high rates recorded after 2008 are mainly due to the regulatory framework, including raising the minimum capital requirement for banks according to Instruction No. 08-04, it would be important to evaluate and analyze the liquidity rates before 2008. However, what can be observed from Table (2) is the same thing, namely, that the liquidity rates throughout

(2002-2008) were at least exceeding the regulatory rates (8%) according to Basel I and II at that time.

The overall solvency ratio of public banks decreased slightly from 22.21% at the end of 2021 to 22.04% at the end of 2022, marking a minor drop of less than one percentage point (-0.2%). This decline is attributed to a 6.01% increase in risk-weighted assets alongside a 6.13% rise in core capital. In contrast to 2021, private banks witnessed a slight improvement in their solvency ratios in 2022, in line with the required regulatory minimum. The overall solvency ratio reached 19.33% (compared to 19.06% in 2021), while the core solvency ratio was 18.52% (up from 18.24% in 2021).

It is worth noting that between 2020 and 2021, the banking sector experienced significant improvement in solvency, driven by precautionary measures implemented by the monetary authority, as well as a special refinancing program. This program continues to have a positive impact on the financial condition of the banking sector in general, and public banks in particular, enabling them to maintain a period of stability despite the lifting of precautionary measures initially put in place to mitigate the effects of the aforementioned crisis.

Table 2. Total Liquidity Indicators in the Algerian Banking System for the Period.(2008-2002)

The years	2002	2003	2004	2005	2006	2007	2008
Capital indicators (solvency ratios)	< %8	10.10	10.40	12.30	15.20	12.90	16.54

Source: Prepared by the researchers based on reports from the Bank of Algeria. (ALGERIA, Economic and Monetary Evolution, 2009)

This is primarily due to the prudential of the Bank of Algeria in adjusting the minimum capital requirements according to the circumstances, such as preparing for the implementation of international standards, as in the case of Regulations No. 04-01 issued in 2004, and No. 08-04 issued in 2008. Or perhaps due to the increasing assets and expansion of activities of banks relative to private funds, as in the case of the issuance of Regulation 18-03 issued in 2018. Table (3) illustrates the revised systems for the minimum capital requirements since the first system included in the Banking Law in 1990 until the latest system in 2018.

Table 3. Evolution of Minimum Capital Requirements for Banks and Financial Institutions According to Various Regulatory Frameworks since the Appearance of the Banking Law.(2018-1990)

The regulation	Minimum capital requirement for banks	Minimum capital requirement for financial institutions
Regulation No. 90-01 on 04-07-1990	500million DZD	100million DZD
Regulation No. 04-01 on 04-03-2004	2.5billion	500million DZD
Regulation No. 08-04 on 23-12-2008	10 billion	3.5billion
Regulation No. 18-03 on 04-11-2018	20billion	6.5 billion

Source : Compiled by the researchers based on the legislative and legal framework through the website of the Bank of Algeria (www.bank-of-algeria.dz)

Until 2013, the Bank of Algeria applied Basel I regulations according to Instruction No. 74-94 issued on November 29, 1994, which required determining the rates falling within the international prudential regulations, including those related to capital adequacy ratios. The implementation of Basel I regulations began at the end of 1999. Since Basel I only includes the commitment to capital adequacy ratios for credit risk-weighted assets only, it can be said that the prudential regulation based on capital implemented by the Bank of Algeria until 2013 is actually a prudential aimed solely at achieving financial safety, whether individual bank safety or overall banking system safety, but not financial stability. Considering that it did not take into account market risks and operational risks stipulated in Basel II, it did not consider total financial connections or the regulatory dimension stipulated in Basel III. Therefore, it represents a partial prudential regulation, although it is concerned with the overall system.

In 2014, the Bank of Algeria issued a new directive in accordance with Regulation No. 14-01 issued on February 16, 2014, aiming to determine liquidity ratios for banks and financial institutions, with the new liquidity requirement being greater than or equal to (9.5%), calculated as the ratio of their legal equity to the total of credit, operational, and market risks, as illustrated in the relationship below:

$$\frac{Legal\ private\ funds}{Credit\ risks Operational\ risks Market\ risks}.$$

Private Legal Funds / (12.5 * Market Risks + 12.5 * Operational Risks + Credit Risks)

And the private basic funds should cover both credit risks, operational risks, and market risks by at least (7%). In addition, banks and financial institutions constitute a (safety cushion) estimated at (2.5%) consisting of

basic private funds covering their probable risks (Bank of Algeria, 2022); thus, this directive represents the actual direction of the Bank of Algeria to apply the Basel II framework since October 2014, which intersects with some Basel III provisions. Therefore, it can be said that the decline in capital adequacy ratios during 2014 can be attributed to the inclusion of both operational and market risks in the calculation of capital adequacy ratios under its new formula.

Subsequently, from 2015 to 2017, capital adequacy ratios continued to rise due to the positive impact of the regulatory framework of 2008 to increase the minimum private funds, in addition to the state's action in 2015 and 2016 to increase the capital of 3 out of 6 public banks, which continued to allocate a portion of their profits to reserves, allowing them to comply widely with the standards related to credit risk coverage, market risk, and operational risk; this also led to a decrease in the number of breaches of certain standards during 2017.

In 2018, the overall capital adequacy ratio decreased very slightly but remained reflective of a higher level than the legal minimum requirement, despite complying with those limits since 2009 until 2018; the increase in banks' assets had an impact on their private funds for most banks. On this basis, the Banking Regulation and Supervision Council issued a new regulatory framework regarding the increase in the minimum capital requirement for banks and financial institutions through Regulation No. 18-03 dated November 4, 2018, requiring banks to have a minimum capital of (20 billion DZD) and (6.5 billion DZD) for financial institutions, with a minimum ownership requirement of (15 billion DZD) for banks and (5 billion DZD) for financial institutions by December 31, 2019; failure to comply with this requirement would result in the withdrawal of accreditation from them. By December 31, 2020, banks and financial institutions were required to have (20 billion DZD) and (6.5 billion DZD) respectively (Bank of Algeria, 2019, p. 112) as referred to. (See Table 3)

Therefore, according to the precautionary prudential based on capital tools, and the transition from a partial precautionary prudential to a complete precautionary prudential since 2014, after including both market risks and operational risks in the calculation of capital ratios within Basel II, and even through Basel III by reporting the value of the financial safety cushion or the additional capital requirements that can be applied to systemically important institutions, even if the level of capital estimated at (9.5%) by the Bank of Algeria differs from its level estimated within Basel III at (10.5%); these high ratios, especially the high-quality basic ratios (exceeding 7% as stipulated within Basel III), represent a positive indicator for maintaining financial stability in Algeria during this period. Therefore,

even though the adoption and implementation of Basel II within the Algerian banking system were delayed, the regulatory frameworks related to increasing the minimum capital requirement played an important role in banks' adaptation to the prescribed precautionary standards, including the 2008 framework or even the 2018 framework, which will have the same role in compliance with the prescribed Basel III pillars.

6. Results and discussion.

Financial stability is the ultimate goal of the comprehensive precautionary prudential, where its tools based on capital represents a fundamental pillar for absorbing shocks that may affect the financial system. Including policies covering financial stability indicators, such as financial safety, and systemic financial links, as reflected in the Basel III regulations.

The Algerian banking system enjoys high levels and quality of capital throughout the study period, exceeding the limits set within the international precautionary standards of Basel I, II, and III. This confirms that the comprehensive precautionary policies based on capital and applied through their tools on the Algerian banking system represent a strong support for maintaining financial stability.

Two fundamental stages were distinguished in achieving the goal of financial stability based on the comprehensive precautionary policies based on capital, and Instruction No. 14-01 for 2014 represented the dividing line between the two stages.

The first stage: throughout the period (2002-2013) and even before that, almost since the end of 1999 and compliance with Basel I regulations according to Instruction No. 94-74 until 2013; the precautionary prudential based on capital applied by the Bank of Algeria on the banking system was a partial precautionary prudential , aimed at achieving financial safety even from the perspective of the overall financial system, but it did not take into account either the overall financial links or the systemic dimension.

The second stage: throughout the period (2014-2018) and until today, the transitional stage in the precautionary prudential based on capital applied by the Bank of Algeria on the banking system, from a partial precautionary prudential to a comprehensive precautionary prudential and the integration of both policies, including financial stability support. Since Instruction 14-01 provides for new liquidity adequacy ratios that intersect in their criteria between Basel II and some Basel III aspects, considering market risks, operational risks, and the safety cushion to protect against periodic fluctuations and meet the requirements of systemically important institutions, in addition to financial safety ensured by the Basel I framework, the intersecting criteria of Basel II and III focus on overall financial links and the temporal systemic dimension, and the regulatory systems for increasing the minimum capital requirement 04 have been the most important factors in strengthening the solvency of the Algerian banking system, with the latest system issued in 2018, Regulation 18-03, reinforcing the overall precautionary prudential based on capital. and compliance with

Basel II, and may allow the addition of future Basel III standards not included in Instruction 14-01 for 2014;

The comprehensive precautionary prudential cannot be based solely on capital tools, even if they are considered strong or even if they include the final dimension; it requires the integration of many policies, whether quantitative or qualitative, such as liquidity-based policies or comprehensive stress testing policies.

7. Conclusion.

This study concludes that the prudent application of capital-based regulatory tools has significantly contributed to the financial stability of Algeria's banking system. The evolution of capital adequacy ratios, particularly in the transition from Basel I to Basel III, has been pivotal in absorbing financial shocks and ensuring system stability. Notably, the regulatory framework issued by the Bank of Algeria from 2009 to 2018, which included the introduction of liquidity and capital requirements aligned with Basel II and III, reinforced the banking sector's resilience.

The findings show that the banking system in Algeria maintained high levels of liquidity and capital, consistently exceeding international Basel standards, even during periods of economic uncertainty. However, the study also highlights the transitional nature of the prudential regulations, with two critical phases: the first phase (2002-2013) focusing on financial safety without considering broader financial system linkages, and the second phase (2014-2018) marked by the inclusion of market and operational risks into regulatory calculations, which brought Algeria's banking system closer to the full implementation of Basel II and III standards. We accept the two hypotheses above.

The study argues that while the regulatory frameworks based on capital were essential in strengthening the solvency of Algerian banks, the transition to a more comprehensive prudential system, which integrates multiple risk factors and broader financial system considerations, is crucial for sustained financial stability. The research further suggests that the comprehensive prudential framework must go beyond capital adequacy and incorporate additional policies, such as liquidity management and stress testing, to ensure long-term financial resilience.

The Algerian banking system has benefited from evolving regulatory policies, but for further stability, the continuous integration of comprehensive risk management practices and the adaptation of future Basel III standards will be essential in enhancing the overall prudential framework.

The study recommends considering the strength of the comprehensive precautionary prudential based on capital in the Algerian banking system,

which is reflected in the strength of its solvency ratios, as an important advantage and pillar for maintaining financial stability over the long term. However, the analysis of financial stability in Algeria must be approached from several aspects. The study also recommends the importance of increasing the minimum capital requirement for banks by allocating a portion of their profits to reserves, as banks in advanced countries do without the need for continuous government intervention, so that the Algerian banking system reflects a stable inherent stability.

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