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Analysis of the main factors in the resilience of the banking system: a multiple case study

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Abstract :
Crises are distressing and critical moments in all contexts, but when it comes to crises affecting the banking system, which is considered the engine of any country's economy, several risks, whether internal or external, can emerge and spread throughout the global banking system. The 2008 crisis is an emblematic example. After this financial distress, all decision-makers were convinced that resilience measures are an absolute priority to reduce fragility and strengthen the solidity of the system in order to face the most challenging scenarios. This study adopts a qualitative inductive approach, analyzing multiple case studies to investigate the factors influencing banking sector resilience. The study leverages data from stress tests conducted by regulatory bodies such as the Federal Reserve, the Bank of Canada, and Bank Al Maghrib. Despite improvements in capital ratios exceeding Basel III expectations, persistent weaknesses remain, particularly evident in the United States, where stress tests failed to prevent widespread bank failures. This study highlights the importance of regulatory measures, stress testing, and effective supervision in bolstering banking sector resilience against economic and financial shocks. By understanding the lessons gleaned from global case studies, policymakers and stakeholders can implement proactive measures to fortify the resilience of banking systems worldwide.

Keywords: Banking crisis, Fragility, Resilience

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Introduction

There's no capitalism without financial crises (Kindleberger, 2000). Banking crises are a form of those crises. Each crisis is specific, because each occurred in a different context and involved a series of general mechanisms.

A banking crisis is a situation in which significant signs of weakness in the banking system or in banks' balance sheets are interpreted by a sharp deterioration in the value of the assets they hold and/or a sudden drying-up of their sources of financing, whether deposits or market resources. This implies a significant increase in the number of financial institutions in the event of failure, and a sharp contraction in the supply of credit "credit crunch", which can lead to widespread paralysis of the economic system (Laeven & Valencia, 2012).

These banking crises are an "eternal restart" in economic history, which proves just how difficult they are to prevent, as they change form as economic and financial systems evolve, and as they take into account the diversity of causes and consequences, the countries of origin of the crisis, the economic and institutional context, as well as the economic policies put in place to cushion them, their frequency of contagion in other financial systems, and their degree of transmission to the real economy. Additionally, banking crises are generally associated with massive government intervention to manage illiquid assets and maintain access to liquidity (Laeven& Valencia, 2008).

The ability of financial intermediaries to finance the economy is questioned, and the consequences of these banking crises are particularly strong recessionary economic dynamics. As a result, the costs these crises impose on the real economy are higher than the traditional recessions resulting from the downward phase of the economic cycle, and in particular the currency, stock market and sovereign debt crises.

The scale of the serious consequences of banking crises can be explained by their systemic nature, since they often result in the overall stability of the financial system, due to the sharp fall in asset prices, both financial and real estate, and in the supply of financing and production, that banking crises generate compared with other forms of financial crisis, this article focuses on the study of bank resilience as a means of containing banking crises and building a resilient financial system.

There are underlying patterns that explain the causes and consequences of banking crises, despite the great diversity of such crises (Minsky& al., 1992; Kindleberger, 2000). When a banking crisis approaches, it is characterized by a significant increase in credit supply, with an overall increase in private and public debt levels, a significant rise in asset prices, all in a euphoric context of speculation driven by investors seeking higher returns and taking on more risks. These crises are also characterized by a global contraction of liquidity in the financial system, especially in the credit offers provided by financial intermediaries, with a sharp rise in interest rates. Then, there is a decrease in investments and consumption, along with an increase in unemployment, leading to a degradation of overall demand and, in turn, economic activity. Finally, there is massive intervention by the government in financial institutions experiencing difficulties to cushion the impact of the banking system's failure on the real economy.

To clarify the purpose of this article, we will pose a crucial question: What factors contribute to the resilience of the banking system in the face of crises that lead to its fragility? Furthermore, another pertinent question that we may ask: What factors induce this fragility in the first place?

I. Crises, bank fragility and resilience: a literature review

First of all, the resilience of a banking system is defined as *a combination of both (i) its ability to absorb shocks without relying on extraordinary government support and (ii) its ability to perform its essential economic functions and thereby contribute to the broader economy's productivity and growth. As stated before, economic functions include the extension of credit, maturity and liquidity transformation, risk management services, payment and transaction services, and money creation.*[1]

Moreover the distinctions between bank collapse and bank default are covered by Fitch (2013). According to the report, a bank fails if it defaults or has defaulted without receiving exceptional support. According to their estimates, the failure rate is six times higher than the default rate between 1990 and 2012.Banking crises have plagued the world for centuries, and the repercussions of these crises have been felt far and wide. Some of the most significant crises to date occurred during the last quarter of the 19th century, In this article, we will take a closer look at two of them.

In May 1873, the world saw a stock market crash that had severe consequences for the global economy. This event is now known as the "Great Depression," which resulted in an economic slowdown. The reason behind this crisis was that around 100 banks that had lent money to real estate investors who used overvalued real estate as collateral, failed. The stock market crash happened on May 9th, which was just eight days after the opening of the Universal Exhibition, which aimed to showcase the Austro-Hungarian Empire's architectural and urban-planning achievements. The rise in speculation caused real estate prices to skyrocket within a few months. Moreover, some of the major banks such as KreditAnstalt, Bankverein Boden KreditAnstalt, and Anglo-Bank collapsed during the financial crisis. On the other hand, Jay Cooke & Co, an investment bank, was severely impacted by the decline in stock and bond prices of Northern Pacific Railway, leading to the closure of Wall Street for ten days. This panic caused the bankruptcy of 57 financial companies. The global economic crisis, characterized by deflation and sluggish growth, lasted for nearly fifteen years.

The Union Générale Bank's bankruptcy in 1882-1884 marked a significant crisis that shook the French banking landscape and had global repercussions. This event triggered a severe economic and stock market crisis that spread across Europe and the United States, marking the first global systemic crisis in France. It was a harbinger of the subprime mortgage market crisis that later followed the collapse of Lehmann Brothers Bank. The Union Générale Bank had indulged in fraudulent practices, such as falsified balance sheets and manipulated capital increases, which were overlooked due to the support it received from financial newspapers owned by its shareholders. The bank's stock plummeted when

[1] MOODY'S ANALYTICS, Measuring the Banking System's Resilience

rumors of speculation against it began to circulate, leading to its eventual closure and bankruptcy. The crisis had a domino effect, impacting other banks and causing widespread bankruptcies, resulting in a reduction in available credit. This crisis stands as a testament to the importance of ethical banking practices and the need for transparency in financial institutions to avoid such catastrophic events.

Banking crises in the last two centuries have increased in frequency and severity, resulting in significant production losses exceeding 10% of GDP in emerging and industrial economies. Deregulation and globalization of financial markets have exposed the vulnerability of banking systems to external crises. Glick and Hutchison (1999) identified 90 banking crises globally since 1975.

The subprime crisis served as a warning to regulators and policymakers that stronger regulations are needed to ensure financial stability in times of contagion. It is not a new threat, as contagion has been a constant concern for banks for years. Nowadays, preventing financial crises requires regulators and policymakers to prioritize the understanding of how contagion spreads throughout financial institutions. By implementing effective regulations, we can prevent financial collapses that have far-reaching consequences.

The recent eurozone sovereign debt crisis has revealed the importance of cross-border connections in transmitting local conditions across national borders. It has also brought to light the feedback loop between banks and sovereigns, emphasizing the need for a more integrated approach to regulating the financial sector (Acharya et al., 2014). By acknowledging these issues and implementing necessary changes, we can strengthen the financial system and protect against future crises.

1. Factors responsible for fragility

1.1. Competition and concentration

In the financial sector, which includes banks, there is a theory and benchmarking argument that suggests that a less concentrated banking sector with more banks is less prone to financial crises than a concentrated banking sector with fewer banks (Allen and Gale, 2000, Allen and Gale, 2004). Firstly, a concentrated banking sector can increase market power and boost bank profits. High profits provide a "buffer" against adverse shocks and increase the reputation and value of banks. This, in turn, reduces the incentives for bank associates and managers to take excessive risks, thereby reducing the probability of systemic banking distress (Hellman et al., 2000, Besanko and Thakor, 1993, Boot and Greenbaum, 1993, Matutes and Vives, 2000)[2].

Those who argue the other way around, and according to the "concentration-fragility" theory, a concentrated banking system can lead to implicit subsidies for banks through the "too important to fail" policy. This policy increases banks' incentives to take risks, which in turn can make the entire banking system more fragile. In contrast, a widely diffused banking system can provide a safety net with more banks and greater focus by policymakers on preventing bank failures. By spreading risk across many institutions, this approach can reduce the likelihood of a systemic collapse. The evidence supports the

[2]Cited in Thorsten B., Demirgüç-Kunt A., Levine R. (2006)

idea that concentration can be a double-edged sword, with both advantages and disadvantages depending on the circumstances.

1.2. Massive deposit withdrawal

One of the "fundamental" reasons why banks are fragile is due to the significant withdrawal of their financing sources. Several developed economies have experienced such runs in their banking systems, including Ecuador (1999), Argentina (2001), and Russia. A similar situation occurred in Great Britain when depositors lost faith in Northern Rock and started withdrawing their deposits, leading to the bank's takeover by the state. In America, the investment bank Bear Stearns and the commercial bank Wachovia both experienced a rapid loss of funds and were taken over by other institutions to stem their collapse. The same phenomenon also affected other types of institution, including a large part of the money in the retirement markets, which led to a colossal withdrawal following the collapse of the Reserve Fund in September 2008.

It is important for depositors to understand the impact of their actions during a bank crisis. As history has shown us, bank runs can have devastating consequences, leading to widespread bank failures and a domino effect that affects everyone involved. The behavior of depositors and investors plays a key role in such situations, as fear and panic can prompt them to rush to withdraw their funds, which only serves to validate the belief that a wave of withdrawals can lead to bank failures. It is crucial for depositors to remain calm and avoid contributing to such a scenario, as maintaining stability is crucial for the health of the banking system and the broader economy.

In the midst of the Panic of 1907, J.P. Morgan made a bold statement to The New York Times: "if people had only left their money in the banks instead of withdrawing it... all would be well".

Considerable literature has been developed to identify the essential components that justify bank panics. Bryant (1980) and Diamond and Dybvig (1983) have paved the way for the coherent development of a theory in this regard.

1.3. Contagion

The term contagion effect has been described and interpreted in various ways in the banking industry (Aharony and Swary, 1983, 1996). It may refer specifically to the fear of a bank run (Diamond and Dybvig, 1983). Conversely, it can refer in a broad sense to any transmission of information across banks, and what is relative to the information of one bank can contaminate other banks which may in turn be exposed in the same way as the first. This more general definition is the one most often used to explain variations in the contagion effects of bank failures reported in the USA over the period 1980-1996.

Allen and Gale (2000), analyze this phenomenon of and propose that there are various channels of contagion that can be studied to understand it better. Calvo and Mendoza (2000) argue that informational frictions *per se*cannot cause contagion. However, they can cause contagion if they are combined with institutional peculiarities or regulatory frameworks associated with financial markets.

The first type of contagion, based on fundamental variables, is linked to shocks (e.g. changes in US interest rates, oil prices or OECD growth rates) that affect several markets as a result of the existence of common components (Dornbusch, Park and Claessens, 2000). These shocks can lead to contagion due to the interdependence of banks and markets in a real-life context. The second type of contagion, which we might characterize as semi-mimetic which means that a crisis in one market prompts investors to reconsider the risks associated with investments in other markets, regardless of whether there are any real links between them. This change in investor behavior regarding asset prices can cause a decline in banks' balance sheets, which can threaten the stability of the entire banking system.

In both cases, there is panoply of ways in which shocks can, if necessary, precipitate a banking crisis in one or more banking systems. If we take the example of Allen and Gale (2000), who showed that the probability and effects of contagion depend on the degree of integration of the interbank market, i.e. the extent to which these banks are linked to one another (i.e., how closely they are connected to one another). Their research also developed the potential domino effect of bank failures, meaning that when several banks are exposed to similar risks or have close links with one another, the failure of one bank alone can trigger a series of cascading failures. Another point is systemic contagion, which refers to the rapid spread of problems from one financial institution to the whole system, and also the role of liquidity, which can contribute to banking contagion. Loss of confidence in the solvency of banks can lead to massive withdrawals of deposits (Diamond and Dybvig model), inducing them to liquidate assets at low prices, thus exacerbating the crisis. However, Chen (1999) has shown that the failure of one bank can induce the failure of other banks through a simple contagion-mimetic effect. In this way, crises could spread despite the non-existence of a real link between banks. And this notion of mimetic contagion is empirically verifiable.

1.4. Others

Claudio Borio and Philip Lowe, in their study "Assessing the Risk of Banking Crises," identify a range of factors that can cause banking crises. In addition to the observation already made above concerning one of the origins of banking crises, which is the deterioration of economic fundamentals and the decline in asset quality. An economic banking crisis that is "costly" in terms of overall production is often the result of the exposure of several institutions to risks that are commonplace. This is the case, for example, for investments in broad asset classes such as real estate or equities, the durability of an expansionary period and the vagaries of major economic sectors. Negative banking crises tend, for this reason, to mirror, and as a backlash amplify, global fluctuations in GDP.

Secondly, vulnerability is exacerbated by the continuing overlap between the financial sector and real economic activity.

It's crucial to consider the potential risks of deregulation in the banking sector. The effects of deregulation, as discussed in this section, are significant. The deregulation of interest rates in the early

1980s led to a startling increase in bank failures in the United States. This was closely followed by the creation of current accounts for investment in money market securities.

2. Resilience-building factors

2.1. The level of capitalization and bank strength: a controversial relationship

Capital requirements are a preventive instrument used by regulators[3]. A bank's capitalization refers to its level of equity accumulation, which determines its ability to bear losses (Lindgren et al., 1996). However, for some authors (Berger, 2010; Petey, 2004 and Tartari, 2002), losses tend to erode a bank's capital first before affecting its depositor's savings, which ultimately leads to bank failure.

The impact of these capital requirements on bank soundness is of considerable interest. The results of theoretical and empirical debate on this subject remain intertwined, as prudential regulation can have an incentive effect on risk-taking. Prudential regulation may induce banks to be selective in rationing credit (Aglietta, 1992; Mojon& al., 1996). For these authors, conditional regulation could reduce banks' solidity by increasing their default risk. On the other hand, some others (Berger, 2010; Gouriéroux and Tiomo, 2007; Madji, 2002; Petey, 2004; Tartari, 2002) see capital requirements as a guarantor of bank solvency. According to the latter, capital requirements can lead banks to reduce their risk-taking under certain conditions. It was this latter ideology that the Basel Committee advocated.

Saadaoui (2010) says "banks need to maintain an optimal level of capitalization for three main reasons". Firstly, there is an ideal level of capitalization that is determined by balancing the cost of failure against the tax advantage. The second reason is the transaction cost. Banks prefer deposit accounts, which are less expensive to issue and manage, rather than title deeds. Finally, there is the issue of information asymmetry between the regulator and the bank, which authorizes the use of capital regulation to encourage banks to limit their risk-taking.

Another argument according to Berger, Petey, and Saadaoui, regulatory capital helps banks reduce risk-taking, protect against credit risk, and cover their debt by limiting leverage. Increasing a bank's capital should decrease risk-taking, while increasing risk-taking requires strengthening capital. Leverage increases lead to the bank increasing capital to cover debt and liquidity.

The implementation of such a procedure involves not only bank management, but also exhaustive risk monitoring.The implementation of an adequate system for monitoring and reporting risk exposure to the bank's governing bodies; and finally, analysis by internal control (COBAC, 2009). This is why some supervisors demand balancing the balance sheet with internal measures aimed at improving profitability through recapitalization.

2.2. Macroprudential policies

[3] The sixth fundamental principle of effective banking supervision and the second pillar of Basel II.

It is said that "It is in the heart of crises that paradigms are made and broke", and this is how the subprime crisis led to the development of new provisions for prudential regulation which recognize that institutions are interconnected and seek to prevent systemic risks from developing. This decree marked a break with the prevailing pre-crisis paradigm, whose premise was that institutions that were individually stable ensured financial stability, which the crisis episode de facto accused.

The consolidation of financial systems from a macroprudential perspective must be a response to two main sources of instability: firstly, the tendency towards excessive risk-taking at the peak of the cycle, and secondly, the underestimation of spillovers within the network that makes up a financial system[4]

The sources of instability in the financial system can be attributed to market imperfections and the transmission of liquidity or solvency shocks. This transmission occurs through two mechanisms: excessive leverage in interbank relations and unreasonable maturity transformations. These factors give rise to two types of risk: *aggregate risk*, stemming from increased overall leverage, and *network risk*, resulting from the interconnectedness of intermediarie's balance sheets. Basel II aims to address these risks by adjusting capital requirements based on the credit risk assessment framework. However, current assessment procedures do not adequately consider macroprudential logic or incorporate long-term forecasting to account for downturn phases. The second pillar of Basel II conducts a prudential review to evaluate bank's internal valuation methods. Notably, the methods used to assess loan portfolio quality tend to worsen during downturns, amplifying the magnitude of the economic contraction.

As we have already discussed in the section on the factors leading to bank fragility, the first factor we explored was how competition among banks can lead to the fragility of a bank. The focus now is on how macroprudential policies can curb this competition among banks. The banking literature has made significant efforts to analyze the effects of macroprudential policies on financial stability (Cerutti et al., 2017; Beck and Gambacorta, 2020).

The effects of these policies affect banking competition through alternatives and non-mutually exclusive channels such as statutory value, demand for credit, and barriers to entry into the banking market. A change in one of these variables can alter the behavior of existing banks. Furthermore, the impact on banking competition can differ according to the macroprudential policies in place and the country. These differences can have an effect on the variables mentioned previously. Claessens and Laeven (2004) have shown that legal restrictions on bank entry and activities are the main drivers of market contestability and competition in banking markets, as they impact the threats posed by new competitors. These two regulatory characteristics can also lead to differences between countries when changes in macroprudential policies alter the degree of attractiveness of the banking sector to new entrants.

The majority of literature on macroprudential regulation focuses on its effect on financial stability. Empirical studies provide a rationale for macroprudential policy in terms of greater financial stability (Kogler, 2020; Jeanne and Korinek, 2020). These studies define two objectives to test their

[4] Bank of England, 2009 Report

effectiveness: the intermediate objective of reducing credit growth and financial cycles, and the final objective of reducing bank risk (Altunbas et al., 2018; Meuleman and Vennet, 2020).

By focusing on the intermediate objective of reducing credit growth, the studies show the effectiveness of macroprudential policies in reducing bank risk. Recent studies have also shown that macroprudential policies are effective in reducing individual bank risk, particularly in poorly capitalized and poorly governed banks (Gaganis et al., 2020).

2.3. Stress tests

« *Supervisors need to sharpen incentives for regulated institutions to improve risk management and stress testing practices and the adequacy of their capital and liquidity buffers. |They| need to sharpen firms focus on tail risks and enhance stress testing regimes in order to identify and mitigate the build-up of excessive risk exposures and concentration risks*[5]».

Before bankruptcy, or close to it, financial institutions such as Bear Stearns-Washington Mutual, Fannie Mae, Freddie Mac, Lehman and Wachovia were adequately or well capitalized, at least by the capital standards they disclosed to the public. That's why, after the crisis, this instrument began to be taken seriously by the regulatory authorities and used frequently.

Actually, stress tests are used in the financial industry for risk management purposes. There are two types of stress tests: micro-prudential and macro-prudential. Micro-prudential tests assess the impact of a severe shock on individual portfolios while macro-prudential tests evaluate the impact of plausible shocks on the financial system as a whole. These tests serve both internal and external purposes, including validating financial models and supporting decision-making. Results of stress tests can be used for decision-making on capital adequacy or business planning for commercial banks. The external purpose of these tests is to provide information for the prudential dialogue with the central bank.

A successful macroeconomic stress test program, particularly during crises, has at least two components: firstly, a credible assessment of the capital strength of the institutions tested and the capital gap that needs to be filled; and secondly, a credible way of filling this gap.

2.4. Others

The SRISK method, developed by Acharya et al (2017) and Brownlees and Engle (2017), provides a benchmark for measuring bank resilience. It determines the ability of banks to maintain a target capital ratio, even after enduring a major shock. This methodology assesses capital ratios after a period of stress, similar to a stress test based on market data. SRISK's aggregate value quantifies the expected capital deficit in the whole banking system in response to a shock that impacts the entire financial system. It calculates the amount needed for each institution's capital ratio to return to its target value after a six-

[5]Financial Stability Forum, Interim Report to the G7 Finance Ministers and Central Banks Governors (2008).

month period of systemic stress, considering total assets, initial capital ratio, and the impact of the shock on the financial system.

Market-based indicators are important for banks to assess the strength of the banking system. They offer real-time information as market prices quickly respond to new expectations and future earnings projections. Unlike balance sheet measures, indicators can better reflect the system's changes and are suitable for international comparisons. They also provide insights into market players' financing and investment decisions, as well as the direction of indirect financing during challenging times. However, caution should be exercised as market perceptions may be inaccurate, leading to potential financing and liquidity issues for banks.

A banking system is considered more resilient if it is able to withstand several shocks and overcome them quickly. All things being equal, a banking system can be resilient if:

1- Its initial capital and liquidity reserves, which are built up to absorb shocksabsorb shocks.

2- The impact of shocks on the financial system as a whole is not critical.

3- The banks that make up this system are able to rebuild their capital as quickly as possibleby digging into their retained earnings once the shock has passed.

II. Methodoly

In the present study, we have opted for a qualitative inductive approach, or as it is commonly known, an empirico-inductive multiple-case approach. We chose this method because in the course of our work we used several cases to collect data. This is a case-by-case study with an inductive paradigm, as our study already sheds light on the consequence of the phenomenon, which is resilience, but we need to see the effects that lead to this cause, so inductive reasoning is the appropriate method for this type of reasoning.

Firstly, the data are collected from the stress test carried out by the Federal Reserve on a sample of 23 banks.The second case is that of the Bank of Canada, which takes as its sample the 6 major Canadian banks and Groupe Desjardins, which qualify as systematically important domestic financial institutions. And last but not least, Bank Al Maghrib's study of all the banks in the system.

The choice of studies based on stress tests stems from the fact that this type of resilience factor makes it possible to combine all the other factors we have already presented in this report. Another is market indicators, which enable decisions to be made on the basis of the various indices used.

In the first case study, the Federal Reserve projects its stress test results using a set of supervisory models that take into account data provided by banks on their financial conditions and risk characteristics, as well as Federal Reserve scenarios. A total of 23 banks are taking part inthis 2023 stress test (In 2022,

33 banks took part in the stress test, as Category IV banks are generally required to take part only every two years.).[6]

The second one and according to the Bank of Canada *'' The stability of the Canadian financial system, as well as its ability to support the Canadian economy, depends on the ability of financial institutions to absorb and manage major shocks. This is especially true for large banks, which perform services essential to the Canadian economy''.*

Using a suite of models called FRIDA (the Framework for Risk Identification and Assessment), the Bank assesses how the banks would perform in a major adverse scenario. This type of stress test takes as its sample the 6 major Canadian banks and Groupe Desjardins (which refer to themselves as domestic financial institutions that are systematically important, or D-SIFIs). Together, these D-SIFIs account for 90% of the total assets of deposit-taking institutions. And the aim of this exercise is to understand the resilience of the banking system as a whole.[7]

Last, the choice of Morocco as a case study stem from the fact that this sector has historically demonstrated a strong resilience, despite being a sector in a developing country and therefore lagging behind the other countries in our study. And is the best example to prove that the combination of the elements we cited in the first part concerning the factors that enable resilience.

III. Results

1. First case study: The resilience of the US banking system

The results of the 2023 stress test indicate that the big banks would suffer substantial losses under the severely adverse scenario, but would maintain capital ratios well above the minimum risk-related requirements.

The aggregate CET1 capital ratio falls by 2.5 percentage points from the start of the projection period to its minimum in the 2023 stress test. This decline is smaller than the 2.7 percentage point drop observed in the 2022 stress test, but comparable to the declines projected in recent years. The smaller decline in this year's post-stress aggregate capital ratio is mainly due to the interest rate trajectory in the scenario.

In February 2023, the Federal Reserve introduced an exploratory market shock specifically for U.S. G-SIBs, in response to global inflationary pressures. This new shock simulated a less severe recession with stronger inflationary pressures caused by various factors such as higher inflation expectations, interest rate increases, US dollar appreciation, and rising commodity prices. The impact of this exploratory shock on banks included losses related to trading positions and counterparty exposures. However, most banks experienced lower losses compared to the global market shock. The purpose of this exploratory shock was to assess a wider range of risks and its findings highlighted the importance of considering multiple scenarios for risk assessment.

[6] To see the full scenarios of this stress test, please refer to: https://www.federalreserve.gov/publications/files/2023-dfast-results-20230628.pdf

[7] To see the full details of this scenario, please refer to: https://www.bankofcanada.ca/2019/05/staff-analytical-note-2019-16/

Overall, the results of the 2023 stress test indicate that the major banks would incur substantial losses under the severely unfavorable scenario, but that they would maintain core Tier 1 capital (CET1) ratios well above the minimum risk-based requirements (10.5% after a 60 basis point drop), with a loss-absorbing capacity of $540 billion, and would continue to lend to households and businesses even under an extremely unfavorable scenario. Banks subject to the stress test had already started the year with a loss on their portfolios, even though their value had appreciated as projections showed that interest rates would fall. On average, this translates into slightly lower capital ratios for the big banks. However, banks with concentrations in mortgages, credit cards and commercial real estate have generally seen larger declines in their post-stress capital ratios.

Yet during this year (2023), a series of crises have followed, leading us to ask the question: is the FED's stress test ineffective? We'll try to unravel the causes of the first bankruptcy that hit the system, which is the Silicon Valley Bank (SVB), in order to confirm or refute this question.

The Dodd-Frank law, enacted in 2010 to safeguard the banking system, required banks with assets exceeding $50 million to face stricter controls and undergo stress tests conducted by the Federal Reserve (FED). However, a law passed in 2018 significantly weakened financial regulation. Under this new law, banks needed to have at least $250 billion in assets to be classified as systemic banks, allowing two-thirds of banks, including Silicon Valley Bank, to skip the resilience tests. Silicon Valley Bank, heavily invested in tech and healthcare sectors, ultimately went bankrupt. 97% of its deposits came from corporate sources, leaving only 3% covered by FDIC for deposits under $250,000.

From Q1 2020 to Q1 2022, SVB significantly grew its bond portfolio from $27 billion to $127 billion by investing customer deposits. However, a week before a market shock, SVB sold its entire $21 billion Available For Sale bond portfolio on the open market, resulting in a $1.8 billion loss. To offset this loss, a capital increase of $2.25 billion was planned but was hindered by a share price decline, leading to share listing suspension and FDIC supervision. SVB's total balance sheet of $211 billion included $14 billion in cash, $21 billion in AFS bonds sold, $91 billion in Held to Maturity bonds with a -$15 billion unrealized capital loss, and $74 billion in customer loans.

After announcing that all categories of depositors could get their money back, the bank run movement occurred, and as we've already mentioned with the Douglas Diamond and Philip Dybvig model, this mechanically led to bankruptcy.

Category IV banks in the USA have the option of not recognizing unrealized losses on their AFS bond portfolios as a deduction from capital when calculating their regulatory ratios. As a result, SVB's CET1 ratio was adversely affected by the non-recognition of an unrealized loss of $1.9 billion at the end of 2022, whereas the major US banks and all European banks include these unrealized losses in their regulatory CET1.

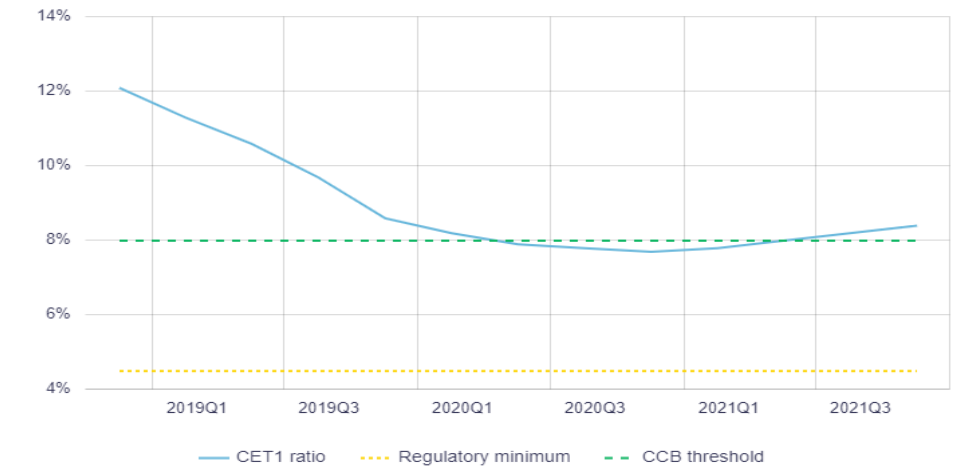
It is likely that other US Class IV banks are in the same situation as SVB, with a greater or lesser level of unrealized losses in their AFS bond portfolios that are not taken into account in their capital ratios. However, this risk is excluded for the other larger US banks and for all European banks.

The resilience factor that all banking literature demands, i.e. the capital adequacy requirement, is also questioned, because in the case of SVB, the CET1 ratio was theoretically adequate, but in reality distorted by the non-recognition of a latent capital loss estimated at -1.9 billion dollars up to the end of 2022, whereas the largest American banks and all European banks include it in their CET1 regulatory capital ratios.

2. Second case study: the resilience of the Canadian banking system

Using the same analysis model as for the first case, we will base our analysis on shareholders' equity. IFIS-I's Common Equity Tier 1 ratio dropped rapidly in the first year of the scenario, falling below the 8% capital conservation buffer threshold in the second year. This triggered dividend payment restrictions, leading to eventual capital exhaustion. However, the overall CET1 ratio began to recover in the third year as IFIS-I returned to profitability. It's worth noting that the ratio remained above the regulatory minimum of 4.5% throughout the year. (Chart 1)

Chart 1: Evolution of aggregate CET1 ratio in adverse scenario

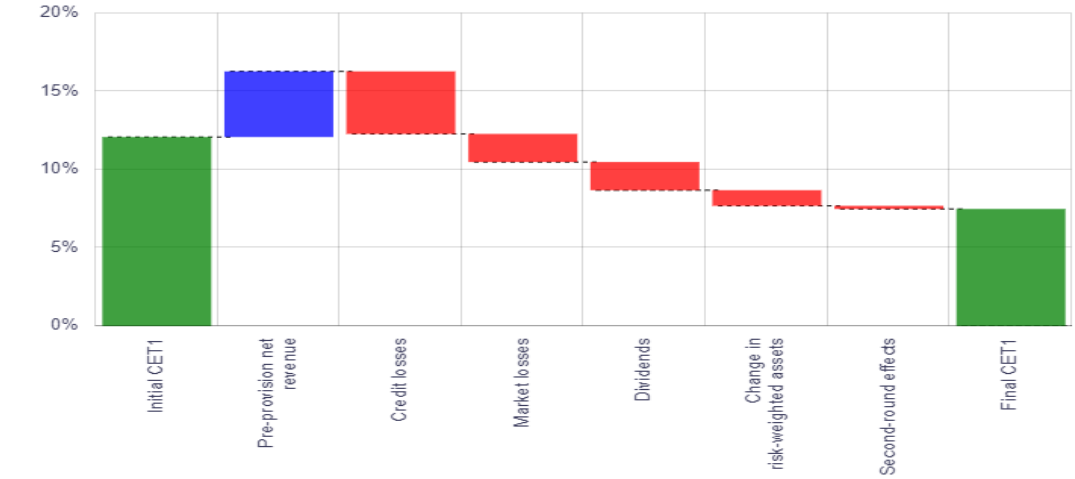


Source: Bank of Canada

The second graph analyzes the impact on the overall CET1 ratio, from peak to trough, for IFIS-I. At the start of the scenario, their equity equals 12.1% of risk-weighted assets. Net income before provisions adds 4.2% to loss-absorbing capacity. Equity decreases to 5.8% due to credit and market losses before the trough. An additional loss of 2.8% is due to increased risk-weighted assets and dividends paid before the capital conservation buffer is lowered. The potential second-round effects of a liquidity crisis and a reduction in the leverage ratio on bank capital are limited to an average of 20 basis points as IFIS-I's liquidity buffers withstand financial stress throughout the scenario.

Chart 2: Decomposition of peak-to-trough decline in aggregate CET1 ratio

2018Q3–2020Q4



Source: Bank of Canada

Banks write off credit losses when borrowers or counterparties fail to meet their contractual obligations. In the current year, interest is charged only on credit losses associated with loans, including losses on conditional exposures arising from first-demand credit lines.

The banking system is resilient, even if a serious scenario were to occur:

IFIS-I remains resilient in a high-risk scenario despite significant losses. The banking system will continue to generate income due to asset diversity and the mortgage loan insurance system supported by the federal government. Canadian regulations provide capital buffers for loss-absorption capacity. However, the results depend on assumptions and method choices. Banks may take steps to maintain capital and liquidity during financial stress, but this could tighten financial conditions and worsen the macroeconomic slowdown. Rising financing costs and deteriorating financial situations could lead to tighter lending criteria and higher interest rates for borrowers.

It should be noted that this analysis does not consider potential actions taken by financial institutions or authorities to ensure the stability of the banking system. Banks have options to increase their capital levels, such as selling units or issuing shares, while authorities can implement crisis management measures to limit the spread of damage and uphold the financial system.

- Bank resilience through market indicators:

The Bank of Canada uses another indicator outside the stress test to assess system resilience. A market index, in this case the Bank has constructed a composite index offering a general measure of the aforementioned dimensions of banking system resilience. (p 130). They measure the degree of interconnection and common exposures within the banking system, as perceived by market players. These aspects have the potential to amplify the systemic effects of shocks. In addition, these indicators also take into account the vulnerabilities associated with unstable funding profiles, which can

compromise the stability of banks' activities and, consequently, their future profits (López-Espinosa et al., 2012 and 2013).

The resilience of the banking system has remained significant since the financial crisis, as indicated by market indicators. This is likely due to the high interconnectedness, common exposures, and complexity of banking systems, along with the consolidation of the sector and international uncertainty. However, market indicators, such as Tier 1 capital ratios, may not fully capture this resilience. Market participants may have underestimated the risks to the banking system before the crisis, but have since become more aware of unstable funding and interconnected systems. Governments' efforts to recapitalize banks through internal schemes may have also contributed to improved risk integration. Additionally, differences in regulatory definitions and accounting methods between banks may downplay improvements in capital adequacy ratios.

(SRISK)

Overall, according to market indicators, market participants consider the Canadian banking system to be quite resilient, especially when compared with the current situation in other advanced countries and with historical episodes of banking crises. These conclusions are in line with the results of the stress test conducted by the International Monetary Fund as part of its Financial Sector Assessment Program for Canada, which demonstrated the resilience of major Canadian financial institutions to the risks associated with a scenario of acute stress (IMF, 2014).

However, despite the improvement in regulatory capital ratios, market indicators do not point to a significant increase in resilience since the pre-crisis period. This may be explained in part by other aspects of banking system resilience taken into account by market indicators, such as expectations of future earnings and the effects of shocks on the financial system as a whole. It is also possible that the market failed to detect the banking system's lack of resilience prior to the crisis. It is therefore essential to use market indicators in conjunction with a wider range of tools that take into account other sources of information.

3. Third case study: the resilience of the Moroccan banking system

Morocco's banking sector has focused on continuous development, aligning with international practices to support economic growth and regional competitiveness. During the subprime crisis, the Moroccan banking system strengthened due to improved indicators, such as a 34% increase in net income compared to 2006, a 17% rise in net banking income, and a 32% increase in loans granted and 18% in deposits. Despite the global financial crisis in 2008, Morocco's banking results only saw a slight 4% decline in net income, with continued growth in net banking income, loans, and deposits.

The banking sector in 2018 experienced similar trends as in previous years, with strong activity from credit institutions and the implementation of the exchange rate regime flexibilization reform. The total balance sheet of the sector reached 1,341 billion dirhams, a 5.5% increase from the previous year. Bank credit to the private sector increased by 6.5%, while total deposits collected from customers grew by

3%. Deposits in foreign currency fell by 10.7%. Overall, the sector achieved a 3% increase in 2018, with a net result of 11.1 billion dirhams, influenced by moderate growth and rising risk-related costs in a global context of decelerating growth and increasing tensions.

Thus, due to the shock of the pandemic, major banks experienced a significant decrease in their average common equity ratios. Between 2019 and 2021, this ratio dropped from 10.3% to 9.2%, representing a decrease of approximately 110 basis points. Similarly, the Tier 1 capital ratio fell from 11% to 9.8%, a decrease of 120 basis points. Additionally, the average overall capital ratio experienced a decrease of around 150 basis points, returning to the average of major banks, from 15.1% in 2019 to 13.9% in 2020 and then to 13.6% in 2021 (BAM, 2020).

These figures are no coincidence. Starting from 2010, the Moroccan Central Bank (Bank al Maghrib) introduced the new circular No. 2/G/10, requiring banks and financial institutions to integrate stress tests into their governance and risk management frameworks. These tests serve as a perspective to assess the strength of banks and ensure they have sufficient capital to absorb potential financial shocks. These stress tests enhance the supervisory process in line with Pillar 2 of Basel II.

To assess the banks' ability to withstand potential external shocks or a major deterioration in macroeconomic conditions, in a context still marked by strong uncertainties and vulnerabilities related to both external and internal environments, such as the repercussions of the war in Ukraine, drought, the consequences of the pandemic, and inflationary pressures, the Central Bank conducted a stress test. The conclusions of this exercise are reassuring, showing that banks remain resilient to scenarios simulating a severe deterioration in economic conditions, based on the economic projections of December 2022. The sector will continue to demonstrate its strength and ability to absorb shocks. The average solvency and Tier 1 capital ratios of the banking sector are respectively at 15.3% and 11.8%, exceeding the regulatory minima of 12% and 9%. Additionally, banks have liquidity buffers exceeding the minimum regulatory requirements.

IV. Discussion and analysis

The capital of banks is an important criterion emphasized by all theorists and regulatory reforms to strengthen the solidity of banks and avoid any bankruptcy that could lead to contagion and consequently weaken the global banking system due to the interconnectedness of global banking systems. Over the past decades, the evolution of the banking sector has been dominated by the need to clean up balance sheets. This cleaning process involves recognizing losses, disposing of depreciated assets, and building strong capital buffers based on sustainable profit capacity.

Before discussing the three cases that have been the subject of our study, statistics show that globally, banks have improved their capital ratios at a faster pace than that anticipated by the transitional provisions of Basel III. Until mid-2012, the average Common Equity Tier 1 (CET1) ratio (common equity and equivalent) of major international banks increased from 7.1% to 8.5% of risk-weighted assets. This was well above the regulatory minimum requirement of 4.5% CET1 capital plus a conservation

buffer of 2.5%. For major banks that did not yet meet the requirements, they reduced their capital shortfall by nearly 60%, to €208.2 billion. This remaining amount to be financed is approximately half of the profit of all these banks (after tax and before appropriation of profit) over this period. For another group of smaller banks, the capital needs amounted to €16 billion, representing 70% of their profit after tax and before appropriation of profit.

According to the three cases, banks' capital is affected differently from one country to another, but for all three, the average equity ratios and all regulatory ratios remain well above regulatory requirements. Stress tests, recommended by literature and regulation as a resilience factor, are regularly conducted to assess how banks' capital in the system could be affected by a distress scenario. However, the reality on the ground in some cases proves otherwise, with the United States being a notable example. The stress tests, neither this year - 2023 - nor in previous years, could prevent the avalanche of bankruptcies faced by the US banking system.

It is worth mentioning that it is not a matter of criticizing the lack of anticipation of the 2008 crisis by this mechanism because the requirement for regular conduct of these resilience exercises by the supervisory authorities only became a priority after the occurrence of this crisis. The concentration mentioned earlier, where a dispersed banking sector could weaken the system, is evidenced in this case; the United States has several thousand banks. Consequently, it becomes more difficult for regulatory bodies to monitor the practices of these banks and ensure that consumer interests are duly protected.

Another tool that was the subject of our study, market indicators, also has its limitations in predicting a crisis of the magnitude of the subprime crisis. However, the Canadian case proves that a combination of factors contributes to its resilience, factors that are also mentioned in our study. The concentration and diversification mentioned earlier, where a concentrated and diversified banking sector could mitigate fragility, are highlighted in the Canadian banking sector, which indeed has just over 80 banks, with the six largest - Bank of Montreal, Royal Bank of Canada, Scotiabank, TD Bank, CIBC, and National Bank - holding 90% of the country's deposits while engaging in diversified activities. Another factor contributing to the system's resilience is the regulator's requirement (Office of the Superintendent of Financial Institutions) to adopt international measures regarding capital adequacy, and another factor enhancing the sector's resilience, as seen in the resilience test specific to this country, is that the Canada Deposit Insurance Corporation (CDIC) protects eligible deposits of member financial institutions up to $100,000 per account.

As for Morocco, even as a developing country, history has shown that despite crises, the country's banking sector has remained resilient, and on the contrary, as seen, it has been able to take advantage of the situation. This is thanks to the adoption of regulatory requirements in terms of capital adequacy and stress tests with a macro-prudential policy wisely crafted by the supervisory authority of the sector, which is Bank Al-Maghrib.

In citing this point, it is important to note a point not mentioned in the literature: the effectiveness of the supervisory authority plays a crucial role in the sector's resilience, and the three cases prove this. The

case of the US Federal Reserve, which manages the economy in addition to the financial system, and because of this dependence, the law of 2011, which was passed in opposition to the former Dodd-Frank law passed in 2010 and which excluded banks with a few billion less from being systemically important banks and which subsequently went bankrupt. Conversely, the Canadian Central Bank manages monetary policy and relies on the expertise of OSFI to enforce banking rules. As for the Moroccan Central Bank, given its status adopted in 2005, it has a dual mandate: the formulation and conduct of monetary policy and the establishment of price stability. Thus, the separation and independence of these authorities could be a factor to be considered for the sector's resilience.

Indeed, the ideal scenario appears to be a combination of all the factors advanced by the literature while trying for countries with the most fragmented banking sectors in the world to conduct stress tests on all banks in the sector because it is not possible to predict, as recent US experience has shown, which bank with which capital may become subject to bankruptcy. It will also depend on the completion of the revision of the regulatory framework and its consistent implementation across countries for greater resilience, even though over time and after each striking crisis since the end of the second half of the 20th century, regulatory reforms have been made to address the shortcomings and weaknesses of the financial system, but they are not suitable and applicable to all countries. For this purpose, it is recommended to categorize countries according to their level of development and to devise frameworks that are adapted to them. The new prudential framework that will be put in place must take into account the increasing complexity that characterizes not only the structure of financial institutions but also financial operations and risk assessment, with a more comprehensive and effective approach that consists of establishing prudential requirements related to capital and liquidity that are aligned with the banking risks of each category. Regarding the uncertainties surrounding risk measurement, the latter must be better understood by jointly using simple indicators of bank solvency in addition to indicators that are more sensitive to risks and more elaborate. Regulation in this regard can potentially improve risk assessment by raising the quality standards applicable to banks' internal models. Lastly, market discipline can be strengthened by requiring the prudential framework to provide more detailed communication of the characteristics and performance of these internal risk assessment models.

Conclusion

A resilient and strong banking system is the foundation of sustainable economic growth, as banks are at the center of intermediation between investors and savers. Furthermore, these banks provide services to all actors, including consumers, small and medium-sized enterprises, large firms, and governments, relying on them to conduct their daily business on both national and international scales.

As we have already seen, one of the major reasons financial crises become more severe is that banking systems in several countries have accumulated excessive on and off-balance sheet debts. This has been accompanied by a gradual erosion of the level and quality of equity capital. At the same time, many banks held insufficient liquidity buffers. Consequently, the banking system was unable to absorb

systemic trading and credit losses, nor to deal with the reintermediation of significant off-balance sheet exposures that had accumulated in the shadow banking system.

Ensuring the stability of a banking system in a constantly evolving financial system requires continuously adapting prudential frameworks. As a general response to vulnerabilities, authorities have tightened prudential rules, and banks have been forced to comply with stricter solvency standards, under the combined effect of all the other measures reviewed in this study (stress tests, macroprudential policies, etc.), the resilience of the sector could be improved. Banks need to regain ground in sectors where they have an advantage and which are a stable source of profits for them. Cleaning up balance sheets will also be one of the key factors for their success.

The response of authorities to the challenges posed by complexity is of paramount importance. Rules aimed at simplifying the organizational structure of banks can, to some extent, reduce complexity at the institution level. However, it is still too early to assess their impact on risks at the systemic level, especially if different national regulations impose divergent requirements on global-scale banks.

The best protection against financial instability lies in establishing prudential standards that strengthen banks' ability to withstand risks. Among the essential elements of these standards are rules requiring the establishment of robust reserves of equity capital and liquidity based on underlying risks. These rules should address the issue of complexity in risk measurement, focusing on improving transparency and comparability within the financial system.

To achieve this goal, it would be essential to leverage the complementarily of solvency indicators, whether or not they account for risks. By adjusting safety levels to reflect the uncertainties and complexity associated with risk assessment, the resilience of individual banks and the financial system as a whole would be strengthened.

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