Migration Letters

Volume: 20, No: 8, pp. 92-110

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)
www.migrationletters.com

The Vulnerability of Lebanese Alpha Banks to the Macroeconomic Downturn and Stress Testing

Jean Elia[1], Dr. Nada Jabbour Al Maalouf[2], Dr. Chadia Sawaya[3], Christian Al Khoury[4], Dr. Michel Karam[5*], Najib Bou Zakhem[6]

Abstract

Aim: This study investigates how vulnerable Lebanese Alpha Banks are through macroeconomic downturns and stress testing. Lebanese Alpha banks face several downturns, especially in an unstable market like Lebanon. Thus, the employment of such tests will help increase and enhance their productivity.

Methodology: The research design is explanatory. The positivism philosophy was used where data was interpreted objectively and depended on quantifiable observations that led to statistical analyses. The research is advanced using deductive reasoning and was conducted in an archival strategy.

Findings: Results from a stress test that was conducted on banks' financial statements indicated the importance of such tests to be applied facing the deviation in macroeconomic conditions that face Lebanon. The main results of this study are as follows: growth is mainly driven by proper risk management, regular supervision must be applied on the implementation of rules and regulations by banks, a second-grade appraisal must be done to follow up on the loans, stress tests are crucial to preserving credit review, and any bank in a sensitive position must be immediately backed up.

Implications: The study's outcomes and recommendations are extremely significant for the Lebanese banking sector and its regulatory bodies, financial analysts, and economists. It adds value and information concerning the banking sector with correlation to macroeconomic and stress lines.

Keywords: *Alpha Banks; Lebanon; Banking Sector; Stress Test; Macroeconomic Conditions.*

1. Introduction

Stress testing is used by banks to assess their resilience to pressure and manage risk. It measures the resilience of banks to theoretical situations like recessions, mass unemployment, and falling housing prices. Central banks and regulatory authorities use the results to measure and manage risk through micro-prudential policy or macroprudential policy (Dent et al., 2016). The test has evolved from a focus on

[1] Lebanese University, Lebanon, jean-elia@hotmail.com, ORCID: 0000-0002-4576-1220
[2] Lebanese University, Lebanon, nadajmaalouf@hotmail.com, ORCID: 0000-0003-3289-1349
[3] Head of Graduate Department – Business School, Holy Spirit University of Kaslik, Jounieh, Lebanon, chadiasawaya@usek.edu.lb, ORCID: 0000-0002-4499-6407
[4] La Sagesse University – Lebanon, calkhoury@student.uls.edu.lb, ORCID: 0009-0009-7500-9644
[5] Holy Spirit University of Kaslik, Jounieh, Lebanon, michelkaram@usek.edu.lb, ORCID: 0000-0002-8896-2639
[6] School of Business, Lebanese International University, Bekaa – Lebanon, najib.bouzakhem@liu.edu.lb, ORCID: 0000-0002-5260-6851

individual banks to a central tool used internationally, with the introduction of Basel II in 2004 and the adoption of EU-wide stress testing in 2009 (Taskinsoy, 2019). Simultaneous stress tests, which focus on banks' capital positions, help policymakers measure financial stability risks and establish macro-prudential policy, liquidity resilience, and capital requirements to ensure banks have sufficient loss-absorbing capital (Dent et al., 2016). Designing a stress test involves selecting risks and determining the severity of shocks. Stress tests can additionally involve factors that are less directly tied to the state of the economy, like compensation payments for previous malfeasance. Models are used to generate projections of bank balance sheets, profitability, and capital for each scenario in the stress test results. Banks, regulatory agencies, or a mix of both may create these models utilizing top-down macro-models or bottom-up micro-models (Dent et al., 2016). However, it is crucial to note the limitations of stress testing. They are not a substitute for a proper capital framework nor can they replace a supervisory authority to ensure ample governance and risk management (Holzmann & Restoy, 2022).

Some of the banks that applied stress tests over the past years include Banco Central Do Brazil which started this approach in 2002 by applying several stress tests using a top-down method which is based on analyzing daily, and monthly information provided by banks that covers several levels (liquidity, accounting, capital, and credit operations) (Tabak et al., 2012), The Bank of Japan also used the top-down approach and which was able to cover the activities of more than 370 banks (Lincoln & Friedman, 1998), National Bank of Georgia on the other side, implemented “The GRAPE” method that consisted of using both micro-prudential and macro-prudential to include the values of risk sensitivity and its simplicity in its supervision (Tvalodze et al., 2016), The Bank of Korea; and to achieve financial stability; has implemented a model that measures the direct effects of macroeconomic shocks on the financial system (Babouček & Jančar, 2005), Banco de Mexico is also one of the banks that use top-down stress tests by applying scenarios that assess the effects on the bank’s financial statements and capital ratios (Basel Committee on Banking Supervision, 2013), in Turkey the Banking Regulation and Supervision Agency of Turkey has conducted a top-down macro stress method by creating scenarios based on historical and hypothetical macro data (Onder et al., 2016), and The Bank of England adopts a framework that runs a cyclical scenario annually to imitate differences in financial and credit markets and an exploratory scenario twice-yearly that allows for a valuation of bank resilience to a broader range of possible threats (Bailey et al., 2020).

Besides the stress test, the Countercyclical Capital Buffer (CCB) was presented by the Basel Committee to protect banks from future downturns that may occur. Learning from past crises, CCB was introduced to form a cushion that protects banks’ capital from extreme credit growth.

As for Lebanon, Lebanese banks were founded in the 1900s. They are subject to auditoria control by the Central Bank. They fall into 3 categories: Alpha, Gamma, and Beta. Each classification is based on how many deposits every bank holds. As for stress tests, Banque du Liban (BDL) adopts a top-down method that uses systemic scenarios in two ways (specific to each bank and the whole sector).

Changes in macro and microeconomic conditions increase the need for the implementation of the stress test. Many authors such as Petrella & Resti (2013) found that using this kind of test helped bank customers develop trust in their financial organizations. Lebanese Alpha banks face several downturns, especially in an unstable market like Lebanon. Thus the employment of such tests will help them increase and enhance their productivity ((Blominvest, 2020)

The main research question is as follows: *How vulnerable are the Lebanese Alpha banks through macroeconomic downturns and stress testing?* The sub-questions are as follows: (1) Which bank-specific indicators and macroeconomic indicators impact a bank’s performance? (2) Are these banks vulnerable to macroeconomic indicators? (3) Are they

expected to increase the bank’s capital through a countercyclical capital buffer (CCB) during normal, mild, and severe times? (4) What is the impact of a stress test on a bank’s profitability and performance?

2. Literature Review

2.1 Stress Tests

After the 2008 recession, senior bank managers and regulators introduced stress tests to prevent recurrence in the banking industry. This was due to investors' loss of confidence and a need to assess banks' resilience to deteriorating conditions (Schuermann, 2014). Stress testing was introduced as a supervisory tool to increase transparency and ensure the banking sector's well-being. The standardization and intervallic usage of stress tests, along with testing adverse macroeconomic scenarios, marked a novel model to adopt (Dendooven, 2017).

A stress test can be defined as an exercise applied to financial institutions to measure their resilience under adverse scenarios. Key components of the stress test include macroeconomic indicators like GDP, unemployment rate, interest rate, and inflation. These indicators measure firms' performance under plausible economic shocks and the amount of capital needed. The stress test assesses the quality of a firm, demonstrating its ability to invest properly and generate plausible revenues by evaluating risk governance and control processes. The stress test is a crucial tool for analyzing the financial systems of a country or institution. It is essential to identify the appropriate risks and intermediaries, as well as the selection of intermediaries, to achieve more accurate and representative results. The shock calibration stage involves selecting events that trigger shocks and their impact on the stress test scenario, drawing inspiration from past events and worst-case scenarios (Vukovic et al., 2014). After assessing the results, feedback effects should be considered to extract comprehensive data on how the macroeconomy responds, typically done through Vector Auto Regression. For example, a stress test by Hoggarth et al. (2005) found that UK banks' aggregate write-offs were highly sensitive to negative macroeconomic scenarios, while household write-offs were more sensitive to fluctuations in income gearing.

Stress testing has been a crucial tool for financial firms since the early nineties to assess capital shortfall risks in banks. Post-2008 financial crises, central banks in the US and EU embraced stress testing as a regulatory review process. Stress testing involves examining pre-defined scenarios to understand the effects on the banking system or individual banks, such as GDP growth or stock market index changes (Sorge et al., 2006).

Moreover, stress testing is an essential component of macroprudential analysis, observing and foreseeing potential weaknesses in a financial system. A macroeconomic stress test is a model that uses multiple techniques to estimate the risk of exposure of financial institutions to macroeconomic shocks. The test aims to identify extreme events that could affect the banking sector, such as changes in a portfolio's balance sheet, capital adequacy ratio, or income statement. However, the results of stress testing are not always exact or accurate due to quantitative techniques, human judgment, and discretionary assumptions (Qagliariello, 2009).

There are two methods for conducting stress tests on the entire system: the bottom-up approach, where regulatory authorities choose macroeconomic shocks and allow institutions to assess their impact on their balance sheets, and the top-down approach, where regulatory authorities apply the shocks to the banking system portfolio or bank-by-bank data. Both methods help in assessing the overall impact of macroeconomic shocks on the financial system. A bottom-up approach is more comprehensive and meticulous, executed according to the institution's specifications. However, the comparability of test

outcomes is limited. Top-down approaches are easier to compare and interpret due to the central institution's less detailed data (Qagliariello, 2009).

Furthermore, to achieve credible and reliable results, several steps and models must be followed closely. The macroeconomic model must be considered a comprehensive stress test scenario, incorporating satellite models to depict macroeconomic variables to some financial variables. This type of stress testing is common in macro-econometric models, where outputs like stressed GDP and short-term and long-term interest rates are inputs for the credit risk model. By following these steps, the stress test can provide valuable insights into the financial sector and economic systems, ultimately enhancing the accuracy and reliability of the results (Foglia, 2008).

There are three primary methods for constructing a macro-econometric model: the structural econometric model, the vector autoregressive method (VAR), and the pure statistical method. The VAR model, renowned for its flexibility and consistency, finds its application within macro-econometric models for projecting and analyzing macroeconomic variables during stressed conditions. Notably, many central banks worldwide employ the VAR model in stress testing (Foglia, 2008). Both the VAR approach and the structural approach necessitate researchers to transform econometric variables into indicators. These indicators are subsequently utilized for estimating and evaluating the impact of stress on financial institutions. In contrast to the macro-econometric model, which creates credit risk satellite models based on individual borrower data, the VAR and structural approaches utilize measurements like non-performing loan ratios to establish connections between the models. This methodology separates the satellite models into two categories: one focusing on loan performance data and the other on micro-level data (Čihák, 2007).

Banks must meet minimum requirements for risk measurement and capital, identifying key risks, choosing the best risk, and establishing procedures to monitor results. To stay within limits, banks must evaluate the number of losses they can endure, relying on available liquidity from creditors, customers, and regulators. The key risks to identify while assessing risk management are market risk which refers to the variation in asset value caused by interest rates, currency exchange rates, and equity prices, credit risk which is the decrease in asset value caused by poor management and a failure to fulfill obligations, and operational risk which includes the costs of mistakes that occur while applying transactions (Pyle, 1999). Moreover, banks' strategy is to minimize the amount of liquidity they hold (to reduce costs and generate profits from assets) expecting that in times of recession and stress, central banks will help them as lenders of last resort preventing firms from failing and limiting the impact of liquidity shortfalls (Jobst et al., 2013). Therefore, an assessment plan is crucial to identify financial distress risks, including liquidity risks. Banks should maintain sufficient liquidity to meet customer needs and reduce stress during a recession. This is because a recession impacts interest, currency, and liquidity indicators, which can negatively impact a bank's revenues and performance.

2.2 The Impact of Economic Recessions on Banks and Financial Markets

Economic downturns, such as the oil crises (1973 and 1979), the Dot-Com crisis (2000), and the Global Finacial Crisis (2007), have severely impacted the banking sector and financial markets due to fluctuations in economic movements, periods of expansion, and events like banking and financial crises (Loukis et al., 2021).

Economic downturns lead to a reduction in financial resources for banks, affecting their profitability and ability to finance investments and operations. This leads to a decrease in deposits, affecting the bank's ability to lend money and make investments. Additionally, withdrawals increase during crises due to customers' concerns about the banking sector's health and its ability to return savings. Furthermore, a significant increase in non-performing loans was observed during several crises, affecting citizens' salaries and

unemployment, which negatively impacted their ability to repay monthly dues to banks. Banks typically make profits from interest collected from loans, but a shortage in collection can affect their ability to pay interest over deposits. As a result, banks become more cautious and cautious in lending, expecting lower performance from firms, reducing their capacity to repay lenders (Loukis et al., 2021). Thus, economic downturns significantly impact banks' operations and profitability, reducing the number of financial resources available for financing investments and operations (Hajilee et al., 2021). Banks in such conditions become more cautious, lending less due to the expectation of lower performance from their firms.

Furthermore, financial markets, such as stocks, bond markets, forex, and money, play a crucial role in creating resources and providing liquidity for businesses. During a recession, several variables, such as exports, exchange rates, inflation, unemployment, and gross domestic product, do not move in the favorable direction of investors, forcing them to pull off their shares. Additionally, the recession can last up to six months, affecting several economic indicators, including real gross domestic product, high interest rates, inflation, consumer confidence, reduced real wages, and unemployment.

2.3 Background of the Lebanese Banking Sector

Despite several bad macroeconomic conditions, the Lebanese Banking sector managed to surpass these circumstances and continued the evolution that led it to earn a great reputation in the MENA region and worldwide later on (Elia, 2020).

In 2001, banks in Lebanon maintained a capital-to-risk-weighted ratio of 19.2%, maintaining a high assets-to-GDP ratio. They monitored risks and hedging capital against foreign exchange risk. To maintain their position, Lebanese banks modernized their IT systems, expanded branches, and recruited new staff. These moves were part of a plan to increase profitability and reach new clients' services (Banque Du Liban, 2002).

In 2005, Lebanese banks experienced positive profit growth in the year despite Prime Minister Hariri's assassination. They maintained a good spread in foreign liquidity and controlled operating costs. Despite the tragedy, growth in assets, deposits, and loans was less than the previous year. To reduce risk, banks increased liquidity, reinforced capitalization, and diversified into retail, insurance, and capital market services (Banque Du Liban, 2006).

In 2006, Lebanese banks experienced growth despite war effects, thanks to their stable financial standing. They applied a successful non-interest profit plan, diversifying their portfolio. To combat domestic conditions, they expanded to the Levant, Gulf, and North Africa regions, leveraging new demand (Banque Du Liban, 2007).

In 2008, the Lebanese banking sector remained resilient during the 2007 Global Financial Crisis by reducing non-performing loans and maintaining high liquidity levels. This resilience was achieved through maintaining a good capital adequacy ratio, conservative activities, and large offshore savings. These factors contributed to their ability to stay insulated from the crisis (Banque Du Liban, 2009).

In 2014, Lebanese banks maintained decent profitability despite challenges, achieving a 9.3% growth in the housing loan sector. The Central Bank's packages helped boost lending activity, while banks maintained a 14.61% capital adequacy ratio (Blominvest, 2020).

In 2016, once again, and despite the struggle that the global economy was facing with the exit of the UK from the European Union, the Lebanese Banking sector managed to maintain its strength due to the financial engineering operations launched by the Central Bank that succeeded in attracting foreign inflows.

In 2017, despite the challenges Lebanon faced during the presidential election, the bank sector remained the backbone of the economy, despite a slowdown in growth and foreign

conditions affecting their activity. However, the Central Bank's financial engineering operations continued to attract foreign deposits, boosting the dollarization ratio to 71.5 percent in 2017 (Blominvest, 2020).

The Lebanese banking sector, a major supporter of the Lebanese economy, has been funding its sovereign debts using agent deposits. Nevertheless, the bank's lack of investment diversification and reliance on government debt assistance triggered a severe financial crisis, resulting in a weakened state for local banks. Lebanese banks have been investing in Treasury Bills and Eurobonds to help the government deal with rising debt, placing Lebanon in third place for the highest indebted country globally (Elia et al., 2021). To finance the public sector and sovereign debt, banks implemented new interest rates and attracted resident and non-resident capital, which were used to cover the government's failure (Blominvest, 2020). BDL engaged in swaps of sovereign bonds with banks to continue supporting public debt, while domestic banks profited from these swaps by recycling new funds at BDL. Despite the losses, BDL continued to apply its plan, despite the potential losses (Elia et al., 2023).

Thus, the Lebanese banking sector has been a significant contributor to the country's economy, leading the financial system and providing funds to individuals and businesses (ABL, 2021). The Bank of Lebanon (BDL) controls banks, while the Banking Control Commission (BCC) supervises them. The growth in domestic assets was attributed to constant inflows from emigrants who benefited from high-interest rate returns on both local and foreign currency. Furthermore, Lebanese banks have expanded internationally through representative offices, subsidiaries, and branches, following international practices and standards set by the Bank for International Settlement (BIS), the International Monetary Fund (IMF), and other international bodies. They have also been able to meet the world's new banking technologies and trends, such as ATM, Card Services, and Electronic Banking, and have improved traditional activities such as Retail, Brokerage, and Insurance Services. Finally, the Lebanese banking sector has overcome shocks and crises due to its strong growth, balance sheet, high liquidity, good return, and risk measures.

In brief, the Lebanese banking sector has faced many modifications forcing it to change from an extremely competitive environment to a deposit-based one. These transformations have divided banks into categories based on deposits and they are as follows: Alpha banks have more than USD 2 billion in deposits, Beta banks have between USD 2 billion and USD 500 million in deposits, Gamma banks have between USD 500 million and USD 200 million in deposits, and Delta banks have less than USD 200 million in deposits (Blominvest, 2020).

3. Methodology

The research design is explanatory. This type of research helps understand the topic by finding the reasons why such a phenomenon occurs. In this topic discovering the relationship between the deviation of the macroeconomic factors and their effect on a bank’s profitability. It uses secondary information such as articles and determines the causes and the changes that can arise. Saunders et al. (2007) research onion was used to select the research choices as they are as follows: positivism as a philosophy, deduction as an approach, quantitative as a mono method, archival research as a strategy, and longitudinal as a time frame since data was collected for 10 consecutive years.

The population for this study includes all Lebanese Alpha banks. However, this study considered all the Lebanese banks in an attempt to examine the effect of the macroeconomic indicators on the whole banking sector. The Alpha banks are Byblos, Audi, Fransabank, SGBL, Bank of Beirut, Medbank, IBL, Crédit Libanais, BLOM, and BLC.

This research focuses on six variables. Return on Equity (ROE) and Return on Assets (ROA) are the two independent variables measuring banks' profitability and GDP, inflation, unemployment, and interest rate are the four dependent variables.

Return on Equity is calculated by dividing net income by total shareholder's equity. It helps investors assess the market value and growth of banks. ROE shows how efficiently a bank manages the money it receives from shareholders. Also, it's used as an indicator to compare different financial institutions to find the best one to invest in. ***Return on Assets*** is calculated by dividing net income by total assets. It measures the bank's return on investment. ROA measures a bank's efficiency in managing its assets, with a normal value of 5%. A high ROA indicates a decent performance, while a low ROA suggests poor financial planning. Higher ROA indicates sufficient profits from asset use. ROA helps compare financial institutions and determines bank profits and earnings from investments. ROE measures earnings from equities, while ROA measures earnings from assets. ***GDP*** is the Gross Domestic Product and it measures an economy's total production of goods and services, indicating growth in sales and impacting financial institutions' deposits and loans demand. ***Inflation*** is the rate at which prices rise due to outstripping production capacity, causing high prices. Governments aim to balance employment and inflation while stimulating the economy. The ***Unemployment Rate*** represents the percentage of the labor force without employment, rising during economic challenges and downturns. ***Interest Rate*** is used as an indicator of attractiveness for investment opportunities (Anbar & Alper, 2011).

It is crucial to note that some of the bank's specific indicators (Bank size, Capital Adequacy, Asset quality, Deposits, Loan, Liquidity, Loan(y to y), Deposits (y to y), and Assets (y to y)) were tested; however, there was multicollinearity between them and total non-significant relationship with the banks' profitability ratios. **Asset Size** is influenced by total assets, impacting profitability and revenue (Smirlock, 1985). **Capital Adequacy** is the equity to total assets ratio that measures capital strength, indicating a bank's ability to absorb losses, increase revenue, and reduce external funding requirements, indicating better performance (Berger, 1995; Bourke, 1989; Hassan & Bashir, 2003). **Asset Quality** is the loans to total assets ratio that measures bank revenue, affecting profitability unless the risk is unacceptable (Erol et al., 2014). **Deposits** impact a bank's profitability positively, as more banks can convert them into loans and generate profits. **Loans** affect bank profitability which is measured by dividing total loans by assets, with loan interest rates and liquidity impacting net income (Demirgüç-Kunt & Huizinga, 1999). **Liquidity** shows the solvency of the bank. **Income-Expenditure Structure** such as Net Interest Margin (NIM) measures the difference between income from credit products and interest paid for savings account holders. It helps investors assess a bank's performance, indicating a positive NIM, indicating sufficient credit revenue to cover saving account interest expenses (Anbar & Alper, 2011).

The Lebanese macroeconomic indicators were collected from the World Bank from 2009 to 2018 and then projected till 2030 using the interpolation method to create scenarios and apply the stress test. Also, Alpha Banks' financial statements were collected from their official websites. Moreover, the consolidated financial statements were collected from the website of the Association of Banks in Lebanon. Data analysis was done using EViews descriptive inferential statistics (multicollinearity test and multi-regression analysis).

The study respected the ethical bases of scientific research including objectivism, nonbiased, honesty, integrity, and confidentiality.

4. Findings and Discussion

4.1 Multiple Regression Models for Byblos Bank

This test examines macroeconomic factors on Byblos Bank's ROE and ROA from 2009-2018. For this purpose, two Multiple Regression models are used as per the following formulas:

- $ROE\ (Byblos) = \beta_0 + \beta_1\ GDP + \beta_2\ Inflation + \beta_3\ Interest\ rate + \beta_4\ Unemployment + e$
- $ROA\ (Byblos) = \beta_0 + \beta_1\ GDP + \beta_2\ Inflation + \beta_3\ Interest\ rate + \beta_4\ Unemployment + e$

Before proceeding with the development of the multiple regression models, it is important to verify the normal distribution of all the used series. Consequently, the Jarque-Bera test is run individually on all the variables using EViews. Table 1 shows that Jarque-Bera probability values are above 5%, indicating normal distribution for all series in the data.

Table 1: Probability Values of Byblos Bank Jarque-Bera

	ROE	**ROA**	**GDP**	**INFLATION**	**INTEREST**	**UNEMPLOYMENT**
Mean	9.922366	0.908234	2.855298	2.927300	4.235140	6.351300
Median	9.798118	0.883407	1.995441	4.152416	4.522214	6.376500
Maximum	11.23552	1.162036	10.23216	6.581474	7.713430	6.452000
Minimum	8.545240	0.656255	-1.926405	-3.749145	-0.649418	6.143000
Std. Dev.	0.918505	0.163875	3.672424	3.276048	2.915043	0.099946
Skewness	0.053050	0.106543	0.923108	-0.852306	-0.541289	-1.028542
Kurtosis	1.643871	1.838392	2.888579	2.678320	2.208519	2.897838
Jarque-Bera	0.770976	0.581141	1.425387	1.253824	0.749341	1.767514
Probability	0.680119	0.747837	0.490322	0.534239	0.687516	0.413228
Sum	99.22366	9.082340	28.55298	29.27300	42.35140	63.51300
Sum Sq. Dev.	7.592859	0.241694	121.3803	96.59242	76.47728	0.089902
Observations	10	10	10	10	10	10

The multicollinearity of independent variables in the model was tested using the Variance Inflation Factors test (VIF) (Table 2). The outcomes reveal that the centered Variance Inflation Factors hover around 1, affirming the absence of correlation among the four macroeconomic factors incorporated in the model.

Table 2: Byblos Bank Variable and Centered VIF

	Centered
Variable	**VIF**
C	NA
GDP	1.357130
INFLATION	1.032828
INTEREST	1.073190

UNEMPLOY	1.301515

Table 3 shows the results of the regression with ROE as a dependent variable, using the Least Squares Method for the period 2009 – 2018. R-squared is 0.699350 which means that about 69.94% of the variability in the dependent variable is explained by the independent variables in the model. The significance of these relationships is limited based on the t-statistic probability values for each variable (>0.05). The F-statistic is 2.907661, and its associated p-value is 0.136216 which is relatively high (> 0.05); thus, the overall model's significance is limited. The result of the autocorrelation model shows a value equal to 2.238955 which is greater than 2%. This means that there is a negative autocorrelation between independent variables and dependent variables.

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-14.81711	16.21107	-0.914011	0.4026
GDP	0.135657	0.071447	1.898702	0.1161
INFLATION	0.015437	0.069870	0.220943	0.8339
INTEREST	-0.016438	0.080042	-0.205361	0.8454
UNEMPLOY	3.838042	2.570916	1.492870	0.1957
R-squared	0.699350	**Mean dependent var**		9.922366
Adjusted R-squared	0.458830			
F-statistic	2.907661	**Durbin-Watson stat**		2.238955
Prob(F-statistic)	0.136216			

Table 3: Regression of Byblos Bank ROE

Table 4 shows the results of the regression with ROA as a dependent variable, using the Least Squares Method for the period 2009 – 2018. R-squared is 0.748795 which indicates that about 74.88% of the variability in the dependent variable is explained by the independent variables in the model. The F-statistic is 3.726009, and its p-value is 0.090835 which is relatively high (>0.05); thus, the overall model's significance is limited. This indicates that this model is not appropriate for predicting ROA. The result of the autocorrelation model shows a value equal to 1.580629 which is less than 2%. This means that there is a positive autocorrelation between independent variables and dependent variables.

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-4.215711	2.643784	-1.594575	0.1717
GDP	0.023279	0.011652	1.997848	0.1022
INFLATION	0.007475	0.011395	0.656011	0.5408
INTEREST	0.001947	0.013054	0.149115	0.8873
UNEMPLOY	0.791547	0.419278	1.887881	0.1177
R-squared	0.748795	**Mean dependent var**		0.908234
Adjusted R-squared	0.547830			
F-statistic	3.726009	**Durbin-Watson stat**		1.580629
Prob(F-statistic)	0.090835			

Table 4: Regression of Byblos Bank ROA

4.2 Multiple Regression Models for Lebanese Alpha Banks

The purpose of this test is to study the impact of the selected macroeconomic factors, on average ROE and average ROA of Lebanese Alpha banks. The data covers the period from 2009 to 2018. For this purpose, two Multiple Regression models are used as per the following formulas:

- ROE (Leb Alpha Banks) = β_0 + β_1 GDP + β_2 Inflation + β_3 Interest rate + β_4 Unemployment + e
- ROA (Leb Alpha Banks) = β_0 + β_1 GDP + β_2 Inflation + β_3 Interest rate + β_4 Unemployment + e

l
important to verify the normal distribution of all the used series. Consequently, the Jarque-Bera test is run individually on all the variables using EViews. Table 5 shows that Jarque-Bera probability values are above 5%, indicating normal distribution for all series in the data.

	ROE	**ROA**	**GDP**	**INFLATION**	**INTEREST**	**UNEMPLOYMENT**
Mean	11.74086	1.021077	2.855298	4.235140	2.927300	6.351300
Median	11.33707	1.008360	1.995441	4.522213	4.152416	6.376500
Maximum	13.66536	1.215641	10.23216	7.713429	6.581474	6.452000
Minimum	10.32965	0.879206	-1.926405	-0.649418	-3.749145	6.143000
Std. Dev.	1.016726	0.087182	3.672424	2.915043	3.276048	0.099946
Skewness	0.564082	0.784829	0.923108	-0.541289	-0.852306	-1.028544
Kurtosis	2.329235	3.975726	2.888579	2.208519	2.678320	2.897842
Jarque-Bera	0.717784	1.423279	1.425387	0.749341	1.253824	1.767519
Probability	0.698450	0.490839	0.490322	0.687516	0.534239	0.413227
Sum	117.4086	10.21077	28.55298	42.35140	29.27300	63.51300
Sum Sq. Dev.	9.303580	0.068406	121.3803	76.47728	96.59241	0.089902
Observations	10	10	10	10	10	10

Table 5: Probability Value of Lebanese Alpha Banks Jarque-Bera

The multicollinearity of independent variables in the model was tested using the Variance Inflation Factors test (VIF) (Table 6). The outcomes reveal that the centered Variance Inflation Factors hover around 1, affirming the absence of correlation among the four macroeconomic factors incorporated in the model.

	Centered
Variable	**VIF**
C	NA
GDP	1.357130
INFLATION	1.032828

INTEREST	1.073190
UNEMPLOY	1.301515

Table 6: Lebanese Alpha Banks Variable and Centered VIF

The results of the regression with ROE as a dependent variable, using the Least Squares Method for the period 2009 – 2018 are shown in Table 7. R-squared is 0.655582 which indicates that about 65.56% of the variability in the dependent variable is explained by the independent variables in the model. The significance of these relationships is limited based on the t-statistic probability values for each variable (>0.05). The F-statistic is 2.379311, and its associated probability value is 0.183716. Since the p-value is relatively high (> 0.05), the overall model's significance is limited. This means that the GDP growth rate, inflation rate, real interest rate, and unemployment are jointly insignificant in explaining the average ROE of Lebanese Alpha banks. The result of the autocorrelation model shows a value equal to 1.401230 which is less than 2%. This means that there is a positive autocorrelation between independent variables and dependent variables.

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-19.60462	19.20642	-1.020732	0.3542
GDP	0.120301	0.084649	1.421180	0.2145
INFLATION	0.025618	0.094832	0.270144	0.7978
INTEREST	0.086650	0.082780	1.046749	0.3432
UNEMPLOYMENT	4.824184	3.045949	1.583803	0.1741
R-squared	0.655582	**Mean dependent var**		11.74086
Adjusted R-squared	0.380048			
F-statistic	2.379311	**Durbin-Watson stat**		1.401230
Prob(F-statistic)	0.183716			

Table 7: Regression of Lebanese Alpha Banks ROE

The results of the regression with ROA as a dependent variable, using the Least Squares Method for the period 2009 – 2018 with included observations of 10 are shown in Table 8.

R-squared is 0.677937 which indicates that about 67.79% of the variability in the dependent variable is explained by the independent variables in the model. The significance of these relationships is limited based on the t-statistic probability values for each variable (>0.05). The F-statistic is 2.631223, and its associated probability value is 0.158631. Since the p-value is relatively high (>0.05), the overall model's significance is limited This indicates that the GDP growth rate, inflation rate, real interest rate, and unemployment rate are jointly insignificant in explaining the average ROA of Lebanese Alpha banks and this model is not appropriate in predicting the average ROA. The result of the autocorrelation model shows a value equal to 1.792883 which is less than 2%. This means that there is a positive autocorrelation between independent variables and dependent variables.

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-0.262209	1.592564	-0.164646	0.8757
GDP	0.016744	0.007019	2.385500	0.0627
INFLATION	0.007540	0.007863	0.958874	0.3817

INTEREST	0.003370	0.006864	0.491031	0.6442
UNEMPLOYMENT	0.187942	0.252565	0.744135	0.4903
R-squared	0.677937	**Mean dependent var**		1.021077
Adjusted R-squared	0.420286			
F-statistic	2.631223	**Durbin-Watson stat**		1.792883
Prob(F-statistic)	0.158631			

Table 8: Regression of Lebanese Alpha Banks ROA

4.3 Multiple Regression Models for Lebanese ABL Banks

The objective of this test is to determine the effect of the selected macroeconomic factors, on average ROE and average ROA of ABL. The data covers the period from 2009 to 2018. For this purpose, two Multiple Regression models are used as per the following

- $ROE\ (ABL) = \beta_0 + \beta_1\ GDP + \beta_2\ Inflation + \beta_3\ Interest\ rate + \beta_4\ Unemployment + e$
- $ROA\ (ABL) = \beta_0 + \beta_1\ GDP + \beta_2\ Inflation + \beta_3\ Interest\ rate + \beta_4\ Unemployment + e$

Before proceeding with the development of the multiple regression models, it is important to verify the normal distribution of all the used series. Consequently, the Jarque-Bera test is run individually on all the variables using EViews. Table 9 shows that Jarque-Bera probability values are above 5%, indicating normal distribution for all series in the data.

	ROE	**ROA**	**GDP**	**INFLATION**	**INTEREST**	**UNEMPLOYMENT**
Mean	0.111877	0.009257	2.855298	4.235140	2.927300	6.351300
Median	0.113377	0.009963	1.995441	4.522213	4.152416	6.376500
Maximum	0.178045	0.012734	10.23216	7.713429	6.581474	6.452000
Minimum	0.000000	0.000000	-1.926405	-0.649418	-3.749145	6.143000
Std. Dev.	0.045135	0.003418	3.672424	2.915043	3.276048	0.099946
Skewness	-1.362520	-2.172790	0.923108	-0.541289	-0.852306	-1.028544
Kurtosis	5.270859	6.786294	2.888579	2.208519	2.678320	2.897842
Jarque-Bera	5.242767	13.84170	1.425387	0.749341	1.253824	1.767519
Probability	0.072702	0.090987	0.490322	0.687516	0.534239	0.413227
Sum	1.118775	0.092571	28.55298	42.35140	29.27300	63.51300
Sum Sq. Dev.	0.018335	0.000105	121.3803	76.47728	96.59241	0.089902
Observations	10	10	10	10	10	10

Table 9: Probability Value of ABL Jarque-Bera

The multicollinearity of independent variables in the model was tested using the Variance Inflation Factors test (VIF) (Table 10). The outcomes reveal that the centered Variance Inflation Factors hover around 1, affirming the absence of correlation among the four macroeconomic factors incorporated in the model.

	Centered
Variable	**VIF**
C	NA
GDP	1.357130
INFLATION	1.032828
INTEREST	1.073190
UNEMPLOY	1.301515

Table 10: ABL Variable and Centered VIF

Table 11 shows the results of the regression with ROE as a dependent variable, using the Least Squares Method for the period 2009 – 2018. R-squared is 0.711999 which indicates that 71.20% of the variability in the dependent variable is explained by the independent variables in the model. The F-statistic is 3.090257, and its p-value is 0.123746 which is relatively high (>0.05); thus, the overall model's significance is limited. This indicates that the GDP growth rate, inflation rate, real interest rate, and unemployment are jointly insignificant in explaining the average ROE of ABL. The result of the autocorrelation model shows a value equal to 2.684475 which is more than 2%. This means that there is a negative autocorrelation between independent variables and dependent variables.

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-1.094784	0.779678	-1.404149	0.2192
GDP	-0.005342	0.003436	-1.554733	0.1807
INFLATION	0.009146	0.003850	2.375891	0.0635
INTEREST	0.005437	0.003360	1.617908	0.1666
UNEMPLOYMENT	0.183784	0.123649	1.486330	0.1973
R-squared	0.711999	Mean dependent var		0.111877
Adjusted R-squared	0.481598			
F-statistic	3.090257	Durbin-Watson stat		2.684475
Prob(F-statistic)	0.123746			

Table 11: Regression of ABL ROE

Table 12 shows the results of the regression with ROA as a dependent variable, using the Least Squares Method for the period 2009 – 2018. R-squared is 0.783958 which indicates that about 78.40% of the variability in the dependent variable is explained by the independent variables in the model. The p-value of the t-statistics the inflation rate is 0.04, and the t-statistics the GDP growth rate is 0.0576 meaning that the inflation rate and the GDP growth rate are individually significant in explaining the average ROA of ABL. The F-statistic is 4.535908, and its p-value is 0.064213 which is relatively high (>0.05); thus, the overall model's significance is limited. This means that the GDP growth rate, inflation rate, real interest rate, and unemployment rate are jointly insignificant in explaining the average ROA of ABL and this model is not appropriate in predicting the average ROA. The result of the autocorrelation model shows a value equal to 3.137344 which is more than 2%. This means that there is a negative autocorrelation between independent variables and dependent variables.

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
C	-0.088982	0.051143	-1.739857	0.1424
GDP	-0.000553	0.000225	-2.454339	0.0576
INFLATION	0.000667	0.000253	2.641980	0.0459
INTEREST	0.000312	0.000220	1.413905	0.2165
UNEMPLOYMENT	0.015128	0.008111	1.865133	0.1212
R-squared	0.783958	**Mean dependent var**		0.009257
Adjusted R-squared	0.611124			
F-statistic	4.535908	**Durbin-Watson stat**		3.137344
Prob(F-statistic)	0.064213			

Table 1: Regression of ABL ROA

4.4 Descriptive Analysis GDP and Growth of Loans

The figure below shows the relationship between the growth of GDP and the growth of loans. From 2009 to 2011, the growth of GDP in Lebanon experienced a decline from 10.23 in 2009 to 0.86 in 2011, affecting the growth of loans of Lebanese banks. Byblos Bank experienced a 27.07-point decrease. Alpha Banks experienced a 6.6-point decrease, and ABL Banks experienced a 0.082-point decrease. From 2011 to 2015, GDP growth experienced ups and downs, with Byblos Bank experiencing a 12.11 point decrease from 2011 to 2012, followed by a 3.98 point increase from 2012 to 2013, and a 12.65 point decrease from 2013 to 2015. Alpha Banks experienced a 34.83-point decrease from 2011 to 2014, while ABL Banks experienced a 0.004-point increase from 2011 to 2012. From 2015 to 2016, GDP growth experienced a 1.3 point increase, with Byblos Bank experiencing a 3.7 point increase, Alpha Banks experiencing a 3.18 point decrease, and ABL Banks experiencing a 0.007 point decrease. From 2016-2018: GDP growth fell from 1.52 in 2016 to -1.92 in 2018, affecting the growth of Lebanese banks. Byblos Bank experienced a 12.64-point decrease, Alpha Banks experienced a 3.62-point decrease, and ABL Banks experienced a 1.9-point decrease.

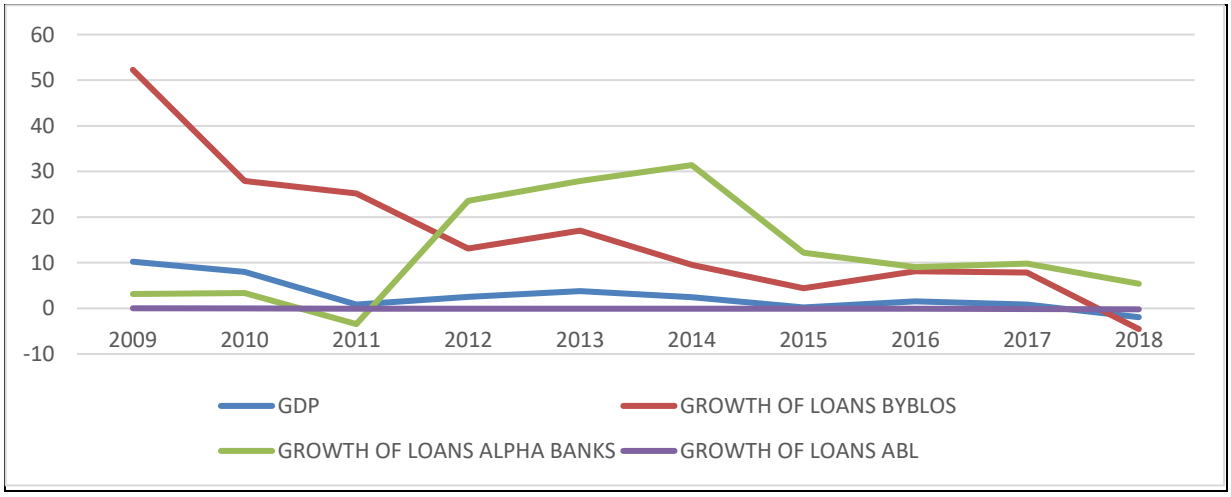

Figure 1: The Relationship between the Growth of GDP and the Growth of Loans

4.5 Stress Test Scenarios

After applying the multiple regression model in three different ways (one alpha bank represented by Byblos bank, ten alpha banks, and all the banking sector (ABL), it indicated that two macroeconomic indicators (GDP, and Inflation) have a significant

relationship with the return on assets of the ABL. To validate the results, stress test scenarios will be applied to confirm this connection. The tests will be conducted in three different situations (Bruinsma et al., 2003):

1. **Baseline scenario**: an economic expansion that falls into average projections of possible economic outcomes using forecasts that follow the changes that occurred during past years.

2. **Plausible scenario:** good conditions that may positively affect the economy.

3. **Severely adverse scenario**: a sharp economic downturn in which the economy inclines rapidly into recession.

This is a theoretical scenario designed to assess the strength and resilience of banking organizations and does not represent a forecast (The Fed, 2021).

4.5.1 Baseline Scenario

YEAR	ROA	Inflation	GDP
2019	0.008708	3.759172	-1.46987
2020	0.008392	3.906338	-1.67258
2021	0.008077	4.053504	-1.87529
2022	0.007761	4.20067	-2.078
2023	0.007446	4.347836	-2.28071
2024	0.00713	4.495002	-2.48342
2025	0.006815	4.642168	-2.68613
2026	0.006499	4.789333	-2.88884
2027	0.006184	4.936499	-3.09155
2028	0.005868	5.083665	-3.29426
2029	0.005553	5.230831	-3.49697
2030	0.005237	5.377997	-3.69968

	Min	**Max**	**Average**
Inflation	3.759172	5.377997	4.568585
GDP	-3.69968	-1.46987	-2.58478
ROA	0.005237	0.008708	0.006972

Table 13: Interpolated Macroeconomic Lebanese Data

Based on the results, the relationship between these two macroeconomic indicators and ABL's return on assets has been verified.

4.5.2 Plausible Scenario

This test presents good conditions that might occur to the economy. These deviations can be predicted or removed from historical data to assess the effects of a sudden rise in GDP and a decrease in inflation. In the below test, the maximum GDP growth (10.23216) and the minimum inflation (-3.74915) will be calculated using old data (from 2000 to 2018 World Bank) to evaluate the return on assets under such macroeconomic conditions.

YEAR	Inflation	GDP
2000	-0.36	1.342
2001	-0.37	3.84
2002	1.76	3.423
2003	1.27	3.227
2004	1.67	6.679
2005	-1.43	2.686
2006	4.09	1.55
2007	4.06	9.311
2008	10.7	9.069
2009	1.195097	10.232
2010	3.983479	7.975
2011	4.971486	0.867
2012	6.581474	2.541
2013	4.82102	3.811
2014	1.854604	2.461
2015	-3.74915	0.211612
2016	-0.78336	1.52952
2017	4.321352	0.8507
2018	6.076989	-1.9264

	Min	**Max**	**Average**
Inflation	-3.74915	10.7	2.6664735
GDP	-3.69968	10.23216	3.66736762

Table 14: Macroeconomic Lebanese Data

Based on the results, the relationship between these two macroeconomic indicators and ABL's return on assets has been verified.

4.5.3 Severely Adverse Scenario

From its name, a severely adverse scenario attempts to put the economy under extreme negative shocks. It represents the evolution of the sector under theoretical adverse conditions underlying the appearance of risks to which the banking system is exposed (Publications Published, 2020). To apply the above test, the researcher will benefit from 2020 numbers which provide a perfect severe adverse scenario for the test to be applied. During this year, Lebanon faced severe macroeconomic conditions which had a negative impact on all of its sectors. Extracted from the World Bank data site, numbers show a severe drop in the GDP growth (-20.3) in other words (3.67%) negative change compared to 2019 and an increase in the country's inflation rate (84.864), a (27.24%) change paralleling it to 2019.

Based on the results, the relationship between these two macroeconomic indicators and ABL's return on assets has been verified.

5. Conclusion

To answer the question of how vulnerable are the Lebanese Alpha banks through macroeconomic downturns and stress testing, this study collected financial and economic data for ten Lebanese Alpha banks and all the Lebanese banking sectors presented by ABL. After applying the multiple regression models to banks' data, the study found a significant relationship between the ABL data bank's ROA and both GDP and inflation and excluded the influence on the ROE. Also, it eliminated the influence of macroeconomic factors on the ten Lebanese alpha bank's ROA and ROE. One of the reasons for this was that bank data were collected for a short period compared to the pooled data of ABL which contained the data of all the Lebanese banks from 2009 to 2018. This made it easier to notice the influence of these factors on a bank's profitability.

Further, the relationship between the growth of GDP and the growth of loans revealed the importance of having protection for banks' capital facing the fluctuations of GDP. The findings showed that for some time when the growth of the GDP of Lebanon was low, banks faced a severe drop in their growth of loans (during the years 2014 and 2015 when 19.2 percentage points shocked the 10 Lebanese Alpha banks). For that reason and according to Basel, banks should consider adding a capital conservation buffer to their capital as a cushion in front of credit risks which is one of the most affecting elements of the capital.

The significance between ABL data and both GDP and inflation was also reflected and reassured using the stress test by applying three different scenarios which revealed results affected by the severity and the state of the situations. When a baseline scenario is applied, results showed a slight difference in ABL return on assets, or when a plausible scenario is used, results showed a slight positive ROA indicating that in good conditions (high GDP and low inflation) banks can profit from a good return on assets, however, at a bad one (high inflation and low GDP (here 2020 Lebanese data were used as a perfect scenario to be applied in such situation) banks faced a decrease in ROA indicating that banks facing bad macroeconomic conditions will face a drop in their return on assets.

Limitations

Data was collected for ten years only which might have distorted the results. Also, due to the recent financial crisis that has stunned the country, 2019 and 2020 GDP and inflation numbers weren't added to the stress test analysis the reason that they could distorter the forecasted data used for the creation of scenarios.

Areas of Further Research

Based on the limitations of the study, it is recommended to apply the multiple regression model on wider years of data for both Alpha Banks and ABL to verify that the same findings are still applicable or the time frame may play a role in determining the vulnerability of the Lebanese alpha banks returns through macroeconomics factors. Results may show not only a relationship between GDP and inflation factors with bank return, but it can also show a connection with all the macroeconomic conditions noting that the history of Lebanese banks shows a link with the political and economic conditions of the country pointing to the role of these circumstances in shaping not only the banking sector but the whole country overall.

References

Anbar, A., & Alper, D. (2011). Bank specific and macroeconomic determinants of commercial bank profitability: Empirical evidence from Turkey. Business and economics research journal, 2(2), 139-152.

Babouček, I., & Jančar, M. (2005). Effects of macroeconomic shocks to the quality of the aggregate loan portfolio (Vol. 22). Praha, Czech: Czech National Bank.

Bailey, A. J., Bridges, J., Harrison, R., Jones, J., & Mankodi, A. (2020). The central bank balance sheet as a policy tool: past, present and future.

Banque du liban. (n.d.). Retrieved May 2023, from https://www.bdl.gov.lb/pages/index/9/154/Official-Banking-Holidays.html

Basel Committee on Banking Supervision (Ed.). (2013). Liquidity stress testing: A survey of theory, empirics, and current industry and supervisory practices. Bank for Internat. Settlements.

Berger, A. N. (1995). The profit-structure relationship in banking--tests of market-power and efficient-structure hypotheses. Journal of money, credit and banking, 27(2), 404-431.

BLOM Bank Publishes Its Financial Results For the Year 2020—BLOMINVEST. (n.d.). Retrieved March 2023, from https://blog.blominvestbank.com/39450/blom-bank-publishes-its-financial-results-for-year-2020/

Bourke, P. (1989). Concentration and other determinants of bank profitability in Europe, North America and Australia. Journal of Banking & Finance, 13(1), 65-79.

Bruinsma, R. F., Gelbart, W. M., Reguera, D., Rudnick, J., & Zandi, R. (2003). Viral self-assembly as a thermodynamic process. Physical review letters, 90(24), 248101.

Čihák, M. (2007). Introduction to applied stress testing.

Demirgüç-Kunt, A., & Huizinga, H. (1999). Determinants of commercial bank interest margins and profitability: some international evidence. The World Bank Economic Review, 13(2), 379-408.

Dendooven, M. (2017). Bank stress tests and stock market performance. Unpublished Master's Dissertation submitted to Universiteit Gent in partial fulfilment of the requirements for the award of Master of Science in Business Engineering Degree.

Dent, K., Westwood, B., & Segoviano Basurto, M. (2016). Stress testing of banks: an introduction. Bank of England Quarterly Bulletin, Q3.

Elia, J. Y. (2020). Lebanese banks: a factor of the current Lebanese financial crisis (2019–2020).

Elia, J., Al Maalouf, N. J., & Sawaya, C. (2023). Bridging Turmoil and Transformation: A Comprehensive Review of the Lebanese Banking Sector from 2000 to 2018. International Journal of Membrane Science and Technology, 10(3), 754-774.

Elia, J., Toros, E., Sawaya, C., & Balouza, M. (2021). Using Altman Z"-Score to Predict Financial Distress: Evidence from Lebanese Alpha Banks. Management Studies and Economic Systems, 6(1/2), 47-57.

Erol, C., F. Baklaci, H., Aydoğan, B., & Tunç, G. (2014). Performance comparison of Islamic (participation) banks and commercial banks in Turkish banking sector. EuroMed Journal of Business, 9(2), 114-128.

Foglia, A. (2008). Stress testing credit risk: a survey of authorities' approaches. Bank of Italy occasional paper, (37).

Hajilee, M., Stringer, D. Y., & Hayes, L. A. (2021). On the link between the shadow economy and stock market development: An asymmetry analysis. The Quarterly Review of Economics and Finance, 80, 303-316.

Hassan, M. K., & Bashir, A. H. M. (2003, December). Determinants of Islamic banking profitability. In 10th ERF annual conference, Morocco (Vol. 7, pp. 2-31).

Hoggarth, G., Sorensen, S., & Zicchino, L. (2005). Stress tests of UK banks using a VAR approach.

Holzmann, R., & Restoy, F. (Eds.). (2022). Central Banks and Supervisory Architecture in Europe: Lessons from Crises in the 21st Century. Edward Elgar Publishing.

Jobst, M. A. A., Ong, M. L. L., & Schmieder, M. C. (2013). A framework for macroprudential bank solvency stress testing: Application to S-25 and other G-20 country FSAPs. International Monetary Fund.

Lincoln, E. J., & Friedman, B. M. (1998). Japan's financial problems. Brookings Papers on Economic Activity, 1998(2), 347-385.

Loukis, E., Arvanitis, S., & Myrtidis, D. (2021). ICT-related behavior of Greek Banks in the Economic Crisis. Information Systems Management, 38(1), 79-91.

Onder, S., Damar, B., & Hekimoglu, A. A. (2016). Macro stress testing and an application on Turkish banking sector. Procedia Economics and Finance, 38, 17-37.

Petrella, G., & Resti, A. (2013). Supervisors as information producers: Do stress tests reduce bank opaqueness?. Journal of Banking & Finance, 37(12), 5406-5420.

Pyle, D. H. (1999, August). Bank risk management: theory. In Risk Management and Regulation in Banking: Proceedings of the International Conference on Risk Management and Regulation in Banking (1997) (pp. 7-14). Boston, MA: Springer US.

Quagliariello, M. (Ed.). (2009). Stress-testing the banking system: methodologies and applications. Cambridge University Press.

Saunders, M., Lewis, P. H. I. L. I. P., & Thornhill, A. D. R. I. A. N. (2007). Research methods. Business Students 4th edition Pearson Education Limited, England, 6(3), 1-268.

Schuermann, T. (2014). Stress testing banks. International Journal of Forecasting, 30(3), 717-728.

Smirlock, M. (1985). Evidence on the (non) relationship between concentration and profitability in banking. Journal of money, credit and Banking, 17(1), 69-83.

Sorge, M., & Virolainen, K. (2006). A comparative analysis of macro stress-testing methodologies with application to Finland. Journal of financial stability, 2(2), 113-151.

Tabak, B. M., Fazio, D. M., & Cajueiro, D. O. (2012). The relationship between banking market competition and risk-taking: Do size and capitalization matter?. Journal of Banking & Finance, 36(12), 3366-3381.

Taskinsoy, J. (2019). Stress Testing Made Easy: No More US Banks Stumbling and Facing Public Embarrassment Due to the Federal Reserve's Qualitative Objection. Available at SSRN 3354018.

The Fed—Comprehensive Capital Analysis and Review 2020 Summary Instructions—March 2020. (n.d.). Board of Governors of the Federal Reserve System. Retrieved April 18, 2023, from https://www.federalreserve.gov/publications/comprehensive-capital-analysis-and-review-summary-instructions-2020.htm

Tvalodze, S., Mkhatrishvili, S., Mdivnishvili, T., Tutberidze, D., & Zedginidze, Z. (2016). National Bank of Georgia. The National Bank of Georgia's Forecasting and Policy Analysis System.

Vukovic, R. K., Fuchs, L. S., Geary, D. C., Jordan, N. C., Gersten, R., & Siegler, R. S. (2014). Sources of individual differences in children's understanding of fractions. Child development, 85(4), 1461-1476.