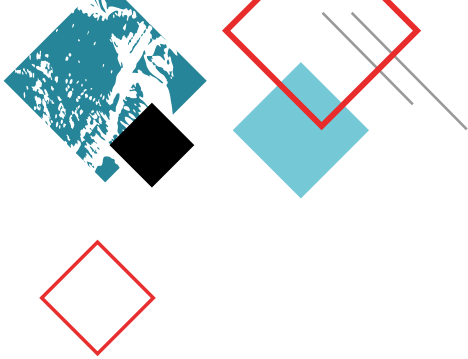


STRESS **TESTING**

Agile Risk Management During Covid-19



Monocle Research Team
2021



In the recent past, the Covid-19 pandemic has significantly impacted all facets of the global financial system. This has led to difficult questions being asked by financial stakeholders in boardrooms – or rather Zoom conference calls – across the world. How do we stress test shock events like these? Are our current approaches proactive and agile enough? Are our stress testing results even relevant?

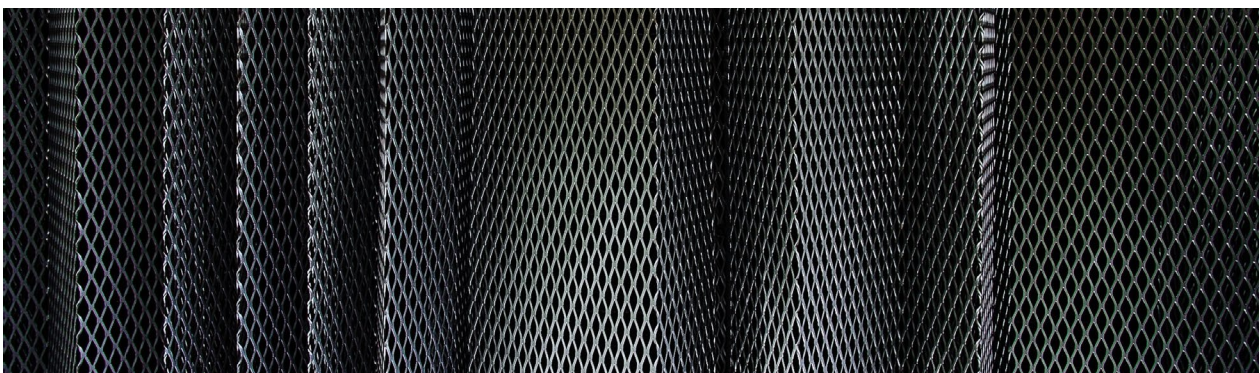
The Global Financial Crisis (GFC) of 2007/2008, was a catalyst for stress testing reform and resulted in financial institutions and supervisory authorities introducing and embedding regulatory stress testing requirements in the financial services industry. Whilst the Covid-19 global pandemic is unlikely to be a catalyst for major reform, as stress testing is currently coming off a significantly higher base of bank adoption and embedment than back in 2008, the volatility and unprecedented impact of the pandemic has prompted a discussion regarding how best financial institutions and supervisory bodies can utilise stress testing to maximise both insight and agility when assessing ad hoc shock scenarios.

In this paper, we review the current state of bank solvency stress testing and examine various critical elements of stress testing with consideration as to how they can enable agile, ad hoc stress testing to assess unexpected shocks similar to the coronavirus pandemic. The paper also highlights the first-response approaches taken by the [Bank of England \(BoE\)](#), [European Central Bank \(ECB\)](#), [South African Reserve Bank \(SARB\)](#) and the [United States Federal Reserve \(Federal Reserve\)](#) in assessing the impact of the coronavirus through Q2 of 2020.

“The volatility and unprecedented impact of the pandemic has prompted a discussion regarding how best financial institutions and supervisory bodies can utilise stress testing to maximise both insight and agility when assessing ad hoc shock scenarios.”

THE EVOLUTION OF STRESS TESTING

The Global Financial Crisis (GFC) of 2007/2008 sparked a change in attitude towards the management of risk and stress testing, as the global recession was directly linked to the mismanagement of risk and reckless behaviour in the financial industry. Stress testing has now emerged as a tool to support the management of various risk types amongst banks, following the GFC's resulting capital adequacy concerns, which severely threatened the financial stability of the world economy.



Stress testing has gained substantial momentum throughout the past two decades:

- 1999** ● International Monetary Fund (IMF) and World Bank introduced the first system-wide stress test through the Financial Sector Assessment Program.
- 2004** ● The Bank for International Settlements' (BIS) Basel Committee on Banking Supervision (BCBS) published the Basel II Accord, which included Pillar 1 and 2 internal stress testing exercises (Internal Capital Adequacy Assessment Process – ICAAP).
- 2009** ● In response to the financial crisis, the BCBS issued the Principles for Sound Stress Testing Practices and Supervision.
- 2009 +** ● Financial supervisory authorities around the world began reviewing their current stress testing regulations and begun implementing system-wide macroprudential stress testing with higher minimum standards, increased frequency, and comprehensive disclosure. Financial Institutions globally strengthened their risk management teams and initiated large internal projects to rebuild their risk models and to improve the quality of data being consumed.
- 2018** ● The BCBS updated their 2009 Principles for Sound Stress Testing Practises to ensure they are kept up to date following the rapid development of stress testing in financial institutions after the GFC.
- 2020** ● The Coronavirus pandemic prompted supervisory authorities across the globe to institute ad hoc, macroprudential stress testing in lieu of their scheduled regulatory stress testing exercises, with the objective of determining the impact to system-wide solvency amongst banks and their financial stability.



BREAKING DOWN STRESS TESTING

Stress testing is highly complex and often requires an intense effort in planning and execution, but the process can be broken down into its main, critical components – **objectives** and its three common elements: **implementation**, **governance**, and **outcomes**.¹

OBJECTIVES

IMPLEMENTATION

GOVERNANCE

OUTCOMES

Stress Testing is best described as quantitative, forward-looking scenario analysis that is used to determine and measure the impact of severe, realistic events on organisations, to gauge if they are able to withstand significant economic and financial shocks. Stress testing can be applied to a broad range of risk areas, such as market and credit risk, as well as profitability and business continuity, however, most stress testing, especially the stress testing enforced by regulators, focuses on solvency, with liquidity becoming increasingly prioritised to supplement solvency results.

Banks around the world, under the Basel II accords, have implemented the **Internal Capital Adequacy Assessment Process** (ICAAP). ICAAP includes mandatory institutional stress testing, amongst other risk management practises that form part of a robust risk management framework, to assess capital planning and stress capital adequacy, as part of pillar 2 requirements. Institutions are required to perform annual institution-wide stress testing that captures all material risk relating to its business model and operating environment, with the objective of ensuring its financial stability and the ability to operate effectively and continually.

Supervisory authorities across the world also enforce mandated stress testing on banks with the objective of assessing individual banks, as well as the financial system in aggregate. Examples of supervisory-led stress testing include the United States' Comprehensive Capital Analysis Review (CCAR) and the Dodd-Frank Supervisory Stress Test (DFAST), as well as the European Central Bank's Single Supervisory Mechanism stress test (SSM ST).

Key Stress Testing Objectives

- Risk identification and management
- Risk appetites and thresholds
- Balance sheet and portfolio management
- Capital management

Stress testing objectives can be broken down between a macroprudential and microprudential approach:

• Macroprudential stress testing

Focuses on the aggregated system-wide impact of a shock on the financial system as a whole, whilst considering the linkages in the financial system. The objective of such a test is generally to observe the impact of system-wide shocks and the interconnected effects throughout the system.

• Microprudential stress testing

Focuses on an individual institution within the financial system and the idiosyncratic impact a shock will have on the organisation. The objective of such a test is to observe the impact at a more granular, institution-specific level.

1. Financial Stability Institute, 'Stress-testing banks – a comparative analysis', FSI Insights on Policy Implementations No 12 (2018), <https://www.bis.org/fsi/publ/insights12.pdf>



Covid-19 Stress Testing:

As economies across the world tackle the Covid-19 pandemic, regulators cancelled their standard stress testing exercises in favour of **ad hoc, first-response Covid-19 scenario stress testing**. The South African Reserve Bank, Bank of England, European Central Bank, and the Board of the Governors of the Federal Reserve System set out to conduct urgent ad hoc macroeconomic stress testing of the banking industry in their jurisdictions throughout **Q2 of 2020**.

These tests had the express objective of determining financial resilience and solvency of their banking industries and the risk to their respective economies, as well as determining the scenarios where banks' ability to provide credit would be impinged, and the effects thereof. All results reflected a decline in regulatory capital, however, resilience remained high within each banking sector.*

With regard to institutional stress testing, the ECB highlighted that the COVID-19 outbreak had emphasised how critical agile stress testing was to effective risk management within banks. The ECB raised the issues of inadequate risk monitoring, stress testing scenario review, and management follow-up action in Europe, combining to inhibit agile and responsive stress testing capabilities.²

OBJECTIVES

IMPLEMENTATION

GOVERNANCE

OUTCOMES

Implementation refers to the technical methodology and design of the stress test and will practically guide stakeholders in designing, building and executing their stress testing process. The BCBS released stress testing principals in 2018³, however, these are considered guidelines rather than a strict set of requirements that must be implemented verbatim. This means that institutions' and supervisors' stress testing frameworks are subject to a degree of variance in interpretation and allow for local policy requirements to be incorporated.

The following fundamentals and approaches will always be pertinent considerations for any stress testing exercise:

1. SCENARIO DESIGN
2. DYNAMIC VS STATIC PROJECTIONS
3. TOP-DOWN, BOTTOM-UP, HYBRID APPROACH
4. DATA AND TECHNOLOGY

2. European Central Bank, Banking Supervision, 'ECB report on banks' ICAAP practises' (2020), https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm_reportbanksicaappractices202007-fc93bf05d9.en.pdf

3. Basel Committee on Banking Supervision, 'Stress testing principles' (2018), <https://www.bis.org/bcbs/publ/d450.pdf>

1. SCENARIO DESIGN

A fundamental element of stress testing is the design of the stress scenarios. These are the hypothetical or, in the case of the coronavirus, historical crisis configurations, with unique risk characteristics. Scenarios are often built from macroeconomic variables attributed to a specific shock event that is translated into an array of specific variables and assumptions (risk drivers). These macroeconomic variables are derived in a variety of ways, including specific macroeconomic variables (interest rates, inflation, etc.) that represent a **judgemental narrative scenario**; deriving specific shocks by analysing aggregated individual bank data and corresponding granular **risk factors**; and **reverse stress testing**, whereby stress testing works back from a predefined outcome (i.e. breaching minimum regulatory capital).⁴ ICAAP stress testing requires both 'vanilla' and reverse stress testing with the purpose of assessing the plausibility and severity of framework assumptions. The scope of stress testing will also include modelling considerations such as timeframes, risk coverage, modelling restrictions and dynamic projections.



Covid-19 Stress Testing:

Scenario design for the supervisory-led Covid-19 stress testing was complicated by the lack of suitable models due to the unique nature of the shock. The transmission of the pandemic was not well understood, with models potentially requiring updated macroeconomic variables and assumptions to accommodate for events such as government-imposed lockdowns, central bank interventions and medical events such as vaccine research and rollouts. While past scenarios can be adjusted and validated through sensitivity analysis, this process can impact the agility of ad hoc stress testing. The SARB, BoE and ECB did in fact produce new Covid-19 specific scenarios but had to caveat their results as only indicative. The Federal Reserve only adjusted key variables of their pre-Covid-19 stress scenario but went on to test three alternative downside scenarios.

Institutionally, ad hoc stress testing remains deficient with the ECB noting that around 50% of European banks do not have documented processes in place for agile scenario design to effectively enable stress testing outside of the regular annual cycle.⁵ Institutions require flexible solutions that allow for iterative scenarios and assumptions and without formalised processes will struggle to effectively conduct and co-ordinate ad hoc stress testing.

2. DYNAMIC VS STATIC PROJECTIONS

Bank balance sheet projections can either be described as "static" or "dynamic". A **static balance sheet** assumes that the size, asset and liability composition and risk profiles of the bank's balance sheet do not vary over time, whilst on the other hand, **dynamic balance sheet** projections will adjust as the institution reacts to the events through the time horizon of the stress test. Stress testing can also consider projections regarding income sources, such as the change in net interest income cash flows due to interest rate changes.

4. Financial Stability Institute, 'Stress-testing banks – a comparative analysis', FSI Insights on Policy Implementations No 12 (2018), <https://www.bis.org/fsi/publ/insights12.pdf>

5. European Central Bank, Banking Supervision, 'ECB report on banks' ICAAP practises' (2020), <https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.reportbanksicaappractices202007-fc93bf05d9.en.pdf>

Macroprudential exercises will generally be designed with dynamic balance sheet assumptions, in order to capture the impact of financial stakeholders' anticipated reactions to the stress event. These dynamic reactions include attempts by bank management to mitigate the effect of the adverse scenario and are considered good transparent practices when disclosed by institutions. Microprudential exercises generally assume a static balance sheet in order to ensure comparability and accountability of results, thereby sacrificing the precision of bank level results and avoid further complicating implementation.



Macroprudential exercises will generally be designed with dynamic balance sheet assumptions, in order to capture the impact of financial stakeholders' anticipated reactions to the stress event.



Examples of dynamic, management actions include:

- Deleveraging of the balance sheet
- Equity issuances by banks
- Postponement of dividend and bonus payments
- Restructurings such as mergers, acquisitions, disposal of business units/functions

Ordinarily **external policy responses** are not included in stress testing exercises, as the results are expected to provide an assessment before any policy measure is administered. However, macroprudential, crisis stress testing would need to consider significant influences that impact the relevance and severity of the scenario. These responses can range from fiscal, monetary, or other regulatory intervention. **Second-round effects** include feedback loops and contagion effects that result from the interconnectedness amongst finance stakeholders and macro-finance transmission channels.

Dynamic modelling seems the obvious choice, however, assumptions then need to be designed and validated. Additionally, second-round transmission channels need to be accurately modelled. Sourcing the required data to feed these models can also quickly become complex and expensive. Additionally, institutions may use dynamic modelling to produce overly optimistic results and erode the relevance of the results to avoid alarming supervisors or the market.



Covid-19 Stress Testing:




The SARB, BoE, ECB and Reserve Bank all opted to include Covid-19 responses to some extent, including bank impacts (regulatory relief, dividend restrictions and credit loss accounting changes) and changes in the real economy (monetary and fiscal policy).⁶ The extraordinary responses and actions taken needed to be incorporated to provide relevant results due to the unprecedented amount of intervention by governments and regulators.

6. Financial Stability Institute, 'Stress-testing banks – a comparative analysis', FSI Insights on Policy Implementations No 12 (2018), <https://www.bis.org/fsi/publ/insights12.pdf>

3. TOP-DOWN, BOTTOM-UP, HYBRID APPROACH

The approach of the stress test remains a fundamental consideration for stress testing, as it not only determines the governance (roles and responsibilities of the stress testing – see below) of the exercise, but also sets up how the exercise will be implemented in its entirety.

The table below unpacks each approach:

APPROACH	DESCRIPTION	ASSUMPTIONS	ADVANTAGES & DISADVANTAGES
Top-Down 	Assesses the impact of macroeconomic shocks on an institution's balance sheet and/or income statement (or regulatory data that supervisory institutions require), using simpler calculations.	<p>This approach is favourable for macroprudential, system-wide stress testing (systemic risk) and is favoured by regulators which develop their own models.</p> <p>Usually utilise dynamic balance sheet projections and including the impact of policy and second-round effects.</p>	<p>This approach is agile, as it is not reliant on complex models, as well as granular input/source data from the tested institution, but more commonly aggregated institutional data and less detailed information.</p> <p>The ability to quickly produce stable results comes at the cost of precision and individual institution insights that updated, granular data can provide. Additionally, an aggregated systemic view may not accurately incorporate all idiosyncratic risks that would be faced by each stakeholder in the sample.</p> <p>Comparisons between institutions can easily be made due to a common framework.</p>
Bottom-Up 	Assesses the impact of macroeconomic shocks using granular data from an institution and calculate financial statements and financial results using complex statistical models. These results can then be aggregated to provide an institution-wide view.	<p>This approach is favourable for microprudential stress testing (institutional risk) and is favoured by banks which develop their own models.</p> <p>Model requirements can be provided by regulators to ensure comparability.</p> <p>Usually utilise static balance sheet projections without modelling policy and second-round effects.</p>	<p>Results are far more accurate and capture the idiosyncratic risks of the institution, whilst accounting for the heterogenous and interconnected nature of the various portfolios.</p> <p>The granularity at which the assumption changes are calculated ensures the impacts of stresses are determined on a product level thereby improving accuracy.</p> <p>The results are not comparable between institutions due to different assumptions being used, especially if using dynamic balance sheet assumptions. Bottom-up places significant operational demand on various teams, as well as intense data requirements, which makes these exercises both costly and effort intensive.</p>
Hybrid 	A combination of these approaches can allow for a 'challenger' approach, whereby each approach is critiqued against the other, in order to validate and provide quality assurance.	See above	<p>The advantages of each approach would still apply, whilst facilitating quality assurance when contrasted against one another.</p> <p>Quality assurance will become less beneficial if the two approaches do not align their methodologies, variables and assumptions. This will require increased effort and time when resolving variances between a supervisory-led top-down approach with an institution-led bottom-down approach.</p>



Covid-19 Stress Testing:

The SARB, BoE, ECB and Reserve Bank all opted for top-down approaches for the supervisory-led stress testing. This approach allowed for results to be quickly calculated using institutional and regulatory data already available to them. This is not surprising considering the objectives of the tests (timely, first response assessments), the lack of suitable models at the time, and the complexity of convergence between top-down supervisory-led results and bottom-up bank-led results.⁷

However, these supervisory-led macroprudential tests were inhibited by a lack of bank interaction and updated granular bank data that could inform a more comprehensive, institutional-level assessment to understand the impact of the pandemic on individual banks.

7. Ibid

4. DATA AND TECHNOLOGY

Data is a critical component of stress testing and, depending on an organisation's data management, it will have a significant impact on the banks abilities to practically perform the calculations and tasks required such as scenario design, model approach and model methodologies.

The quality and complexity of data is recognised by the industry at large with many regulators raising concerns around banks' stress testing data. In 2019, 30% of European banks' ICAAP results were submitted with significant errors.⁸ The BCBS issued specific guidelines through the **BCBS standard number 239**, 'Principles for effective risk data aggregation and risk reporting' in 2013, with the object of addressing banks information technology (IT) and data architectures that were unable to support accurate risk management calculations that drive decision making.

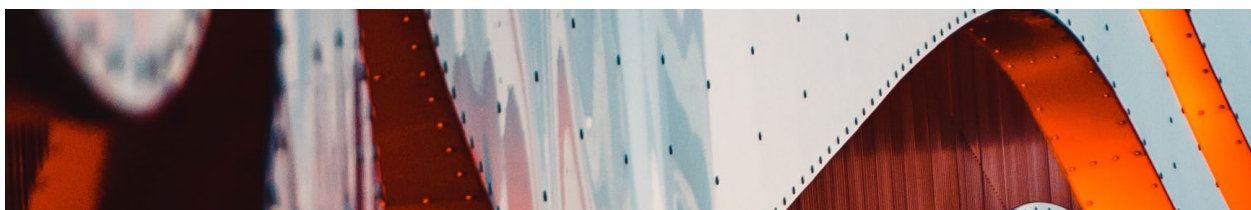


Critical data practices:

- Data quality (completeness, accuracy, timeliness)
- Data lineage and archiving
- Effective control and monitoring mechanisms
- Automation enabled straight-through-processing
- Centralised and comprehensive data warehousing
- Documented and embedded data management frameworks
- Embedded data management tools and instruments

Additionally, large financial institutions can consist of several dozen source systems where trades and transactions of various financial products are processed. This source data then flows through integration layers undergoing various ETL processes with the objective of being standardised and consolidated. **The ECB reported that one third of European banks do not use central data warehouses for ICAAP stress testing data.**⁹ The complexity of these data processes are known to be notoriously significant within financial institutions where multiple subsidiaries and functions using different technology, practices, and integration combine to create a fragmented data landscape. **This leads to increased manual interventions, points of reconciliation and reviewal of outcomes that inhibit an agile stress testing framework.**

Technologically, stress testing requires powerful and effective data management systems for segmentation and aggregation that makes use of formalised workflow management, supported by embedded controls and governance. Model management will also require significant investment to manage model risk through the use of model inventory tools as well as model lifecycle processes and model management frameworks.



8. European Central Bank, Banking Supervision, 'ECB report on banks' ICAAP practises' (2020), https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm_reportbanksicaappractices202007-fc93bf05d9.en.pdf

9. Ibid

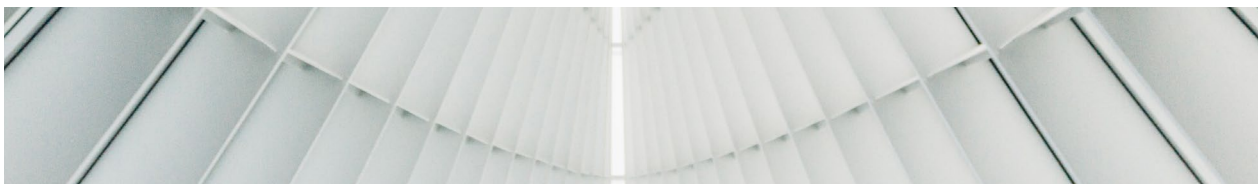
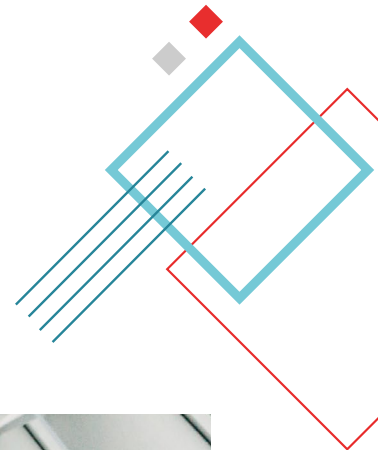


Covid-19 Stress Testing:

The SARB, BoE, ECB and Federal Reserve all opted for a top-down approach in part because of the data burden that a bottom-up approach requires. While granular data can produce more precise results, banks needed to focus on remaining financial and operationally stable and did not have the capacity to begin such an intensive exercise. Institutionally, ineffective data quality frameworks and controls along with underdeveloped standardised central data warehousing continue to remain factors that inhibit agile stress testing.

OBJECTIVES	IMPLEMENTATION	GOVERNANCE	OUTCOMES
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Governance of the stress testing exercise will establish how the testing will be administered, as well as defining the roles and responsibilities of all stakeholders, whilst also setting out the scope of the exercise in line with the objectives. The BCBS guidelines for stress testing specify that stress testing frameworks should provide for clear and comprehensive governance structures with detail regarding engagement between stakeholders that allows for credible challenges to the stress testing framework, including assumptions, methodologies, scenarios and results, as well as the assessment of its effectiveness and any remediation required.¹⁰ ICAAP includes an entire principle dedicated to governance. Additionally, roles and responsibilities should be defined for scenario development and approval, model development and validation, reporting, critique and use of stress test outputs.¹¹



Covid-19 Stress Testing:

In all cases, these top-down exercises were governed completely by the supervisory authorities, without direct collaboration with the banks in each jurisdiction. This decision can be attributed specifically to operational constraints within the banks at the time, who were encouraged to focus on the operational challenges of the coronavirus to their institutions.

10. Basel Committee on Banking Supervision, 'Stress testing principles' (2018), <https://www.bis.org/bcbs/pub/d450.pdf>
 11. Ibid

OBJECTIVES

IMPLEMENTATION

GOVERNANCE

OUTCOMES

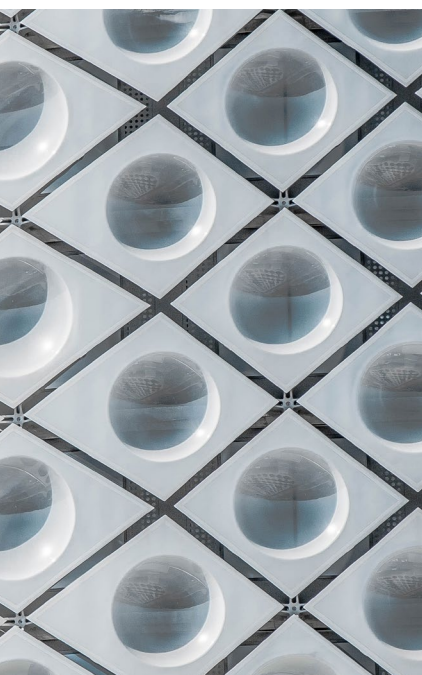
Once results are available, they should be used to inform business and strategic decision making in banks, as well as provide a clear understanding of the financial system to guide regulatory, fiscal and monetary action amongst authorities. In general, most supervisory-led stress testing is disclosed at an aggregated level with limited disclosure of methodology design and bank-level results.



It is important that results are supplemented with robust contingency actions and effective backstops by regulators.



The disclosure of results creates a conundrum. Releasing results to the market should nurture transparency and confidence by supporting market assessments of banking resilience. However, adverse results can lead to market reactions that further destabilise already precarious financial institutions. It is therefore important that results are supplemented with robust contingency actions and effective backstops by regulators.



Covid-19 Stress Testing:

In all cases, no bank-level disclosure was provided, but rather aggregated capital adequacy ratios under each of the scenarios were performed. Authorities did advise taking a cautious approach to interpreting the results, as they were indicative of their financial system's solvency following the limitations mentioned above.¹²

Frequent, agile stress testing through times of stress can be a critical tool to inform and update senior management's strategic and operational decision especially as a crisis unfolds. As stress testing is streamlined through technological and process innovation, banks will be able to gain significant decision-making benefits from the exercise rather than simply completing a regulatory task.

HOW MONOCLE CAN ASSIST

The global pandemic has highlighted stress testing shortcomings and is likely to accelerate the current trend towards embedding efficient stress testing practises to meet unprecedented shock events. Monocle assists our clients in developing and embedding end-to-end stress testing solutions that are flexible enough to provide agility while robust enough to produce meaningful results. Our strong technical skills and industry knowledge ensures we understand our client's current state and what is required to provide a fit-for-purpose solution. We work closely with our clients to implement the capabilities that unlock ad hoc stress testing with consideration to data models, data sourcing, controls and governance, operating models and model management.



ABOUT MONOCLE

Monocle is an independent, results-focused management consulting firm, specialising in banking and insurance, with almost two decades of experience working alongside industry leading banks and insurance companies around the world. With offices in London, Cape Town and Johannesburg we service our clients across the United Kingdom, Europe, Scandinavia, Asia, South Africa and much of Sub-Saharan Africa.

We design and execute bespoke change projects, from start to finish, bridging the divide between business stakeholders' needs and the complex systems, processes and data that sit under the hood. We offer several unique capabilities to our clients, which have been forged over time through the combination of a highly specialised skillset and extensive experience working with the systems, processes and people that are at the heart of the financial services industry.

*Covid-19 First Response Macroprudential Test Results:

Board of Governors of the Federal Reserve System, *Federal Reserve Board releases results of stress tests for 2020 and additional sensitivity analyses conducted in light of the coronavirus event [Press release]* (2020), <https://www.federalreserve.gov/newsevents/pressreleases/bcreg20200625c.htm>

European Central Bank, Banking Supervision, *Euro area banking sector resilient to stress caused by coronavirus, ECB analysis shows [Press release]* (2020), <https://www.bankingsupervision.europa.eu/press/pr/date/2020/html/ssm.pr200728-7df9502348.en.html#:~:text=Overall%2C%20the%20results%20show%20that,2020%20ECB%20staff%20macroeconomic%20projections.&text=In%20the%20severe%20scenario%2C%20banks,to%208.8%25%20from%2014.5%25>

Bank of England, 'Interim Financial Stability Report' (2020), <https://www.bankofengland.co.uk/-/media/boe/files/financial-stability-report/2020/may-2020.pdf>

South African Reserve Bank, 'Financial Stability Review Second Edition' (2020), <https://www.resbank.co.za/content/dam/sarb/publications/reviews/finstab-review/2020/financial-stability-review-2nd-edition-2020/Second%20edition%202020%20Financial%20Stability%20Review.pdf>



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