

# THE MICROPRUDENTIAL STRESS TESTING FOR BANKING SYSTEM. A STUDY CASE ON ALGERIAN PRIVATE BANK, USING ACCOUNTING APPROACH

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## Abstract

The aim of this article is to highlight the importance and effectiveness of stress testing as part of microprudential policy. We focus on microprudential stress testing to assess financial stability, the resilience and solvency of one important private bank in Algeria in the face of liquidity risk. Our empirical analysis adopts a bottom-up approach based on an accounting method. It studies the relationship between the bank solvency ratio (ratio cook) and bank portfolios, such as loans to the construction, trade, industry, and automotive sectors. Microeconomic stress tests assess the credit risk of a bank's loan portfolio by bottom-up accounting approach, applying eleven pessimistic and plausible multi-variable scenarios with potential risks. The tests introduce several types of microeconomic shocks into the scenarios, which are designed to replicate those that occurred during the global financial crisis. The tests results show that this private bank is highly resistant to liquidity risk, despite significant losses on its investment portfolio. The stress tests prove once again, and especially after the 2008 financial crisis, that they are indispensable tools in the management of banking risks and against systemic risks.

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**Keywords:** microprudential policy; stress test; liquidity risk; solvency.

**JEL Classification:** G01; G21; G32

## **1. Introduction**

The COVID-19 crisis shows the importance of the interaction between the financial system and the economic stability of countries. The COVID-19 crisis shows the importance of the interaction between the financial system and the economic stability of countries. Crisis affected the financial system and then spread through different transmission channels to all economies, especially the most fragile ones. The social damage, in the sense of economic development, unemployment, public deficit and debt, caused by the actual crisis is disaster. These results call for the overcoming of traditional methods that favor monitoring the financial soundness of individual institutions. This means strengthening banks' microprudential policy by analyzing the interactions with different economic sectors and their effects on financial stability in general. In this respect, stress tests represent a necessary lever for analyzing the relationship between microeconomic changes and the stability of the financial system (Olszak, & Kowalska, 2017).

The duration and severity of financial crises have led banks and supervisors to question whether stress tests are sufficient to predict or limit shocks, and whether they are adequate to integrate quickly with new shocks. Despite the fact that the crisis is far from being severe, according to the results published by the banks, it is possible to ignore the weakness of the stress tests in relation to the course of events on the part of the banks. As long as the crisis has not yet emerged, banks and monetary authorities must learn lessons. Stress tests have become an indispensable tool in the management of banking risks (Kapinos & Mitnik, 2016). They were developed gradually after the systemic financial crisis of 2008 that affected the banking sector (Abdymomunov & Curti, 2020).

The purpose of the Basel Accords is to require banking institutions to balance their balance sheets in a certain way. The ratio to be applied, called the McDonough ratio (formerly the Cooke ratio), is not immediately legally binding but is drafted by the regulators in internal regulations. Several devices and a body of law to assess and identify banking risks were implemented. Two main ratios represent the

axis of banking regulation: liquidity and solvency ratio. However, prudential regulation serves to prevent a bank failure, as this will have negative repercussions on the economic and financial sphere in general. Thus, the Basel Accords aim to reform the system of bank resilience to economic shocks and turmoil. A sound banking system is the cornerstone of monetary and financial stability that leads to macroeconomic stability. (Bank for International Settlements, 2005)

The new requirement of the Basel agreements, called the McDonough ratio, does not change the logic of the basic agreement but enriches it. To indicate this ratio is expressed indistinctly as solvency ratio or capital adequacy. The mechanism of agreement, called Basel II, lasted for many years and caused much ink to flow in the specialized press.

In Algeria, stress tests are far from performing well due to several reasons. A weak banking data infrastructure limits the optimal application of stress tests. Hence, insufficient training of banking staff to master the tools for analysis and application of stress tests. That is why, Algerian monetary supervisors should continue to progress in the area of risk management, applying various mechanisms (Bouchetara, 2018).

In this article, we focus on microprudential stress testing to assess financial stability in a private Algerian bank, and address two natural issues. First, how to measure credit risk in commercial bank? Second, how to measure a bank's fragility in the face of credit risk? To answer these questions, we develop a framework for microeconomic stress testing of credit exposures in a private investment bank. Our empirical analysis adopts a bottom-up approach based on an accounting method. It studies the relationship between the bank solvency ratio (ratio cook) and bank portfolios, such as loans to the construction, trade, industry and automotive sectors. Microeconomic stress tests assess the credit risk of a bank's loan portfolios by applying pessimistic and plausible multi-variable scenarios with potential risks. The tests introduce different types of microeconomic shocks into the scenarios, which are designed to replicate those that occurred during the financial crises of 2008.

## **2. Literature review**

In the face of the COVID-19 health crisis, microprudential policy is an effective tool. From 1990 onwards, the supervisory authorities

have surrounded themselves with a corpus of preventive models similar to the stress tests (Andrieş, Nistor, & Sprincean, 2020). Several approaches are used to limit the rise in systemic risk (Angora & Tarazi, 2011). In the experience of the Asian crisis of 1997 and the recent crises in Latin America and advanced countries, these approaches have revealed many limitations, which can be summarized in two important points. First, the majority of these approaches are based on a notion of the banking crisis that is not unanimous and therefore raises the issue of the timing of the outbreak or detection of the crisis. Second, the history of banking crises suggests that a multiplicity of causes is at the root of banking panics. However, the majority of these stress test approaches rely on macroeconomic, macro-monetary and financial parameters and neglect a few variables that are typical for banks.

The objective of microprudential policy is to protect individual financial institutions against risks and prevent them from taking too much risk (Osiński, Seal, & Hoogduin, 2013). However, the recent financial crisis in 2008 showed that the stability of individual financial institutions is not sufficient to ensure the stability of the financial system as a whole. Microprudential policy instruments involve, at a minimum a set of quantitative risk-based instruments, to establish capital and liquidity requests for individual institutions, effective supervisory powers over institutions (e.g., licensing, governance, risk management, sanctions, and powers to take remedial action). Internal control units are obliged to assist in the monitoring of all risks incurred by the institution. This activity is crucial because it targets major issues, such as the fight against money laundering or the illegal allocation of funds. The principle of creating a typical business is in line with the recommendations of the 2003 Basel Committee on the compliance function, which ranked eleven principles (BIS, 2003).

The duration and severity of financial crises have led banks and supervisors to ask the question whether stress tests are sufficient to predict or limit shocks, and whether they are adequate to integrate quickly with new catastrophic situations. Despite the fact that the crisis is far from being severe, according to the results published by banks, it is possible to ignore the weakness of stress tests with respect to the course of events on the part of banks. Although the crisis has not yet emerged, there are lessons to be learned by banks and monetary authorities. Stress tests have become an indispensable tool in the management of banking risks. They were developed progressively after the systemic financial crisis of 2007 that affected the banking

sector. Pillar II of the banking requirements was reinforced by the stress test tool not only at the US and European level but at the global level.

Stress tests aim to measure the temporary impact of severe and pessimistic, but rather plausible, scenarios on financial stability in general and banking stability in particular. The scenarios are based on shocks and micro-macroeconomic simulations. Typically, a standard stress test for banks has a time horizon of two to five years to be implemented (Martin, Tavoraro & Viol, 2013)

Several financial institutions in the United States and Europe have introduced rigorous stress testing programs since 2009, as required by supervisors.

### **2.1. SCAP: Supervisory Capital Assessment Program**

The first stress test initiative was the Supervisory Capital Assessment Program (SCAP), launched during the severe crisis of April 2009. The SCAP had two key objectives:

- To identify institutions vulnerable to continued downside under macroeconomic conditions.
- Detect systemic risks to the financial system and financial markets.

The 19 banks required to perform the SCAP test included U.S. banks with assets in excess of \$100 billion. This group, at the time managing 66% of the U.S. banking asset system and 50% of its loans, was asked to define losses and revenues during the 2009-2010 period under two scenarios (Rebonato, 2010):

- Base case: reflecting economists' forecasts as of February 2009.
- Worse or very pessimistic scenario: simulating a deeper and lasting recession.

Despite the results affirming the basic stability and soundness of the largest financial institutions, the SCAP tests showed serious flaws in the stress test industry's capabilities, efficiencies and processes. This was not surprising since many institutions had little experience, because most managers were concerned about the financial crisis. The SCAP program did not meet these two objectives: identifying vulnerable institutions and detecting systemic risks. The initiative also provided valuable information for regional banks that

were building a stress test program. In addition, the results published by SCAP enhanced market stability by providing evidence that the capital position of several institutions was being monitored, and the likelihood of a structural systemic shock was decreasing.

SCAP provided considerable insight to the Fed into the particular vulnerability of America's largest financial institutions. Renewed investor confidence provided the 19 bank holding companies with an increase of more than \$300 billion in common stock from the fourth quarter of 2008 through the end of 2010. The increase in investor confidence coincided with improvements in the balance sheet strength of the 19 institutions, with the average common weighted Tier 1 ratio increasing from 5.4% in the fourth quarter of 2008 to 9.4% in the fourth quarter of 2010.

## **2.2. CCAR: Comprehensive Capital Adequacy Review**

In February 2011, the affected banks were required to pass a second test: Comprehensive Capital Adequacy Review (CCAR). For this initiative, the FED had the top banks that passed the stress tests around new scenarios. These tests represented a significant departure from SCAP in terms of the depth and breadth of the objectives, as well as the robustness of the scenarios and the seriousness of their implications. The 19 U.S. banks were asked to develop and implement capital plans in response to the continued deterioration of the economy. The results of CCAR would help determine whether an institution should be allowed to release capital in the form of increased dividends to shareholders. These institutions were then asked to submit detailed plans across five aspects (FSR, 2015):

- Capital assessment and planning processes.
- Capital distribution policy.
- Plans for repayment of any state investments.
- Plans to address the expected impact of Basel III and Dodd-Frank.

Three scenarios were simulated in the projected tests of bank earnings, losses, and capital position over a nine-quarter period, beginning in the fourth quarter of 2010 and ending in the fourth quarter of 2012 (FSR, 2013):

- Base case: a replication using current economic projections.

- Stress scenario: assessing each bank-specific vulnerability, the scenarios are generated by the bank with input from the FED.
- Supervisory Stress Scenario: a perspective scenario generated by the FED to assess the ongoing impact, unemployment, sharp decline in GDP and real estate.

The main results of this stress scenario analysis were new quarterly regulatory capital projections for each bank – the Tier 1 capital ratio, the capital and leverage ratio, the total ratio, as well as a basic Tier 1 ratio similar to that used in the SCAP.

### **2.3. European Banking Authority Testing**

The European Banking Authority (EBA) Testing was similar to the SCAP and CCAR tests in its rigor and discipline. The objective of EBA was to test the resilience of an adverse but plausible scenario. The benchmark is that banks must have at least 5% of risk-weighted assets as Core Tier 1 capital. The simulation covered from 2010 until 2012, publishing the results in July 2011. The banks made provisions for losses of \$ 200 billion for two years (the test period). The first results showed that 20 banks, out of 90 banks, fell below the 5% threshold. However, the EBA asked the banks to make efforts to increase their capital during the first months of 2011 to reach the adequate capital. Only 8 banks did not pass these tests. The stress test scenario cannot be the same for all banks because of the specificities of their activities, for example: interest rate, exchange rate. Banks aim to deal with solvency risks (credit risk, market risk, sovereign risk) and to deal with contagion tragedies.

In 2011, EBA published recommendations for stress tests (EBA, 2011). These recommendations show the sophisticated evolution of stress tests. BIS further confirmed that:

- Stress tests cannot be a model-driven on-off exercise (The Driven on-off is a software that makes the automatic programming of models).
- The tests produce applicable results.
- The results found are used in risk management.
- Supervisory authorities are active participants.

Recommendations are:

- Banks develop a stress test program that promotes identification and control, provides complementary perspectives for other risk

management methods, improves capital and liquidity management, strengthens internal and external communication.

- The stress test considers the management forms of the entire organization.
- The importance of the flexibility of the banking infrastructure to accommodate the various possible changes of the stress test program.
- The bank should maintain and update the structure of its stress tests.
- Stress tests should cover different risks.
- Stress tests cover different scenarios, including forward-looking scenarios, and take into account system-wide interactions and feedback effects.
- Stress tests are characterized by severity, including events capable of generating the most damage and loss whether through share value or reputational damage.
- The stress test program must also determine the scenario that can challenge the viability of banks and discover the hidden risks and interactions between risks.
- In partial application of the stress test program, the bank should consider the simultaneous pressures on funding and asset markets, and the impact of reduced market liquidity.
- The effectiveness of risk mitigation techniques should be systematically challenged.
- The stress test program should explicitly cover complex and customized products such as securitized exposures.
- The bank should improve the stress test methodology to accurately the effects of reputational risk. The bank should incorporate risks arising from off-balance sheet vehicles<sup>1</sup> and other related entities into its stress test program.
- The bank should improve its stress testing approaches for highly leveraged counterparties when considering its vulnerability to specific asset classes or market movements and assessing the potential risk of misdirection of risk mitigation techniques.

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<sup>1</sup> Off-balance sheet banking vehicles (financed at less than one year) were exempted from the solvency ratio when they were not the subject of a line of credit granted by the bank that set up the vehicle. However, many banks had to support these structures, which involved their reputation.



#### **2.4. The performance of stress tests during crises**

The last financial crisis of 2008 showed the weaknesses of the stress tests used, for that, it would be necessary to know the key elements of the resistance tests (BIS, 2009):

- The usefulness of stress tests.
- The methodology of stress tests.
- The selection of scenarios.
- Stress testing for specific risks and products.

##### ***The usefulness of stress tests***

Those responsible for managing and applying stress tests have been criticized for their use of bank stress tests in terms of governance and capital. The parameters of stress tests encompass the following objectives:

- The identification of scenarios.
- Analysis of stress test results.
- Evaluation of the decisions taken.

The banks that were exposed to the financial crisis of 2008 managed to hold, thanks to the managers who successively succeeded in the development and management of stress tests, with the results obtained serving as input to the banks' strategies. However, the application of stress tests at the level of all banks did not promote internal debates or challenge previous assumptions such as costs, risks and the speed with which capital can be increased. The financial crisis of 2008 also showed the weakness of organizational stress testing programs. Prior to the 2008 financial crisis, risk management departments with market interaction applied stress tests separately.

This meant, among other things, that market participants often thought that the analyses and results were not credible. The stress tests were only routine technical exercises. As long as there is a department that operated the stress tests with routine and without understanding the stress test program, it does not allow showing the accurate picture because of the mechanical approach that cannot take into account the changing business market conditions nor incorporate qualitative solutions. Prior to the 2008 financial crisis, many banks did not have a comprehensive stress test program in place but managed stress tests separately for specific risks or portfolios with limited

integration of businesses. While market and interest rate stress tests had been applied for several years. In contrast, the application of banking stress tests in the literature has recently been achieved. Other styles of stress tests are not yet developed. Stress tests were not able to act flexibly and quickly when crises occur. New investments in IT infrastructure may be needed to improve the availability and granularity of risk information that enables rapid analysis of the impact of new stress scenarios designed to respond to a rapidly changing environment.

***The methodology of the stress tests***

A varied complexity, starting with simple to more complex stress tests. The goal is to assess and determine the severe impact of macroeconomic shocks by measuring, for example, earnings and capital. Stress tests are performed on several levels of aggregation, starting with the level of an individual instrument at the institutional level. Stress tests are effective for many types of risk such as market, credit, operational and liquidity risk. Despite the existence of several methodological types of application, the financial crisis of 2008 highlighted the weakness of these instruments.

Specifically, the weakness of the infrastructure limited the ability of banks to identify the risks involved. These weaknesses limit the effectiveness of risk management tools - including stress tests. Most risk management methods, including stress tests, use statistics and recent data to assess risk. They assume that a known and constant statistical process drives risk, i.e., they assume that historical relationships provide a good basis for predicting future risk. The crisis has shown their shortcomings in relying on such an approach.

First, having a long period of stability is linked to prior information that favors conditions, so the models could not detect shocks or the accumulation of vulnerabilities in the system. Historical statistical relationships, such as correlations, proved to be reliable once the actual events began to unfold.

Second, the 2008 financial crisis also showed us that, under conditions of stress and panic, risk characteristics can change rapidly as can the reactions of market participants in a system that is sensitive. These effects can dramatically amplify shocks like the last financial crisis of 2008. Extreme reactions as defined above occur rarely and can carry an extra charge for the model that is linked with historical data. In other words, they have a weight on the model quantitatively.

The managers of most banks have neglected this issue of risk management model, the most traditionally used seriously, to derive the results of stress tests.

Furthermore, they did not take into consideration the qualitative advice of experts in developing scenario innovations. As a result, banks in general have underestimated the close links between lack of market liquidity and pressure to find funding or liquidity. Reliance on data relationships and ignorance of reactions in the system is generally due to banks underestimating the interaction between risks and the impact of a severe scenario. Prior to the 2008 financial crisis, most banks had not properly applied stress tests according to the advisors' perspectives. Even so, the stress tests were insufficient to detect risks. As a result, banks did not have a clear view of the credit, market and liquidity risks to their operations.

#### ***Scenario selection***

One of the main challenges facing most supervisors and banks in designating a stressed scenario is consistency. Scenarios have several factors, seeking to develop rich descriptions of undesirable situations in the world from a severe risk factor and taking into account this is not enough to identify only high unemployment, increased credit speculation or a sudden and unexpected drop in prices. This is not enough to identify only high unemployment, increased credit losses or an unexpectedly sharp drop in prices. When one factor changes, the other factors do not remain fixed. Difficulties arise in determining common outcomes for all risk factors. Now, not all exchange rates depreciate at once, some appreciate. In 2009, SCAP had a simple scenario specification. The states had only three dimensions (GDP growth, unemployment, real estate price indices), the market risk scenarios were based only on historical experiences.

For the year 2011, the EBA test supervisors identified about 70 portfolio risk factors, 08 macroeconomic factors for 21 countries (macro factors such as GDP growth, inflation, unemployment, real estate price indices, and stock prices). ECB economists generated the macroeconomic stress test scenarios. Most bank stress tests were not previously designed to capture and detect extreme market events. Most firms found that one or more severe aspects of the stress tests did not reach considerable development. Prior to the crisis, severe and severe stress scenarios estimated losses of no more than a quarter of earnings. History has shown that when stress events occur, banks

easily lose more than a quarter of earnings. Several techniques have been used to develop the scenarios. In general, there are sensitive tests at the base, which influence only one parameter, leaving other factors constant. Since the scenarios ignore several risk factors or feedback effects, their main purpose is to provide a quick initial assessment of the portfolio sensitive to a given risk factor and to identify risk concentrations.

Other more sophisticated approaches apply shocks to several parameters simultaneously. The approaches are generally historically based or hypothetical. The historical scenarios implemented are often based on significant market events in the past, such as stress tests that were unable to capture the risks of new products in the midst of a crisis. In addition, the high level and duration of stresses indicated by previous episodes have proven inadequate. The long period of stress tests is observed without difficulty and the historical stress tests underestimated the level of risk and the interaction between risks. Banks also apply hypothetical stress tests, based on pessimistic scenarios that manage to capture events that could be adversely affected. However, prior to the 2008 financial crisis, banks in general applied only modest scenarios, in terms of severity, degree of portfolio interaction, or types of risks. In many banks, it is difficult for risk managers to get the right methodology to build severe scenarios. Risk managers often treated these scenarios, which are considered severe or novel, in an implausible way.

To now, all stress tests have imposed a single scenario for all banks. Of course, any scenario can be difficult for some banks and easy for others, depending on their location and activities. This one-size-fits-all approach is analogous to both the regulatory problem and the internal capital business models. Between 2011 and 2012, CCAR recognized this problem and asked banks to publish their results using their scenarios (base and stressed scenario) in addition to the common stress test supervisor results. This was an important step prior to the start of 2009 SCAP: asking banks to develop their scenarios, which they used to show vulnerabilities, portfolio sensitivities and banking activities. Supervisors can learn from banks about high-risk scenarios. This is used not only for microprudential supervision, also for macroprudential supervision, by allowing the possibility of learning common risks across previously undiscovered banks.

### **Special risks**

The scenarios were not severe enough to stress test structured products and leveraged loans before the crisis. This means that at some level they were dependent on historical data. In general, stress tests for structured products suffered from the same problems as other risk management models. These differences were exposed during the 2008 financial crisis and degraded the effectiveness and performance of stress tests. Furthermore, the stress tests also assumed that the markets for structured products would remain liquid, or, if the market for liquidity were weak, that it would not remain so for long. Therefore, banks underestimated the securitization risks associated with the new structured products.

The banks' reaction to the failure of the scenarios could have negative repercussions. This is related to the risk of notoriety or reputation, as well as idiosyncratic risk. The collective reaction of banks could lead to broader disruptive effects on financial markets (systemic risk). In many cases, stress tests treated only one-way risk, forgetting to detect the main causes of the risks, which reduced the effectiveness of the hedges. The other specificity of the crises was the risk of misdirection or misdirection, which could be linked to the credits purchased by the insurance companies. Another weakness of these models was the inability to capture the possible risks that arose on a regular basis, from the legally binding credit and liquidity lines or by reputation.

### **Applications of stress tests after the 2008 financial crisis**

After the shocks suffered by the crises, the stress tests have obtained great importance and credibility in the banks as a risk management tool to determine the different risks. It is important that this process continue in this way, the stress test programs become part of the governance structures. These processes still need to be suggested by risk managers. Banks recognize that the current stress test plan should be strengthened with respect to the terms and types of risks. A few banks have already begun to improve this plan. Other weaknesses of the specific risk stress tests were identified after their implementation. In general, the points of improvement of the banks are:

- Improvement and invention of scenarios.
- Reviewing new products to identify potential risks.
- Assessing the adequacy of time and impact responses.

- Reforming the identifications and aggregations of correlated risks through guides such as interactions between markets, credits and liquidity risks.

In general, stress tests are still being planned and improved at several banks to allow for the identification of appropriate risks and their effective aggregation.

### **3. Data and method framework**

#### **3.1. Data**

In order to stress the selected variables, we used the following data:

- Prudential statements, (Bank of Algeria, 2020)
- The elements used to calculate a bank's assets (current claims, classified claims, other assets) and off-balance sheet items;
- The elements used to calculate weighted risks (for credit risk and operational risk).
- The reporting of provisions for classified receivables, (Bank of Algeria, 2020)

The breakdown of commitments by:

- Type of client (corporate, professional, individual);
- Business sectors;
- Credit ratings;
- The breakdown of watch list commitments.
- The breakdown of provisions for classified receivables.

#### **3.2. Method**

In this paper, we apply a microprudential stress testing as bottom-up approach. This will be carried out on the Algerian private bank only and will be based on the specificities of the bank without taking into account the characteristics of other banks (BIS, 2017). As regards the method to be used, we have chosen to carry out the stress test by sensitivity analysis, because it is the efficient method to carry out, because other methods require models that link macroeconomic variables to financial variables (IMF-BIS-FSB, 2009).

### **3.2.1. Scenario building and definition of shocks**

Before building the scenarios, we analyze the portfolio of the bank's liabilities that we stress because the determination of shocks is based on its characteristics. Our commitment portfolio is made up of 42% off-balance sheet loans and 48% on-balance sheet loans, mainly to companies. Off-balance sheet assets comprise 47% documentary credits and medium-term credits have the highest percentage on the balance sheet.

As far as the most dominant sectors of activity in the portfolio are concerned, we distinguish five: construction (15.1%), automobile distribution (14%), pharmaceuticals (14.3%), trading (11%) and the food industry (7.5%). This portfolio of commitments is well diversified and does not show any concentration on any particular sector or product.

As we do not have historical data (crises that have already occurred), we create scenarios of crises that may occur in the future to carry out our sensitivity tests (Cihák, 2007). We create eleven scenarios. In each scenario, there will be one shock or several shocks at the same time. Indeed, we will start stress testing a single variable, and then we will add other variables to it.

With regard to the intensity of the shocks, we apply different degrees of severity to determine the sensitivity of the institution to them. In view of the characteristics of the external environment and through the analysis of the bank's internal situation, we have chosen to carry out the following scenarios:

- Deterioration of current claims.
- Deterioration of current claims and downgrading of classified claims (with different intensities).
- Deterioration of claims held on the construction sector.
- Deterioration of claims held on the automotive sector.
- Simultaneous deterioration of claims held on the construction and automotive sectors.
- Downgrading of the Watch List claims.
- Simultaneous downgrading of doubtful loans and Watch List loans.
- Downgrading of credit ratings.

Before applying on to the application of shocks to the selected variables, first we present the initial situation. The figures recorded for

the initial situation are as follows: (the figures are in thousand Algerian dinars).

**Table 1**

**The initial situation**

<i>- Algerian dinars -</i>	
<b>Net income for the last financial year</b>	1.985.717
<b>Regulatory capital</b>	16.683.590
<b>Risk Weighted Assets RWA</b>	144.953.023
<b>Capital Adequacy Ratio CAR (%)</b>	11,51%

*Source: authors*

As far as commitments are concerned, we have the following data at our disposal:

**Table 2**

**Commitments data**

<i>- Algerian dinars -</i>	
<b>Type of receivables</b>	<b>Amount</b>
<b>Current receivables</b>	158.657.111
<b>Receivables in category</b>	2.976
<b>Potentially problematic receivables (CAT 1)</b>	286.031
<b>High-risk receivables (CAT 2)</b>	1.742.214
<b>Impaired receivables (CAT 3)</b>	3.432.612
<b>Watch List receivables</b>	16.590.000
<b>Receivables from the construction sector</b>	23.975.500
<b>Receivables from the automotive sector</b>	22.373.400

*Source: authors*

The above figures show that the bank is achieving a profitable result and that it is managing its risks well. In fact, the classified debts represent only 3% of the total commitments and the solvency ratio is well controlled, with a percentage of 11,51% exceeding the regulatory limit set at 9,5%. the bank is solvent and that it has no difficulty in managing its portfolio of commitments.

**3.2.2. Conduct of the stress test exercise**

Our stress test exercise consists of calculating the corresponding solvency ratio for each scenario. We assume that the denominator of the ratio remains unchanged in all scenarios, and we analyze the impact of shocks on the numerator only.

Indeed, the deterioration in the quality of the claims affects the shareholders' equity because it generates an increase in the provisions



for classified claims and therefore in expenses, which will reduce the result and consequently the shareholders' equity.

It should be noted that the expenses for general banking risks that are part of the additional capital will also be assumed to remain unchanged because their variation is not very significant and because through these tests, we want to analyse the simple fact of a change in the provisions for classified receivables.

From another point of view, the upheaval in the economic environment caused by a crisis would also affect the entity's activity, which would see a decrease in income and, as a result, would record a lower result and show a decrease in its equity.

The downgrades that we are going to carry out on the latter require additional provisions in order to meet the regulatory requirements relating to the provisioning of classified receivables (Bank of Algeria; Regulation 14-03, Article 10, 2014).

Provisions must be made for new classified receivables and additional provisions must be made for receivables that are already in this category and that have been downgraded to an inferior quality. The provisioning of loans constitutes a cost of risk borne by the bank, and is equal to the sum of allocations to provisions less the sum of write-backs of provisions.

$$\text{Cost of risk} = \sum (\text{allocations to provisions} - \text{reversals of provisions})$$

In order to make the shocks more severe, we have considered that there is no reversal of provisions, in which case the cost of risk becomes equal to the provision allocations. A bank's claims are subdivided into two categories, current claims and classified claims, which in turn are further, subdivided into three subcategories, potential problem claims, high-risk claims and impaired claims.

The provisions are according to Article 11 of Regulation 14-03 of the Bank of Algeria, relating to the classification and provisioning of claims and commitments by signature of banks and financial institutions, made on the basis of "the gross amount excluding unrecovered interest and after deduction of admitted guarantees".

In order to make the shocks more severe, we assumed that there was no eligible collateral for the receivables to be provisioned. Our basis for calculating provisions is therefore gross excluding interest recovered.

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- Claims with potential problems (CAT1) 20%
- High-risk receivables (CAT2) 50%
- Impaired receivables (CAT3) 100%

#### 4. Application and results

The further deterioration of the result in some scenarios is assumed to be due to a low level of the bank's income because of the COVID-19 crisis. Indeed, we analyse the double impact of a crisis: a decrease in income and an increase in expenses at the same time.

##### 4.1. Scenario one: Deterioration of current receivables

We assumed a 5% deterioration in the portfolio's current receivables. Then, and in order to accentuate the effect of this action, we imagined the possibility of a 5% decrease in the bank's result compared to the previous year. The results obtained by carrying out this test are as follows:

##### ***The constitution of the classified debts and their provisioning***

**Table 3**  
**Results after scenario 1 on classified claims**

*- Algerian dinars -*

Categories	NPL before the shock	Provisions before the shock	NPL after the shock	Loss provision	Provisions after the shock
<b>Category 1</b>	286.031	73.312	8.218.886	1.586.571	1.659.883
<b>Category 2</b>	1.742.214	821.160	1.742.214	0	821.160
<b>Category 3</b>	3.432.612	3.255.366	3.432.612	0	3.255.366
<b>Total</b>	5.460.856	4.149.838	13.393.712	1.586.571	5.736.409

*Source: authors*

*Provisions after shock*  
 = *provisions before shock*  
 + *allocation to provisions*

*Provisions after shock*  
 = *doubtful loans after shock \* provisioning rate*

**Capital and solvency ratio after the shock**

**Table 4**

**Results after scenario 1 on the solvency ratio**

	Before shock	After shock
		- Algerian dinars -
<b>Capital requirement</b>	16.683.590	15.097.019
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	10,42%

*Source: authors*

*Equity after shock*  
 = *equity before shock – allocation to provisions*

By exerting additional stress by reducing the bank's earnings, we obtain:

**Table 5**

**Results after scenario 1 with a decrease in the result**

	Before shock	After shock
		- Algerian dinars -
<b>Bank result</b>	1.985.717	1.886.431
<b>Capital requirement</b>	16.683.590	14.997.733
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	10,35%

*Source: authors*

We note that after the exercise of this first scenario, the solvency ratio is still above the regulatory limit of 9,5%, even though it has fallen from 11.5% to 10,42%. The impact on the bank's financial strength is therefore not significant and this stress would not put the bank at risk even if it achieves a lower result.

#### 4.2. Scenario two: Deterioration of current and classified receivables

For this second scenario, we have chosen the following assumptions.

- Deterioration of 5% of current receivables and receivables from category 0 to category 1 of classified receivables.
- Downgrading of classified receivables:
  - a. Receivables in category 1 are in category 2.
  - b. Category 2 receivables are included in category 3.

As with the first shock, we will also analyse the additional effect of a 5% deterioration in the bank's current earnings. The results are as follows:

#### ***The constitution of classified claims and their provisioning***

**Table 6**

#### **Results after scenario 2 on classified claims**

- Algerian dinars -

Categories	NPL before the shock	Provisions before the shock	NPL after the shock	Loss provision	Provisions after the shock
<b>Category 1</b>	286.031	73.312	7.935.832	1.587.166	1.587.166
<b>Category 2</b>	1.742.214	821.160	286.031	106.359	927.520
<b>Category 3</b>	3 432 612	3.255.366	5.174.826	921.054	4.176.420
<b>Total</b>	5.460.856	4.149.838	13.396.688	2.614.579	6.691.106

Source: authors

*Allocation to provisions of category 1*  
 = (5% of current claims before shock  
 + claims of category 0) \* 20%

*Allocation to category 2 provisions*  
 = (category 1 claims  
 – category 1 provisions before shock) \* 50%

*Allocation to category 3 provisions*  
 = (claims in category 2  
 – provisions in category 2 before shock) \* 100%

*Provisions after shock*  
 = receivables after shock \* provisioning rate

The changes in shareholders' equity and the solvency ratio are as follows

**Table 7**  
**Results after scenario 2 on the solvency ratio**

	<i>- Algerian dinars -</i>	
	<b>Before shock</b>	<b>After shock</b>
<b>Capital requirement</b>	16.683.590	14.069.011
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	9,71%

*Source: authors*

After adding a further deterioration of the result, we obtain:

**Table 8**  
**Results after scenario 2 with a drop in the result**

	<i>- Algerian dinars -</i>	
	<b>Before shock</b>	<b>After shock</b>
<b>Bank result</b>	1.985.717	1.886.431
<b>Capital requirement</b>	16.683.590	13.969.725
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	9,64%

*Source: authors*

We note that the exercise of this shock, like that of the first one, has no influence on the bank's financial health and solvency because the solvency ratio remains always higher than the 9.5% imposed by the regulator, even if it has fallen close to this limit.

#### **4.3. Scenario three: Deterioration of claims in the building and public works sector**

The construction sector is the main sector making up the bank's loan portfolio. A crisis affecting this sector would, therefore, seriously undermine the financial health of the institution.

In order to know the impact of such an incident, we have assumed the deterioration of 50% of the claims held on this sector and the results we have obtained are summarized in the following tables:

**The constitution of claims and their provisioning**

**Table 9**

**Results after scenario 3 on classified claims**

- Algerian dinars -

Categories	NPL before the shock	Provisions before the shock	NPL after the shock	Loss provision	Provisions after the shock
<b>Category 1</b>	286.031	73.312	12.271.781	2.397.150	2.470.462
<b>Category 2</b>	1.742.214	821.160	1.742.214	0	821.160
<b>Category 3</b>	3.432.612	3.255.366	3.432.612	0	3.255.366
<b>Total</b>	5.460.856	4.149.838	17.446.606	2.397.150	6.546.988

Source: authors

Allocation to provisions

= 50% of claims in the automotive sector \* 20%

**The constitution of equity capital and the solvency ratio**

**Table 10**

**Results after scenario 3 on classified claims**

- Algerian dinars -

	Before shock	After shock
<b>Capital requirement</b>	16.683.590	14.286.440
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	9,86%

Source: authors

**4.4. Scenario four: Deterioration of claims in the automotive sector**

The automotive sector is the second largest sector in the liability portfolio, and like the construction sector, it is exposed to changes that could affect the bank's financial strength. Indeed, 2015 was a year full of changes for this sector in Algeria and these changes may not stop. As a result, we have realized this scenario, which consists in downgrading 50% of the claims of this sector. The results obtained with this exercise are the following.

**The constitution of the classified debts and their provisioning**

**Table 11**  
**Results after scenario 4 on classified claims**

*- Algerian dinars -*

Categories	NPL before the shock	Provisions before the shock	NPL after the shock	Loss provision	Provisions after the shock
<b>Category 1</b>	286.031	73.312	11.472.731	2.237.340	2.310.652
<b>Category 2</b>	1.742.214	821.160	1.742.214	0	821.160
<b>Category 3</b>	3.432.612	3.255.366	3.432.612	0	3.255.366
<b>Total</b>	5.460.856	4.149.838	16.647.556	2.237.340	6.387.178

Source: authors

**The constitution of equity capital and the solvency ratio**

**Table 12**  
**Results after scenario 4 on the solvency ratio**

*- Algerian dinars -*

	Before shock	After shock
<b>Capital requirement</b>	16.683.590	14.446.250
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	9,97%

Source: authors

The results of Scenarios 3 and 4 gave solvency ratios above the regulatory limit. We can then conclude that a crisis of moderate intensity affecting only one of the main sectors financed by the bank would not cause solvency problems for the bank.

**4.5. Scenario five: Deterioration of claims in the construction and automotive sectors at the same time**

The purpose of this test is to show the impact of a simultaneous degradation of both the construction and automotive sectors. It is based on the downgrading of 50% of the receivables of each sector and thus combines the two previous scenarios. The results we obtained are as follows:

**The constitution of classified receivables and their provisioning**

**Table 13**  
**Results after scenario 5 on classified claims**

- Algerian dinars -

Categories	NPL before the shock	Provisions before the shock	NPL after the shock	Loss provision	Provisions after the shock
<b>Category 1</b>	286.031	73.312	23.458.481	4.634.490	4.707.802
<b>Category 2</b>	1.742.214	821.160	1.742.214	0	821.160
<b>Category 3</b>	3.432.612	3.255.366	3.432.612	0	3.255.366

Source: authors

Allocation to provisions

= claims in category 1 after shock \* 20% \* 20%

**Building up equity capital and the solvency ratio after the shock**

**Table 14**  
**Solvency ratio results after scenario 5**

- Algerian dinars -

	Before shock	After shock
<b>Capital requirement</b>	16.683.590	12.049.100
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	8,31%

Source: authors

The simultaneous stress of the two main sectors financed by the bank has just shown the vulnerability of the bank to such a shock. Indeed, the solvency ratio recorded is 8.31%, which is below the limit set by the regulator.

This scenario is already quite violent, but we will intensify it even more with the assumption of a 5% drop in the bank's result compared to its current amount, because such a shock would not be without impact on the bank's income.

The effects observed by this exercise are summarized in the following table:



**Table 15**  
**Results after scenario 5 with a drop in the result**

	- Algerian dinars -	
	Before shock	After shock
<b>Bank results</b>	1.985.717	1.886.431
<b>Capital requirement</b>	16.683.590	11.949.814
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	8,24%

Source: authors

With a further drop in the bank's result in times of crisis, the solvency coefficient would deteriorate even further causing more damage. This type of crisis may occur in the near future due to economic and regulatory changes in these two sectors of activity. The bank must then take the necessary measures to avoid this situation.

#### **4.6. Scenario six: Downgrading of Watch List receivables**

Watch list is a list held by the bank, on which a certain number of customers presenting irregularities or having shown difficulties in repaying their credits. It is considered as tool for monitoring and managing customers in difficulty. Indeed, the customers on this list are subject to special monitoring and treatment to enable the situation to be regulated and with the aim of minimizing the risk borne by this category of customers. Watch List clients are therefore clients to be monitored very closely, their situations are critical, they are therefore very exposed to risk, and they are the first to be affected in times of crisis. This is where we build this scenario, which consists of downgrading all the receivables in this category.

This type of stress will allow us to know whether the bank is managing its fragile clients well or whether this management would not be sufficient in times of crisis. The stress test gave the following results:

**The constitution of classified receivables and their provisioning**

**Table 16**  
**Results after scenario 6 on classified claims**

*- Algerian dinars -*

Categories	NPL before the shock	Provisions before the shock	NPL after the shock	Loss provision	Provisions after the shock
<b>Category 1</b>	286.031	73.312	16.876.031	3.318.000	3.391.312
<b>Category 2</b>	1.742.214	821.160	1.742.214	0	821.160
<b>Category 3</b>	3.432.612	3.255.366	3.432.612	0	3.255.366
<b>Total</b>	5.460.856	4.149.838	22.050.856	3.318.000	7.467.838

Source: authors

*Allocation to provisions*

*= amount of the Watch List receivables \* 20%*

As regards the solvency ratio, the results obtained are as follows:

**Table 17**  
**Results after scenario 6 on the solvency ratio**

*- Algerian dinars -*

	Before shock	After shock
<b>Capital requirement</b>	16.683.590	13.365.590
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	9,22%

Source: authors

The impact of a 5% drop in the bank's earnings added to this scenario:

**Table 18**  
**Results after scenario 6 with drop in the result**

*- Algerian dinars -*

	Before shock	After shock
<b>Bank result</b>	1.985.717	1.886.431
<b>Capital requirement</b>	16.683.590	13.266.304
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	9,15%

Source: authors

The results of this stress show that with or without the additional decrease in the bank's result, the bank would record a solvency ratio below the threshold regulatory. The bank should then take an even greater interest in the management of Watch List customers.

**4.7. Scenario seven: Declassification of receivables from one class to another**

In this scenario, we performed the same shock as in the second scenario, the only difference being the intensity applied. We proceeded to downgrade the claims, class by class, as follows:

- The downgrades to category 1: 10% of current receivables. Receivables in category 0.
- Downgrading to category 2 of all existing potential problem receivables.
- Downgrading to category 3 of existing high-risk receivables.

The results are as follows:

***The constitution of classified receivables and their provisioning***

**Table 19**  
**Results after scenario 7 on classified claims**

*- Algerian dinars -*

Categories	NPL before the shock	Provisions before the shock	NPL after the shock	Loss provision	Provisions after the shock
<b>Category 1</b>	286.031	73.312	15.868.688	3.173.738	3.173.738
<b>Category 2</b>	1.742.214	821.160	286.031	106.359	179.671
<b>Category 3</b>	3.432.612	3.255.366	5.174.826	921.054	4.997.580
<b>Total</b>	5.460.856	4.149.838	21.329.544	4.201.151	8.350.989

*Source: authors*

The method of calculating provisions is the same as that of scenario 2.

**The constitution of equity capital and the solvency ratio after the shock**

**Table 20**  
**Results after scenario 7 on the solvency ratio**

	- Algerian dinars -	
	Before shock	After shock
<b>Capital requirement</b>	16.683.590	12.482.439
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	8,61%

Source: authors

The 5% deterioration of the bank's result intensifies the shock and gives as results:

**Table 21**  
**Results after scenario 7 on the solvency ratio**

	- Algerian dinars -	
	Before shock	After shock
<b>Bank result</b>	1.985.717	1.886.431
<b>Capital requirement</b>	16.683.590	12.383.154
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	8,54%

Source: authors

This exercise shows that the application of the same shock with a higher intensity caused by a larger crisis would cause a deterioration in the bank's financial health.

**4.8. Scenario eight: Deterioration of Watch List receivables and bad debts at the same time**

A deterioration in the external environment generally affects all of the bank's variables at the same time. This test then aims to analyse the overall effect of a crisis on the bank's solvency.

The stress scenario is:

- Downgrade Watch List receivables and customers from category 0 to category 1;
- Downgrade receivables from category 1 to category 2, and those from category 2 to category 3.

The results of the test exercise are as follows:

**Constitution of classified receivables and their provisioning**

**Table 22**  
**Results after scenario 8 on classified claims**

*- Algerian dinars -*

Categories	NPL before the shock	Provisions before the shock	NPL after the shock	Loss provision	Provisions after the shock
<b>Category 1</b>	286.031	73.312	16.592.976	3.318.595	3.318.595
<b>Category 2</b>	1.742.214	821.160	286.031	106.359	179.671
<b>Category 3</b>	3.432.612	3.255.366	5.174.826	921.054	4.997.580
<b>Total</b>	5.460.856	4.149.838	22.053.833	4.346.008	8.495.846

Source: authors

*Provisions after shock*  
*= doubtful loans after shock \* weighting rate*

**Results without taking into account the deterioration of the bank's results**

**Table 23**  
**Results after scenario 8 on the solvency ratio**

*- Algerian dinars -*

	Before shock	After shock
<b>Capital requirement</b>	16.683.590	12.337.582
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	8,51%

Source: authors

The results with the 5% drop in the bank's result give:

**Table 24**  
**Results after scenario 8 with a drop in the result**

*- Algerian dinars -*

	Before shock	After shock
<b>Bank result</b>	1.985.717	1.886.431
<b>Capital requirement</b>	16.683.590	12.238.296
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	8,44%

Source: authors

The downgrading of the Watch List claims alone was already damaging the bank's financial health, so an additional shock would only further worsen the consequences for the bank. This is what the results of this test show, which gave a solvency ratio of 8.44%, compared to 9.15% for the Watch List downgrade alone.

The ratio was not very far from the regulatory limit, but the overall effect of the crisis on receivables as sensitive as those on the Watch List has caused it to fall even further, a situation that calls for more attention to be paid to this type of receivable. This test is probably more significant than those that involved stressing Watch List and independently classified claims separately. It better captures the overall impact of a crisis.

#### **4.9. Scenario nine: Deterioration in credit scores**

At this private bank, credits are rated on a scale from 1 to 12, where 12 is the worst rating. Customers rated eight are close to the category of customers to be monitored very closely and those rated between 9 and 10 are considered very sensitive and may at the slightest shock move into the doubtful category.

An economic downturn could affect the bank's customers who fit these descriptions. This is what we are going to see in this scenario, which consists of downgrading 50% of the customers who are rated eight and all those who have ratings between 9 and 10 to the category of doubtful customers. The consequences of such a shock are given in the following tables:

#### ***The constitution of classified receivables and their provisioning***

**Table 25**  
**Results after scenario 9 on classified claims**

*- Algerian dinars -*

Categories	NPL before the shock	Provisions before the shock	NPL after the shock	Loss provision	Provisions after the shock
<b>Category 1</b>	286.031	73.312	32.248.031	6.392.400	6.465.712
<b>Category 2</b>	1.742.214	821.160	1.742.214	0	821.160
<b>Category 3</b>	3.432.612	3.255.366	3.432.612	0	3.255.366
<b>Total</b>	5.460.856	4.149.838	37.422.856	6.392.400	10.542.238

*Source: authors*

**The constitution of equity capital and the calculation of the solvency ratio**

**Table 26**  
**Results after scenario 9 on the solvency ratio**

	- Algerian dinars -	
	Before shock	After shock
<b>Capital requirement</b>	16.683.590	10.291.190
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	7,1%

Source: authors

The bank did not respond well to this test because we note that the solvency ratio is 7.10%, it is therefore below the regulatory limit of 9.5%. However, in order to take into consideration all the assumptions that may accompany this shock; we will analyze the magnitude of the consequences of this scenario if the bank had to suffer a 7% deterioration in its earnings.

The following table gives the solvency ratio under these circumstances:

**Table 27**  
**Results after scenario 9 with drop in the result**

	- Algerian dinars -	
	Before shock	After shock
<b>Bank result</b>	1.985.717	1.846.717
<b>Capital requirement</b>	16.683.590	10.152.190
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	7,0%

Source: authors

As expected, the solvency ratio is even lower. This scenario shows once again the importance of managing customers who need to be monitored very closely and those who are not in a very strong position.

**4.10. Scenario ten: Deterioration of current receivables with high intensity**

This scenario consists of downgrading 20% of the bank's current claims to the class of potential problem claims. This is a shock of very high intensity but is based on events that may occur. We quote some of them:

- The 50% downgrading of claims in the three main sectors of activity;
- The downgrading of all the claims held on the automotive sector and those of companies related to this sector;
- A 50% write-down of the top 10.

If any of these events were to occur, the bank would see 20% of these current claims downgraded to potentially problematic claims. The results we have obtained are as follows:

***The constitution of the classified debts and their provisioning***

**Table 28**  
**Results after scenario 10 on classified claims**

*- Algerian dinars -*

Categories	NPL before the shock	Provisions before the shock	NPL after the shock	Loss provision	Provisions after the shock
<b>Category 1</b>	286.031	73.312	32.017.453	6.346.284	6.419.596
<b>Category 2</b>	1.742.214	821.160	1.742.214	0	821.160
<b>Category 3</b>	3.432.612	3.255.366	3.432.612	0	3.255.366
<b>Total</b>	5.460.856	4.149.838	37.192.278	6.346.284	10.496.122

*Source: authors*

***The constitution of equity capital and the solvency ratio after the shock***

**Table 29**  
**Results after scenario 10 on the solvency ratio**

*- Algerian dinars -*

	Before shock	After shock
<b>Capital requirement</b>	16.683.590	10.337.306
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	7,13%

*Source: authors*

We intensify this shock by assuming that a reversal of the macroeconomic situation would affect the result and make it decrease by 7% of its present value. We obtain the following results:



**Table 30**  
**Results after scenario 10 with drop in the result**

*- Algerian dinars -*

	Before shock	After shock
<b>Bank result</b>	1.985.717	1.846.717
<b>Capital requirement</b>	16.683.590	10.198.305
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	7,04%

*Source: authors*

The application of this shock caused a sharp increase in the cost of risk, leading to a reduction for capital and a solvency ratio below the limit set by the regulator. This exercise has just shown that if Scenario 1 were to occur with greater intensity, the financial health of the bank would be affected.

#### **4.11. Scenario eleven: Very high-intensity debt downgrades**

The last test that we are going to carry out consists in analyzing the impact of a shock of very high intensity that affects several variables at the same time. It cumulates the effect of several scenarios carried out previously and is based on the following hypotheses:

- Downgrading of 20% of current receivables and receivables from category 0 to category 1 of classified receivables;
- Downgrading of receivables from category 1 to category 2 and those from category 2 to category 3.

The results obtained are as follows:

#### ***The constitution of classified receivables and their provisioning***

**Table 31**  
**Results after scenario 11 on classified claims**

*- Algerian dinars -*

Categories	NPL before the shock	Provisions before the shock	NPL after the shock	Loss provision	Provisions after the shock
<b>Category 1</b>	286.031	73.312	31.734.399	6.346.880	6.346.880
<b>Category 2</b>	1.742.214	821.160	286.031	106.359	927.520
<b>Category 3</b>	3.432.612	3.255.366	5.174.826	921.054	4.176.420
<b>Total</b>	5.460.856	4.149.838	37.195.255	7.374.293	11.450.819

*Source: authors*

*Provisions after shock = claims after shock \* provisioning rate*

*Provisioning allocation  
= Provisions after shock – Provisions before shock*

**Constitution of equity capital and solvency ratio after shock**

**Table 32**  
**Results after scenario 11 on the solvency ratio**

	<i>- Algerian dinars -</i>	
	<b>Before shock</b>	<b>After shock</b>
<b>Capital requirement</b>	16.683.590	9.309.297
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	6,42%

*Source: authors*

As the situation has changed a lot, we expect a lower result than the current one. We will therefore add to the scenario the fact that the result loses 10% of its current value. The result obtained is:

**Table 33**  
**Results after scenario 11 with a drop in the result**

	<i>- Algerian dinars -</i>	
	<b>Before shock</b>	<b>After shock</b>
<b>Bank result</b>	1.985.717	1.787.145
<b>Capital requirement</b>	16.683.590	9.110.725
<b>RWA</b>	144.953.023	144.953.023
<b>CAR (%)</b>	11,51%	6,29%

*Source: authors*

The solvency ratio obtained by exercising this shock is 6.29%, the lowest coefficient recorded since the beginning of the application of the stress tests. We can then say that this scenario is the worst of all and that its occurrence could disrupt the bank's activity.

## 5. Discussion and conclusion

Through the application of stress tests on the bank's portfolio of commitments, we have observed that the bank has responded well to certain stresses and has reacted less well to others. This is due to the types of shocks applied and their intensities.

Indeed, we found that the cost of risk resulting from stress varied from one scenario to another. Sometimes the bank was able to cope without jeopardizing its financial soundness as in scenarios 1, 2, 3 and 4, and other times, as in scenarios 5, 6, 7, 8, 9, 10 and 11, the bank bore this cost less well and consequently recorded solvency ratios below the regulatory limit. The solution to remedy such situations is an increase in shareholders' equity, which can be achieved by increasing the bank's share capital or by reducing the dividends to be distributed to shareholders.

We have also noted that there are more sensitive claims than others in the portfolio, such as Watch List claims and those held on the main business sectors financed by the bank. The latter require more rigorous monitoring. Indeed, the bank could cap the amounts of loans to be granted to sectors of activity that are exposed to changes that could adversely affect its portfolio and should try to reduce the number of Watch List clients by providing them with advice that would help them improve their situations.

After the quantitative estimation of likely scenarios, financial institutions could take measures that serve to minimize the impact of the most severe scenarios. A good understanding of the nature of the risks is an advantage when implementing these instruments. Scenarios can be generated in many ways. One way is to consider severe shocks to a single market aggregate. An extension is to consider such shocks for all market aggregates based on past extreme variations. The best model remains the use of supervisory judgment and practice to generate pessimistic but plausible scenarios.

Financial institutions sometimes run reverse stress tests with algorithms to detect extremely dangerous scenarios. These scenarios must be comprehensive and embrace systemic risk. Supervisors require banks to have capital based on the scenarios performed. It is necessary to be innovative in the preparation of scenarios. One of the conditions is to have more than twenty years of historical data and to select as scenarios the riskiest events of this phase. Generally, especially when the financial situation is stable, the results of the stress tests are forgotten.

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