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**Stress Testing as an Approach for Measuring Financial Stress and Its
Impact on Predicting Credit Risks: An Analytical Study**

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Abstract: Nowadays, there are several issues or risks facing the banking sector, therefore, it is necessary to banks apply some methods to reduce that problems and risks. As results, this study aimed to apply stress tests to measure financial stress for predicting credit risks in banks. The research was based on the main hypothesis that by applying stress scenario tests, it is possible to predict credit risks. The research used a descriptive and analytical methods to test the hypothesis. The study population was the Iraqi banking sector, with a purposive sample taken from Ashur International Bank for Investment. In the main findings, the research concluded that stress testing scenarios contribute to predicting credit risks. Finally, the study recommends emphasizing further investment in diverse investments that yield higher returns.

الاختبارات الضاغطة كمنهجية لقياس الاجهاد المالي وتأثيره في التنبؤ بمخاطر الائتمان: دراسة تحليلية

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المستخلص

في العصر الحالي، يواجه قطاع البنوك مجموعة من التحديات والمخاطر، مما يستدعي من المصارف ضرورة تبني استراتيجيات فعالة للتقليل من هذه الأخطار. على هذا الأساس هدفت الدراسة إلى استخدام اختبارات الضغط كأداة لقياس الاجهاد المالي بهدف التنبؤ بمخاطر الائتمان في القطاع المصرفي. تركزت الدراسة على فرضية أساسية تفيد بأن تنفيذ اختبارات سيناريوهات الضغط يمكن أن تعزز من قدرة المصارف على التنبؤ بمخاطر الائتمان بفعالية. لاختبار هذه الفرضية، اعتمدت الدراسة على منهجيات وصفية وتحليلية، مع التركيز على القطاع المصرفي العراقي واختيار عينة محددة متمثلة بمصرف آشور الدولي للاستثمار للتحليل. أظهرت النتائج الرئيسية أن تطبيق سيناريوهات اختبار الضغط يلعب دوراً مهماً في التنبؤ بمخاطر الائتمان. وأخيراً، توصي الدراسة بضرورة التركيز على المزيد من الاستثمار في الاستثمارات المتنوعة التي تدر عوائد أعلى.

الكلمات المفتاحية: السيناريوهات، الاختبارات الضاغطة، الاجهاد المالي، المخاطر الائتمانية.

Introduction:

The banking sector represents a fundamental pillar in driving the process of economic development, by its essential role in enhancing economic growth. However, this sector has recently faced numerous challenges and problems due to increased competition and rapid technological advancements, threatening some financial institutions with decline or even disappearance from the financial arena. This necessitates the search for new methods and standards for banking operations in line with the directives of the central bank, aiming to avoid the banking risks that may be encountered. Employing scenarios is considered a contemporary approach that provides a deep understanding of the risks facing the banking sector, whether on a global or local level.

in previous studies, the research variables have been addressed, such the study of Dítě, which is under the title "The Impact of Stress Testing on Bank Risks," which aimed to determine banks' ability to obtain new information that enables them to face crises through stress testing, as well as to understand the pressures faced by shareholders and benefit from them. The study population was a group of banks in the European Union, and one of the main results was that stress testing to assess and understand the banks'

capacity to withstand shocks and the authorities' ability to control and act when needed (Dítě, M. 2015).

Furthermore, the study of Maléřová focused on evaluating crisis preparedness and providing resources for stress testing, aiming to highlight the extent and capacity of commercial banks in their preparedness serving regional crisis units. This was achieved by using stress testing to understand the banking system's ability to face potential crises while continuing to bear them, with the Czech bank as the study sample. One of the key findings was that stress tests are an important tool in the banking financial system as they determine its capacity and resilience towards future events (Maléřová et al. 2019).

Meanwhile, the study of Gambetta highlighted how comprehensive stress testing affects the capital of European banks and identifies the risks they may face. Stress testing was considered a key tool used by banks and regulatory bodies for risk management, forming an essential part of these institutions' risk management systems. The study included a sample of banks operating within the European Union and highlighted the importance of an effective risk management system in reducing the impacts of regulatory stress tests. It was found that banks with large loan portfolios and high profitability levels are less negatively affected by the outcomes of stress tests (Gambetta et al., 2019).

Research Methodology

First: Research Problem: In particular, The Iraqi banking sector faces numerous financial shocks and crises that have affected the world in general. Therefore, these banks should search for methods that enabling them to maintain their financial position and the ability to continue and grow. Consequently, banks focus on having financial, statistical, and mathematical indicators and standards that are based on sound and studied foundations. Through these, they adopt scenarios and strategies that enable them to effectively manage the financial risks they face. Thus, the research problem emerges through the main question: To what extent can modern methods represented by stress testing for measuring financial stress predict the credit risks of the researched bank?

Second: Importance of the Research: The importance of the research emerges through the significance of its variables and the specificity of the

researched field. Hence, the importance of the research is encapsulated in the following aspects:

1. Providing a set of financial and quantitative tools and measurements that contribute to analyze the financial situations of banks for measuring financial stress.
2. Offering a collection of financial tools and standards that contribute to predicting banking risks.
3. Revealing the reality of the researched bank by analyzing future scenarios of stress tests to understand the financial stress situation of the bank.
4. The findings of this study will determine the extent to which the researched bank can achieve continuity in times of crisis and growth leading to the possibility of facing future crises.

Third: Research Objective: Identifying the research problem and its specific questions that aims to achieve the main objective of applying stress tests to measure financial stress in predicting credit risks in the researched bank. Therefore, from the main goal, a set of subsidiary objectives emerged:

1. Measuring and analyzing the specific conditions of stress tests for measuring financial stress in the researched bank.
2. Predicting and estimating the credit risks in the researched bank.
3. Diagnosing the role that stress tests for measuring financial stress play in predicting credit risks to hedge against future crises.
4. Presenting a set of results and recommendations related to the researched variables.

Fourth: Research Hypothesis: In light of focusing on the research problem and objectives, a primary hypothesis has been formulated stating that (stress tests for measuring financial stress, through scenarios, contribute to predicting credit risks in the researched bank).

Fifth: Research Boundaries:

- A. Spatial Boundaries: The spatial boundaries are represented by selecting the Ashur International Bank for Investment.
- B. Temporal Boundaries: The temporal boundaries span from 2010 to 2022.

Sixth: Research Methodology: The research utilized the descriptive method to frame the theoretical framework, while the analytical method was employed to measure and test the practical aspect through collecting the financial data from the published reports of the researched bank. Financial analysis was conducted using EXCEL software, and statistical tests were

performed using a suite of statistical software packages to understand the scenarios of stress tests and estimate credit risks.

Theoretical Aspects

Firstly: Stress Tests:

A. Concept: Stress testing for measuring financial stress is viewed as a modern, future-oriented tool. It is considered the optimal solution for measuring banks' resilience to crises, through which important weaknesses can be identified. It is defined as the mechanism through which a bank's financial position, when subjected to severe stress, meaning anticipation of what happens to previous standards, signifies the bank's ability to survive upon the occurrence of shocks with potential negative effects (Vuković, S, 2014:88). Stress tests evaluate the sensitivity of financial institutions towards future events that have a negative impact on their economy. This test forms one of the primary tools to enhance financial stability, and its use is significantly increasing by central banks and financial regulatory authorities. This approach is used to examine the risks that may confront the financial system and significantly contributes to understanding the potential impacts of those risks on the sustainability of financial institutions and the economy in general (Hoggarth & Zicchino, 2005: 393). They can also be seen as tests of severe and mild impact possibilities used in evaluating banks' stability and resilience against potential financial shocks or future high risks (Arab Monetary Fund, 2018: 7). Meanwhile, the European Central Bank mentioned that adopting stress tools is an effective way to identify potential weaknesses within the banking sector and to measure its ability to adapt to negative shifts (Kok & Henry, 2013: 7). The Bank for International Settlements views stress tests for measuring financial stress as techniques used to test the stability of financial institutions for supervisory purposes. Integrating these techniques is effective in revealing the different economic and financial aspects of those institutions (Borio et al., 2012: 2). Thus, the use of these techniques can contribute to examining and evaluating the financial stability of institutions comprehensively.

B. Importance of Stress Tests: Given the significant role the banking sector plays in the economic development of all countries, the condition of banks and their ability to continue operating are among the most critical criteria that need to be assessed. Central banks and governments work hard to maintain financial stability. According to (Baud & Chiapello, 2017), banks

constantly face challenges related to liquidity availability since their activities depend on financing loans and long-term assets, relying on depositor funds. The problem is that these funds are often short-term, especially concerning current accounts that customers can withdraw from (Kadhim & et al., 2019: 280). The importance of stress testing comes from the fact that it provides two basic types of information: identifying the extent of potential losses due to catastrophic situations, and offering scenarios and perceptions about the conditions that may lead to these losses. These two types of information, provided by stress testing, are vital inputs for decision-makers in financial institutions. These decisions include formulating hedging policies, setting credit limits, allocating asset distribution ratios in investment portfolios, and adjusting capital adequacy (Abdel Hai, 2014: 93).

C.Objectives of Stress Tests: (The Financial Stability Report in Arab Countries, 2019: 118) views stress tests as aimed at identifying and managing key risks, which is an essential part of the bank's risk management processes at all levels. This aims to identify the risks facing the bank, focus attention on these risks, and their potential impacts. Stress tests are considered a primary quantitative tool for understanding the bank's risk system (Profile Risk) and assessing its capacity to withstand various types of shocks.

Furthermore, stress tests significantly contribute to the capital planning process by providing an internal capital adequacy assessment (ICAAP). These tests offer tools for evaluating the adequacy of the bank's internal capital to face all materially impactful risks and withstand any potential financial shocks. They also help the bank in estimating the amount of capital that needs to be provided in the future over the coming years.

D. Although there isn't a complete consensus among researchers and authors on a specific classification for types of stress tests, some studies such as (Friesz, 2021: 68) and (Zanknah & Al-Rubaie, 2019: 96) suggest adopting the following classifications for stress tests:

Stress Tests by Risk Level: This type of test is conducted to analyze the sensitivity of banks to various risk factors. This is done by examining the ratio of non-performing loans, changes in interest rates and exchange rates, and fluctuations in stock prices. Typically, the source of the shock is not specifically identified in these tests; rather, the focus is on identifying risks

directly related to the bank and macroeconomic risks such as those related to exchange rates, interest rates, and credit.

Scenario Analysis Test: This type of test is used to examine the financial situation of banks through various risk factors. This includes examining the ratio of non-performing loans, assessing changes in interest rates and exchange rates, and tracking stock price fluctuations. Like the stress tests by risk level, the source of the shock is usually not specifically identified in scenario analysis; instead, the focus is on analyzing risks related to the bank and comprehensive economic risks.

The scenarios are often divided into three categories based on their severity:

- ❖ **Less Severe Scenarios (25%):** Represent relatively challenging operational conditions that the bank can manage without significant stress.
- ❖ **Medium Severity Scenarios (50%):** Represent more difficult conditions that may significantly affect the bank's financial performance.
- ❖ **Most Severe Scenarios (75%):** Represent exceptionally negative conditions likely to cause significant financial stress on the bank.

Secondly: Financial Stress

A. Concept: Previously, financial systems-which encompass financial institutions-were prone to periods of rapid expansion followed by restructuring phases. To understand the impact of financial activity cycles on the banking sector, it's beneficial to identify the key features of ongoing disturbances in financial markets and then look for previous instances of financial stress that share characteristics with the current situation (Cardarelli & et al., 2011: 8). Financial stress is defined as the analysis conducted through envisaged scenarios and potential economic situations designed to test whether a bank has sufficient financial solvency to face potential financial and banking risks. This is done using specific techniques and methods that help assess the sensitivity of various activities to exceptional, yet plausible, events through their exposure to a series of shocks and scenarios on indicators in the financial institution and showing the overall impact of those potential changes (El-Daly, 2022: 417).

Financial stress can be measured through the following (Khader, 2022: 43-44) (El-Daly, 2022: 430-439) (Al-Attar, 2023: 254):

- ❖ **Capital Adequacy Ratio = 10.5%** according to Basel III recommendations and 12% according to the Iraqi Central Bank law.

- ❖ Liquidity Ratio, measured as Current Assets / Current Liabilities, with the standard value being 105%.
- ❖ Return on Investment (ROI) Ratio, with the standard value being greater than 8%.
- ❖ Return on Assets (ROA) Ratio, with the standard value being greater than 2%.
- ❖ Return on Equity (ROE) Ratio, with the standard value being greater than 8%.

B. The Importance of Implementing Financial Stress Tests: The significance of developing a mechanism for financial stress tests lies in the ability to understand and measure the extent of potential losses faced by a bank, which could lead to catastrophic situations. Furthermore, it's essential to identify the scenarios or envisaged situations that might result in such losses. The information provided by stress tests forms a crucial resource for senior management to make significant decisions within the bank or institution, leading to the formulation of hedging policies to confront potential risks (El-Daly, 2022: 218-2019).

Thirdly: Credit Risks: Credit risks arise when a client fails to meet their financial obligations towards the bank, potentially leading to losses and endangering the bank's financial position (Al-Harith & Hazouri, 2016: 246). Credit risk can be defined as the possibility that one of the parties fails to fulfill its obligations as per the agreed terms. It's also referred to as default risk, performance risk, or counterparty risk, all of which essentially denote the impact of an inability to repay (Bluhm & Wagner, 2016:1-2). These risks also encompass the ability to repay the principal amount and due interest, where failure to do so could result in losses for the creditor (Badrawi & Saadoun, 2021: 296).

Credit risks cover the client's inability or unwillingness to meet the obligations related to lending policy, liquidity, hedging and settlement operations, and other financial transactions. Generally, these risks include default risks and portfolio risks, which encompass concentration and systemic risks, and are influenced by internal and external factors (Spuchakova et al., 2015: 6).

According to Schuller (2008), credit risks can be measured through various criteria, where two main metrics were adopted: the ratio of loans to total assets and the ratio of loans to total deposits (Habib et al., 2021: 75). These metrics help in assessing the bank's exposure to credit risks and the effectiveness of their management.

Analysis of Financial Indicators: This section involves selecting the financial statements of Ashur International Bank for Investment for the period from 2010 to 2022. It will present financial stress indicators as follows:

Introduction to Ashur International Bank for Investment: Ashur International Bank was established with a nominal capital of 25 billion Iraqi dinars, according to the incorporation certificate number M.S. 25812 dated April 25, 2005, issued by the Company Registration Department. The bank obtained a banking license from the Central Bank, as per letter number 9\3\2627 on September 22, 2005.

Operating within the private sector as an investment bank, Ashur aims to provide comprehensive banking services efficiently to businesses and individuals. The bank strives to keep up with all the developments, updates in the banking market, and is characterized by effective money management. The bank's financial solidity is notable, with a capital adequacy ratio of 59% at the end of 2022, exceeding both global and local benchmark ratios that require a minimum of 12%. The bank's current capital reached 250 billion dinars, according to its 2022 annual report.

Financial Analysis Indicators for Financial Stress: The table presents a series of financial indicators for the Assyrian International Bank for Investment, tracking its performance from 2010 to 2022. These indicators include capital adequacy, liquidity ratio (2:1 as per standard), Return on Investment (ROI) where the standard value is greater than 8%, Return on Assets (ROA) with a standard value greater than 2%, and Return on Equity (ROE) where the standard value is greater than 8%. The Basel Accord mandates a 12% capital adequacy ratio, while the Central Bank's law prescribes 10.5%.

Table (1): Financial indicators of financial impact %

Year	Capital Adequacy (%)	Liquidity Ratio (2:1)	ROI (%) Standard > 8%	ROA (%) Standard > 2%	ROE (%) Standard > 8%
2010	0.55	2.11	0.12	0.05	0.09
2011	0.55	1.84	0.01	0.002	0.01
2012	0.66	2.57	0.22	0.06	0.09
2013	1.03	2.65	0.18	0.04	0.06
2014	1.4	2.48	0.001	0.01	0.002
2015	1.94	3.07	0.15	0.04	0.07
2016	0.52	3.4	0.16	0.04	0.58

Year	Capital Adequacy (%)	Liquidity Ratio (2:1)	ROI (%) Standard > 8%	ROA (%) Standard > 2%	ROE (%) Standard > 8%
2017	1.16	3.95	0.18	0.04	0.05
2018	2.76	2.39	0.03	0.01	0.02
2019	2.71	2.74	0.04	0.01	0.02
2020	2.22	2.96	0.13	0.03	0.05
2021	1.72	3.62	0.05	0.01	0.03
2022	0.59	3.41	0.06	0.02	0.04
Average	1.37	2.86	0.10	0.03	0.09

The source of this data is compiled by the researcher relying on annual reports published on the Iraq Stock Exchange for the period from 2010 to 2022.

It is evident from Table 2 that the average capital adequacy ratio is higher than the standard set by the Central Bank and Basel Committee regulations, which are 10.5% and 12% respectively. The average capital adequacy ratio for the examined years is 1.37, which is a high percentage. Similarly, the average liquidity ratio also exceeded the accepted standard for liquidity, 2:1, reaching a liquidity index of 2.86 times. Meanwhile, the Return on Investment (ROI) indicator, with an established standard of 8%, achieved a rate of 10%, which is above the standard. In addition, the Return on Assets (ROA) reached 3%, surpassing the accepted benchmark of 2%. The Return on Equity (ROE) index also achieved a rate of 9%, higher than the accepted standard of 8%. This analysis indicates that the Assyrian International Bank for Investment not only met but exceeded several critical financial performance benchmarks over the examined period, showcasing strong capital adequacy, liquidity, and profitability.

Stress Financial Scenarios Analysis:

1. Capital Adequacy Scenario Analysis at Three Levels:

Table (2): Scenarios for Capital Adequacy Indicator at Three Levels
Scenarios for Capital Adequacy: 10.5% according to Basel Committee standards and 12% as recommended by the Central Bank

Year	Base Scenario	Less Severe Scenario (25%)	Moderate Severity Scenario (50%)	High Severity Scenario (75%)
2010	0.55	0.4125	0.275	0.1375
2011	0.55	0.4125	0.275	0.1375

Year	Base Scenario	Less Severe Scenario (25%)	Moderate Severity Scenario (50%)	High Severity Scenario (75%)
2012	0.66	0.495	0.33	0.165
2013	1.03	0.7725	0.515	0.2575
2014	1.4	1.05	0.7	0.35
2015	1.94	1.455	0.97	0.485
2016	0.52	0.39	0.26	0.13
2017	1.16	0.87	0.58	0.29
2018	2.76	2.07	1.38	0.69
2019	2.71	2.0325	1.355	0.6775
2020	2.22	1.665	1.11	0.555
2021	1.72	1.29	0.86	0.43
2022	0.59	0.4425	0.295	0.1475
Average	1.37	1.0275	0.685	0.3425

Source: Compiled by the researcher based on the annual reports published on the Iraq Stock Exchange for the period 2010-2022.

From the scenario analysis results, it is evident that the Assyrian International Bank for Investment boasts a high capital adequacy indicator across all potential scenarios for shocks and crises. The bank achieved higher than the Central Bank standard and Basel Committee requirements set at (10.5%, 12%) respectively. The outcomes for all years were above these standards, with results for the less severe scenario at 1.03, the moderate severity scenario at 0.68, and the high severity scenario at 0.34. This implies that in the event of shocks or crises affecting capital adequacy, the bank would maintain strength and security, not showing any signs of financial stress at the three levels.

2. Liquidity Ratio Scenario Analysis Across Three Levels:

Table (3): outlines the scenarios for liquidity ratios at three distinct levels, adopting a 2:1 standard liquidity ratio:

Year	Base Scenario	Less Severe Scenario (25%)	Moderate Severity Scenario (50%)	High Severity Scenario (75%)
2010	2.11	1.5825	1.055	0.5275
2011	1.84	1.38	0.92	0.46
2012	2.57	1.9275	1.285	0.6425
2013	2.65	1.9875	1.325	0.6625
2014	2.48	1.86	1.24	0.62

Year	Base Scenario	Less Severe Scenario (25%)	Moderate Severity Scenario (50%)	High Severity Scenario (75%)
2015	3.07	2.3025	1.535	0.7675
2016	3.4	2.55	1.7	0.85
2017	3.95	2.9625	1.975	0.9875
2018	2.39	1.7925	1.195	0.5975
2019	2.74	2.055	1.37	0.685
2020	2.96	2.22	1.48	0.74
2021	3.62	2.715	1.81	0.905
2022	3.41	2.5575	1.705	0.8525
Average	2.86	2.15	1.43	0.72

Source: Developed by the researcher, based on annual reports from the Iraq Stock Exchange for the years 2010-2022.

The table demonstrates that liquidity scenarios vary across each level. The lowest ratio was observed in the less severe scenario (25%) at 1.38 in 2017, while the highest ratio was 2.96, indicating that all years within this scenario met the standard.

In the moderate severity scenario (50%), the lowest ratio was 0.92 in 2011, which falls below the accepted standard. However, other years remained within the standard, reaching a peak of 1.9 in 2017. The overall average for this scenario was 1.43, aligning with the standard.

For the high severity scenario (75%), all years fell below the standard with an overall average of 0.72, indicating that in the face of severe crises or shocks, the bank would encounter liquidity risks, leading to financial stress at the most severe third level.

3. Return on Investment (ROI) Scenario Analysis Across Three Levels:

Table (4): presents scenarios for the return on investment (ROI) at three levels, with a standard ROI set at 8%:

Year	Base Scenario	Less Severe Scenario (25%)	Moderate Severity Scenario (50%)	High Severity Scenario (75%)
2010	0.12	0.09	0.06	0.03
2011	0.01	0.0075	0.005	0.0025
2012	0.22	0.165	0.11	0.055
2013	0.18	0.135	0.09	0.045
2014	0.001	0.00075	0.0005	0.00025
2015	0.15	0.1125	0.075	0.0375

Year	Base Scenario	Less Severe Scenario (25%)	Moderate Severity Scenario (50%)	High Severity Scenario (75%)
2016	0.16	0.12	0.08	0.04
2017	0.18	0.135	0.09	0.045
2018	0.03	0.0225	0.015	0.0075
2019	0.04	0.03	0.02	0.01
2020	0.13	0.0975	0.065	0.0325
2021	0.05	0.0375	0.025	0.0125
2022	0.06	0.045	0.03	0.015
Average	0.10	0.075	0.05	0.025

Source: Developed by the researcher, based on annual reports from the Iraq Stock Exchange for the years 2010-2022.

Analysis reveals that in the less severe scenario (25%), the years (2010, 2012, 2013, 2015, 2016, 2017, 2020) exceeded the 8% standard, with respective ratios of (0.09, 0.165, 0.135, 0.1125, 0.12, 0.135, 0.0975), whereas the years 2011, 2018, 2019, 2021, and 2022 fell below the standard. The overall index was 7.5%, which is within the standard for the aggregate index.

For the moderate severity scenario (50%), the years (2012, 2013, 2016, 2017) met the standard, with ratios of (0.11, 0.09, 0.08, 0.09) respectively, while the overall average was 0.05, below the standard. This indicates the need for preparedness for potential conditions if the bank faces shocks or crises at this severity level, highlighting a state of moderate financial stress under such circumstances.

In the high severity scenario (75%), all years were below the standard, with an overall average of 0.025. This suggests that in the event of crises or shocks at this level, the bank would face losses.

4. Scenarios for analyzing the return on assets index:

Table (5): return on assets index scenarios for the three scenarios

Year	Base Scenario	Less Severe Scenario (25%)	Moderately Severe Scenario (50%)	Highly Severe Scenario (75%)
2010	0.05	0.0375	0.025	0.0125
2011	0.002	0.0015	0.001	0.0005
2012	0.06	0.045	0.03	0.015
2013	0.04	0.03	0.02	0.01
2014	0.01	0.0075	0.005	0.0025
2015	0.04	0.03	0.02	0.01

Year	Base Scenario	Less Severe Scenario (25%)	Moderately Severe Scenario (50%)	Highly Severe Scenario (75%)
2016	0.04	0.03	0.02	0.01
2017	0.04	0.03	0.02	0.01
2018	0.01	0.0075	0.005	0.0025
2019	0.01	0.0075	0.005	0.0025
2020	0.03	0.0225	0.015	0.0075
2021	0.01	0.0075	0.005	0.0025
2022	0.02	0.015	0.01	0.005
Average	0.03	0.0225	0.015	0.0075

Source: Prepared by the researcher, based on annual reports published on the Iraq Stock Exchange for the period 2010-2022.

The table above illustrates the impact of applying scenarios of varying severity on the Return on Assets index. It is evident that under less severe scenarios. The index maintains higher levels compared to moderately and highly severe scenarios, indicating that the bank or financial institution may face varying degrees of financial stress based on the severity of the crises or shocks it encounters. When analyzing the dark blue scenario at the 75% level, the results of the analysis for the different years were less than the empty ones, as well as the general average, as the cancellation of flags reached 0.01. This means that when the bank is exposed to shocks or crises at that level, it means that the bank will face a state of Marquis stress.

5. Return on Equity Scenario

The table (6): presents scenarios for the Return on Equity (ROE) at three levels: Scenarios of Return on Equity: 8% Benchmark

Year	Base Scenario	Less Severe Scenario (25%)	Moderately Severe Scenario (50%)	Highly Severe Scenario (75%)
2010	0.09	0.0675	0.045	0.0225
2011	0.01	0.0075	0.005	0.0025
2012	0.09	0.0675	0.045	0.0225
2013	0.06	0.045	0.03	0.015
2014	0.002	0.0015	0.001	0.0005
2015	0.07	0.0525	0.035	0.0175
2016	0.58	0.435	0.29	0.145
2017	0.05	0.0375	0.025	0.0125
2018	0.02	0.015	0.01	0.005

Year	Base Scenario	Less Severe Scenario (25%)	Moderately Severe Scenario (50%)	Highly Severe Scenario (75%)
2019	0.02	0.015	0.01	0.005
2020	0.05	0.0375	0.025	0.0125
2021	0.03	0.0225	0.015	0.0075
2022	0.04	0.03	0.02	0.01
Average	0.09	0.06	0.04	0.02

Source: Prepared by the researcher based on the annual reports published on the Iraq Stock Market for the period 2010-2022.

The analysis results for the bank at the three levels of 25%, 50%, and 75% were all below the 8% benchmark. Moreover, the average rates for the three levels were 6%, 4%, and 2%, respectively. This indicates that, in the event of crises or shocks affecting shareholder rights, the bank would not sustain for long and would face significant financial stress under all three scenarios.

Fourth: Measuring the Credit Risk of Ashur International Bank for Investment for the period 2010 to 2022

The table (7): measures credit risk:

Year	Loans to Total Assets	Loans to Total Deposits
2010	0.12	0.30
2011	0.26	0.63
2012	0.19	0.71
2013	0.27	0.12
2014	0.16	0.60
2015	0.07	0.02
2016	0.05	0.19
2017	0.03	0.14
2018	0.01	0.03
2019	0.04	0.11
2020	0.05	0.22
2021	0.14	0.53
2022	0.31	0.31
Highest Risk	0.31	0.71
Lowest Risk	0.01	0.02
Average	0.13	0.30

Source: Prepared by the researcher based on the annual reports published on the Iraq Stock Market for the period 2010-2022.

The analysis results reveal that the highest risk for the total loans to total assets ratio was in 2022, with a rate of 0.31, indicating a significant risk, while the lowest risk rate was in 2018 at 0.01. Meanwhile, the average for this indicator was 0.13, suggesting that credit risk is not exceedingly high, indicating a lack of aggressive credit policy.

On the other hand, the loans to total deposits ratio reached its highest in 2012 at 71%, representing a very high risk in providing credit facilities. The lowest rate was in 2015 at 0.02. The average was 0.30, indicating a high risk and the absence of a credit policy that reduces this risk, exposing the bank to financial stress in most of its indicators.

Statistical Aspect

First: Study Variables: To clarify the mechanism of the practical side of this study, it is important to identify the variables used in the research.

Table (8): summarizes the study variables as follows:

Variable Description	Variable Name	Variable Symbol
Independent	Capital Adequacy	X1
	Liquidity Ratio	X2
	Return on Investment Indicator	X3
	Return on Assets Ratio	X4
	Return on Equity Indicator	X5
Dependent	Loans to Total Assets	Y1
	Loans to Total Deposits	Y2

Source: This table was prepared based on the model description by the researcher.

Second: The Statistical Model Used: R is a programming language and analytical tool developed by Robert Gentleman and Ross Ihaka in 1993 at the University of Auckland, New Zealand. It is widely used among software programmers, statisticians, data scientists, and in the field of data mining. R is considered one of the most popular analytical tools for data analysis and business analytics, thanks to its diverse applications in areas such as healthcare, academia, consulting, finance, and media, among others. Its widespread use in statistics, data visualization, and machine learning has increased the demand for professionals proficient in R.

In the context of this study, R language can be used to analyze the relationships between independent and dependent variables, allowing for the

assessment of the impact of capital adequacy, liquidity ratios, return on investment and assets indicators, and return on equity on the credit risk levels of Ashur International Bank for Investment. These relationships can be analyzed through regression models, hypothesis testing, and other statistical methods provided by R

Second: Stress tests as an input to measure financial stress and its impact on loans to total assets

```
ARDL<-lm(Y1~ X1 + X2+ X3+ X4+X5)
```

```
summary(ARDL)
```

```
Call:
```

```
lm(formula = Y1 ~ X1 + X2 + X3 + X4 + X5)
```

```
Residuals:
```

```
Min 1Q Median 3Q Max
```

```
-0.117824 -0.014153 0.000048 0.019370 0.088769
```

```
Coefficients:
```

```
Estimate Std. Error t value Pr(>|t|)
```

```
(Intercept) 0.42656 0.12299 3.468 0.0104 *
```

X1	-0.11467	0.02846	-4.029	0.0050
X2	-0.02492	0.03957	-0.630	0.5488
X3	0.81194	0.89945	0.903	0.3967
X4	-4.44441	3.53088	-1.259	0.2485
X5	-0.31285	0.15311	-2.043	0.0003

```
Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
Residual standard error: 0.06919 on 7 degrees of freedom
```

```
Multiple R-squared: 0.7264, Adjusted R-squared: 0.5311
```

```
F-statistic: 3.718 on 5 and 7 DF, p-value: 0.05812
```

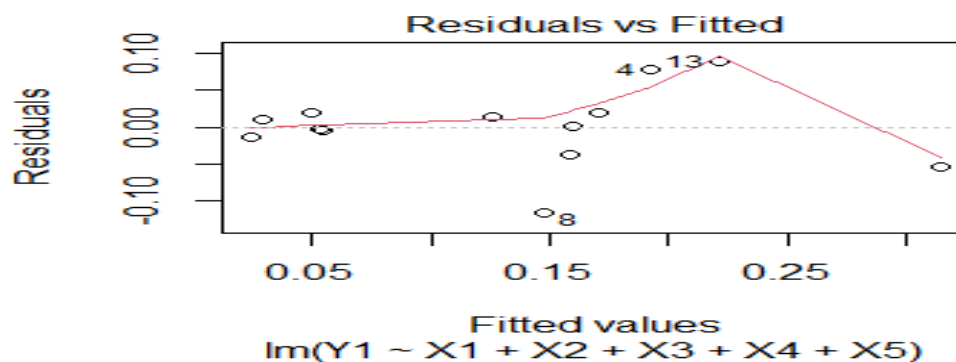
The results from the R programming above regarding the impact of stress test variables as an approach to measure financial stress showed the following insights:

1. The Capital Adequacy Index (X1) as an independent variable has significantly proven its inverse effect on the Loans to Total Assets indicator. Specifically, a 100% increase in Capital Adequacy results in an 11% decrease in Loans to Total Assets.
2. The variables Liquidity Ratio (X2), Return on Investment (X3), and Return on Assets (X4) as independent variables failed to impact the Loans to Total

Assets indicator significantly due to their p-values exceeding the 5% threshold.

3. The Return on Equity (X5) as an independent variable successfully demonstrated its significant inverse effect on the Loans to Total Assets indicator. Specifically, a 100% increase in Return on Equity results in a 31% decrease in Loans to Total Assets.
4. The value of Adjusted R-squared is 0.531, which indicates that the independent variables explain 53% of the variance in the dependent variable, showing a substantial impact of the independent variables on the dependent variable.
5. These findings highlight the importance of capital adequacy and return on equity in managing the proportion of loans to total assets, indicating their effectiveness in reducing financial stress as reflected in the decrease in loans to total assets.

The graph shows multiple linear regression



It is clear from the graph that there is a fluctuation in the relationship between stress tests as an input to measure financial stress and loans to total assets.

Third: The impact of stress tests as an input for measuring financial stress on loans to total deposits.

$\text{ARDL} \leftarrow \text{lm}(Y2 \sim X1 + X2 + X3 + X4 + X5)$

`summary(ARDL)`

Call:

$\text{lm}(\text{formula} = Y2 \sim X1 + X2 + X3 + X4 + X5)$

Residuals:

Min 1Q Median 3Q Max

-0.21133 -0.11998 -0.02176 0.09287 0.37251

Coefficients:

Estimate Std. Error t value Pr(>|t|)

(Intercept) 0.84045 0.41144 2.043 0.0804

X1	-0.19797	0.09522	-2.079	0.0062
X2	-0.04613	0.13237	-0.349	0.7377
X3	-0.41416	3.00889	-0.138	0.8944
X4	-2.07243	11.81166	-0.175	0.8657
X5	-0.42527	0.51218	-0.830	0.4338

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.2314 on 7 degrees of freedom

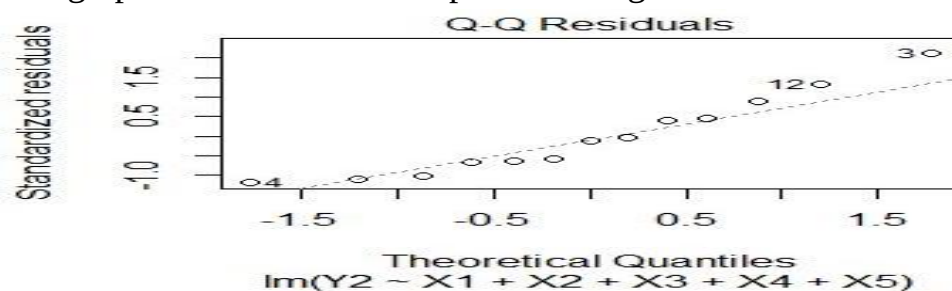
Multiple R-squared: 0.4517, Adjusted R-squared: 0.06006

F-statistic: 1.153 on 5 and 7 DF, p-value: 0.4158

The results from the R software above, concerning the impact of stress testing as a means to measure financial stress ($X1 + X2 + X3 + X4 + X5$) as independent variables on (loans to total deposits) as a dependent variable, revealed several findings including:

1. The capital adequacy ratio as an independent variable successfully demonstrated a significant inverse effect on the loans to total deposits ratio. That is, a 100% increase in capital adequacy results in a 19% decrease in loans to total deposits.
2. All variables ($X2, X3, X4, X5$) as independent factors failed to impact the loans to total deposits ratio due to their probabilities exceeding the 5% threshold.
3. The value of (Adjusted R-squared: 0.06006) indicates the ability of the independent variables to affect the dependent variable, showing an effect size of 53%.

The graph illustrates the multiple linear regression.



It is clear from the graph that there is a fluctuation in the relationship between stress tests as an input to measure financial stress and loans to total deposits.

Conclusions: In sum, the main findings of this study are summarized below:

1. The bank in focus aims to achieve banking efficiency through the utilization of all its available resources to enhance profitability and increase capital. The research found that the bank's capital is on an upward trend.
2. There are discrepancies among the financial stress ratios at three levels; however, the capital adequacy levels and liquidity ratios are within standard limits and do not indicate financial stress.
3. A clear deficiency in achieving the return on investment by the senior management was observed through the analysis at medium and higher stress levels.
4. The return on assets did not meet the general acceptable standard except at the lowest stress level.
5. The return on equity index did not achieve acceptability within the standard for the three scenario levels.
6. There is an increase in credit risk concerning the loans to total deposits ratio.

Recommendations: Via the findings of this study, the researcher mentioned some recommendations are listed below:

1. It's crucial to emphasize further investment in diverse ventures that yield higher returns.
2. Efficient and effective utilization of assets is necessary to enable the bank to withstand future shocks.
3. Greater attention should be paid to shareholder rights, notably through the issuance of profitable shares for sale and attracting more investors to the bank.
4. It's essential to focus on managing credit risk to study the risks associated with market and credit operations.

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