



CENTRAL BANK

of BELIZE

Basel II/III Implementation

Stress Testing Principles

August 2021

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INTRODUCTION

The Central Bank of Belize (Central Bank) has adopted these principles to promote sound stress testing practices. These guidelines are founded on the Basel Committee on Banking Supervision's *Stress Testing Principles*. As part of the revision of the capital framework, banks will be required to implement a stress testing framework incorporating these principles as a minimum benchmark.

Stress testing is a critical element of risk management for banks and integral to banks' risk management, in that it alerts bank management to unexpected adverse outcomes arising from a wide range of risks, and provides an indication to banks of the financial resources that might be needed to absorb losses should large shocks occur. It plays a particularly important role in:

- providing forward-looking assessments of risk;
- overcoming limitations of models and historical data;
- supporting internal and external communication;
- feeding into capital and liquidity planning procedures;
- informing the setting of a banks' risk tolerance; and
- facilitating the development of risk mitigation or contingency plans across a range of stressed conditions.

Stress testing is especially important after long periods of benign economic and financial conditions, when fading memory of negative conditions can lead to complacency and the underpricing of risk. It is also a key risk management tool during periods of expansion, when innovation leads to new products that grow rapidly, and for which limited, or no loss data is available.

Banks are expected to adopt its stress testing framework commensurate to the nature, scale and complexity of its activities. Given the rapid evolution of stress testing, and recognizing its increasing importance, the principles outlined in this document will be used by the Central Bank to evaluate the adequacy and soundness of the stress testing framework adopted by banks.

PRINCIPLES FOR SOUND STRESS TESTING PRACTICES

PRINCIPLE 1

Stress testing frameworks should have clearly articulated and formally adopted objectives.

- 1.1 Stress testing frameworks should be designed to meet clear objectives that are documented and approved at the board level of the organization, or an appropriate senior-level governance body. The objectives should be the basis for setting out the framework's requirements and expectations and should be consistent with the bank's risk management framework and its overall governance structure.
- 1.2 Staff involved in the implementation of the bank's stress testing framework should also have a clear understanding of the framework's objectives, as this will help to guide any discretionary or judgmental element.
- 1.3 The high-level objectives of the stress testing framework should be aligned with the bank's risk appetite and risk management framework, and may relate, for example, to the use of stress tests to inform capital and liquidity planning, or to their role as an integral element of risk management.

PRINCIPLE 2

Stress testing frameworks should include an effective governance structure.

- 2.1 Stress testing frameworks should include an effective governance structure that is clear, comprehensive and documented. This should specify the roles and responsibilities of senior management, oversight bodies and those responsible for the ongoing operation of the stress testing framework. This governance framework should identify all key stakeholders and ensure full and consistent oversight and monitoring of the actions taken at the different stages of the stress testing process.
- 2.2 Board and senior management's involvement are critical in ensuring the appropriate use of stress testing in a banks' risk governance and capital planning. This includes setting stress testing objectives, defining scenarios, discussing the results of stress tests, assessing potential actions, and decision making.
- 2.3 Roles and responsibilities should be specified for all aspects of the stress testing framework, including scenario development and approval, model development and validation, reporting and challenge of results, and the use of stress test outputs. The roles of the second and third lines of defence should be specified (e.g. risk management and compliance, and internal audit, respectively). Policies and procedures should cover all aspects of the stress testing framework, be clearly documented, updated, and approved by the board and/or senior management.

- 2.4 The stress testing framework should also ensure collaboration of all necessary stakeholders and the appropriate communication to stakeholders of the stress testing assumptions, methodologies, scenarios and results. The engagement structure should facilitate credible challenge of the stress testing framework, both at senior and technical expert levels, including not only assumptions, methodologies, scenarios and results, but also the assessment of its ongoing performance and effectiveness, and the remediation of gaps identified by key stakeholders.
- 2.5 All aspects of the governance arrangements should be specified. The banks' boards of directors should have the ultimate responsibility for the overall stress testing framework, including its oversight. The board, or an appropriately senior-level governance body, is expected to have an understanding of the material aspects of the stress testing framework that enables it to actively engage in discussions with senior management or senior experts that are responsible for stress testing and challenge key modelling assumptions, the scenario selection, and the assumptions underlying the stress tests.
- 2.6 Banks should document the governance arrangements that specify their own specific roles in these exercises. For example, relevant responsibilities likely relate to data quality control, interactions with supervisory authorities on interpretative issues, and modelling choices where these are not specified by the authority. The functions of the bank that are engaged in a given stress testing exercise depend on a number of factors, including the objectives of the framework or particular stress test, the type of stress test (firm-wide vs. more targeted), and the specific structure of the bank itself. Examples of bank functions that are likely to be relevant include risk, finance, strategy and front-line operations.
- 2.7 The development and implementation of the stress testing framework may be delegated to senior management or a stress testing committee. Senior management should be able to identify and clearly articulate the bank's risk appetite and understand the impact of stress events on the risk profile of the bank. Senior management must participate in the review and identification of potential stress scenarios, as well as contribute to risk mitigation strategies. In addition, senior management should consider an appropriate number of well-understood, documented, utilized and sufficiently severe scenarios that are relevant to their bank. Senior management's endorsement of stress testing as a guide in decision-making is particularly valuable when the tests reveal vulnerabilities that the bank finds costly to address.
- 2.8 The rationale for decisions made regarding the stress testing framework, as well as their principal implications, should be explained and documented so that the board and senior management are aware of the limitations of the stress tests performed (e.g. key underlying assumptions, the extent of judgment in evaluating the impact of the stress test or the likelihood of the event occurring). Stress testing should promote candid discussion on modelling assumptions between the board and risk managers.
- 2.9 The internal policies and procedures that govern the stress testing framework should be documented. The following aspects should be detailed:
- (i) type of stress testing and the main purpose of each component of the framework;

- (ii) frequency of stress testing exercises, which is likely to vary depending on type and purpose;
 - (iii) methodological details of each component, including the methodologies for defining the relevant scenarios and the role of expert judgement; and
 - (iv) range of remedial actions envisaged, based on the purpose, type and result of the stress testing, including an assessment of the feasibility of corrective actions in stress situations. Documentation requirements should not, however, impede the bank from being able to perform flexible ad-hoc stress testing, which by their nature need to be completed quickly and often to respond to emerging risk issues.
- 2.10 The assumptions and fundamental elements for each stress testing exercise should be documented. These include the reasoning and judgements underlying the chosen scenarios and the sensitivity of stress testing results to the range and severity of the scenarios. An evaluation of such fundamental assumptions should be performed regularly and documented in light of changing external conditions.

PRINCIPLE 3

Stress testing should be used as a risk management tool and to inform business decisions.

- 3.1 As a forward-looking risk management tool, stress testing constitutes a key input into banks' activities related to risk identification, monitoring and assessment. As such, stress testing should also contribute to formulating and pursuing strategic and policy objectives.
- 3.2 When using the results of stress tests, banks and authorities should have a clear understanding of their key assumptions and limitations, for instance in terms of scenario relevance, risk coverage and model risk.
- 3.3 To promote risk identification and control, stress testing should be embedded in risk management activities at various levels. This includes the use of stress testing for the risk management of individual or groups of borrowers and transactions, for portfolio risk management, as well as for adjusting a bank's business strategy. In particular, it should be used to address existing or potential risk concentrations.
- 3.4 As one component of demonstrating that the stress testing program is embedded in risk management, the Central Bank expects to see stress testing as an integral part of the Internal Capital Adequacy Assessment Process (ICAAP). The ICAAP should be forward looking and account for the impact of a severe scenario that could impact the institution. The ICAAP should demonstrate that stress testing reports provide the board and senior management with a thorough understanding of the material risks to which the institution may be exposed.
- 3.5 Since stress testing allows for the simulation of shocks which have not previously occurred, it should be used to assess the robustness of models to possible changes in the economic and financial environment. In particular, appropriate stress tests should challenge the projected risk characteristics

of new products where limited historical data are available and which have not been subject to periods of stress.

- 3.6 In order to serve as a meaningful risk management tool, stress tests should be undertaken regularly. While ad hoc stress tests may be performed for specific reasons, generally stress tests should be undertaken, according to a defined schedule. The appropriate frequency will depend on several factors, including the objectives of the stress testing framework, the scope of the stress test, the size and complexity of the bank, as well as changes in the macroeconomic environment.
- 3.7 Banks should ensure that stress testing results, and all other relevant findings, are effectively used in accordance with the objectives and internal policies and procedures of the stress testing framework. These uses should provide insight to the board and senior management, to inform key decisions about (or regarding) the direction and management of the bank. For that purpose, the stress test results should be reported to the board and senior management on a regular basis, at relevant levels of aggregation. The reports should include the main modelling and scenario assumptions as well as any significant limitations.
- 3.8 Stress tests should be used to support a range of decisions. Results of stress tests should, where appropriate, inform banks' calibration of risk appetite and limits, financial and capital planning, liquidity and funding risk assessment, contingency planning and recovery and resolution planning. For instance, stress tests should support the bank's adequacy assessments of capital and liquidity. Moreover, stress testing results should be used, where appropriate, to support portfolio management, new trade/product approval processes and to inform other corporate decision-making processes such as the evaluation of strategic options.

PRINCIPLE 4

Stress testing frameworks should capture material and relevant risks and apply stresses that are sufficiently severe.

- 4.1 The stress testing framework should capture material and relevant risks, as determined by a sound risk identification process. The risk identification process should include a comprehensive assessment of risks, which may include those deriving from both on-balance sheet and off-balance sheet exposures, earnings vulnerabilities, operational risks, and other factors that could affect the solvency or liquidity position of the bank. This could include events which cause damage to the bank's reputation.
- 4.2 Stress test scenarios should be designed to capture material and relevant risks identified in the risk identification process and key variables within each scenario should be internally consistent. A narrative should articulate how the scenario captures the risks. If certain material and relevant risks are excluded from the scenarios, their exclusion should be explained and documented. The scenarios should be sufficiently severe and varied, given the objective of the exercise, to provide a meaningful test of banks' resilience. That is, the scenarios should be sufficiently severe but plausible.

- 4.3 Banks should ensure that the scenarios designed reflect the bank's risk appetite and objectives. This design process must be transparent to internal and relevant external stakeholders. As part of the stress testing framework, it is important to include some severe scenarios which would cause the firm to be insolvent or illiquid (i.e. stress events which threaten the viability of the whole firm).
- 4.4 The scenarios and sensitivities used in stress tests should be reviewed periodically to ensure that they remain relevant. Consideration should be given to historical events and hypothetical future events that take into account new information and emerging risks in the present and foreseeable future. Scenarios not based on historical events and empirically observed relationships may be warranted for some or all risks if new or heightened vulnerabilities are identified, or if historical data do not contain a severe crisis episode. The scenarios and the sensitivities should also take into account the current macroeconomic and financial environment.
- 4.5 Banks should ensure that scenarios are tailored to their businesses and address their bank-specific vulnerabilities. Reverse stress tests explore scenarios that could potentially lead banks to fail, and thus can be useful in helping banks to identify their core vulnerabilities. Reverse stress tests start from a known stress test outcome (such as breaching regulatory capital ratios, illiquidity or insolvency) and then asking what events could lead to such an outcome for the bank. A reverse stress test induces firms to consider scenarios beyond normal business settings and leads to events with contagion and systemic implications that could potentially cause a bank to fail. Hence, reverse stress testing has important quantitative and qualitative uses, such as informing senior management's assessment of vulnerabilities.
- 4.6 Banks should conduct stress tests at relevant levels of their organization, consistent with the objectives [e.g. at a portfolio level, a business unit level, or at a firm-wide level (consolidation, solo or sub-consolidated)]. When looking at risks at a bank-wide level, particular attention should be paid to risk concentrations. The bank's strategic orientation and its economic environment should likewise be taken into consideration when defining the stress test's scope and scenarios.
- 4.7 Funding and asset markets may be strongly interrelated, particularly during periods of stress. A bank should enhance its stress testing practices by considering important interrelations between various factors.

PRINCIPLE 5

Resources and organizational structure should be adequate to meet the objectives of the stress testing framework.

- 5.1 Stress testing frameworks should have organizational structures that are adequate to meet their objectives. Governance processes should ensure the adequacy of resourcing for stress testing, including ensuring that the resources have the appropriate skill sets to execute the framework. Resourcing decisions should take account of the fact that stress tests have become more sophisticated over time, increasing the need for specialized staff, systems and IT infrastructure.

- 5.2 Processes to ensure that resources have the appropriate skill sets could include building the skills of internal staff, ensuring knowledge transfer to internal staff, as well as hiring personnel with specialized stress testing skills. The skillsets typically required include (but are not limited to) expertise in liquidity risk, credit risk, market risk, capital rules, financial accounting, modelling and project management.
- 5.3 Banks should ensure that effective policies and internal controls are in place to govern systems and processes used in stress testing exercises.
- 5.4 Banks that adopt centralized approaches to their stress testing activities should ensure that governance systems are in place to facilitate feedback from business lines, such as how their portfolios will be impacted by the stress scenarios. Banks that adopt decentralized approaches should have group level policies, procedures and controls to ensure that there is sufficient consistency in how stress scenarios are translated into impacts that can be aggregated to give a coherent view of the risks that the bank is facing.
- 5.5 If services supplied by third parties are used by banks to supplement internal resources, policies and procedures should establish appropriate due diligence, oversight and control consistent with sound third-party risk management.

PRINCIPLE 6

Stress tests should be supported by accurate and sufficiently granular data and by robust IT systems.

- 6.1 In order for risks to be identified and the results of stress tests to be reliable, the data used should be accurate and complete, available at a sufficiently granular level, and in a timely manner. The granularity of the data should align with the objectives of the stress test.
- 6.2 Banks should have in place a robust data infrastructure capable of retrieving, processing, and reporting information used in stress tests to ensure that the information is of adequate quality to meet the objectives of the stress testing framework. Processes should be in place to address any identified material information deficiencies.
- 6.3 The infrastructure capabilities of banks should be flexible enough to retrieve data for use in all stress tests. Where appropriate, banks should ensure consistency of data sources, processing, and aggregation across their stress tests. Banks should ensure that the data they produce for stress testing purposes are coherent with their overall risk management framework.
- 6.4 Banks should also collect, quality-assure, and maintain historical data relevant for their internal stress testing frameworks. Banks should ensure that they are able to accurately integrate data associated with mergers and acquisitions with their historical data set.
- 6.5 Banks should build up, revise and improve their capacity to use data to enhance their ability to identify and manage bank-wide risks. In particular, banks' risk data aggregation capabilities should

be (i) subject to strong governance arrangements; (ii) supported by an adequate data architecture and IT infrastructure; and (iii) capable of capturing and aggregating all material risk data across the banking group, wherever applicable.

- 6.6 The infrastructure should be sufficiently flexible to allow for targeted or ad hoc stress tests in times of rapidly changing market conditions, and to meet on-demand requests arising from both internal needs and externally from supervisory queries.

PRINCIPLE 7

Models and methodologies to assess the impacts of scenarios and sensitivities should be fit for purpose.

- 7.1 The models and methodologies used to derive stress estimates and impacts should fit the purpose and intended use of the stress tests. This implies:

- (i) the need to adequately define at the modelling stage the coverage, segmentation and granularity of the data and types of risk in line with the objectives of the stress test framework;
- (ii) the level of sophistication of the models should be appropriate for both the objectives of the exercise and the type and materiality of the portfolios being monitored using the models; and
- (iii) the models and methodologies used for stress tests should be well justified and documented.

- 7.2 Sound model development requires the collaboration of different experts. The model developers should engage with stakeholders to gain insights into the risks being modelled and to identify the business objectives, business drivers, risk factors and other associated business information that are relevant given the objectives of the stress testing framework (e.g. market, product or portfolio types, nature and materiality of risk exposures). The modelling choices and calibration decisions should consider the interactions between different risk types, as well as the linkages among models. In this regard, the links between solvency and liquidity stresses should be considered. The collaboration of model developers and stakeholders is particularly important for bank-wide stress testing to ensure the inclusion of all material risks and a sound aggregation of results.

- 7.3 Stress tests employ a certain amount of expert judgment, including assumptions within a model or methodology. In some cases, model overlays are appropriate. Like the models, these overlays or expert judgments should be well justified, documented and subject to credible challenge (including, where appropriate, validation and/or independent review).

- 7.4 The mix of a bank's business lines, its strategy, the risk characteristics of its activities/exposures and the objective of the stress testing exercise should guide the development of appropriate models. Banks should consider a range of methodologies to quantify the stress impacts, ranging from, for instance, point-in-time static approaches to more sophisticated dynamic simulations that reflect future business activities and management actions.

- 7.5 Banks should ensure that adequate model inventory and model management processes are in place for their stress testing activities, including a robust model validation function. The documentation of models used for stress testing, including performance testing, should be maintained and made available to senior management and other internal and external stakeholders, including the Central Bank.

PRINCIPLE 8

Stress testing models, results and frameworks should be subject to challenge and regular review.

- 8.1 Regular review and challenge are key steps in the stress testing process. They are critical to improving the reliability of stress test results, aiding an understanding of their limitations, identifying areas where the stress testing approach should be improved, and ensuring that the stress test results are being used in a way that is consistent with the framework's objectives. Such reviews should provide coverage of all aspects of the stress testing framework on a periodic basis and should be used to ensure that stress testing frameworks are maintained and regularly updated.
- 8.2 Challenge during a stress test exercise should occur at multiple levels within the bank. Reviews should include validation and other types of independent review of the key individual components of the stress testing process, such as review of the methodologies and scenario assumptions, and estimations of the stressed losses, revenues and liquidity forecasts. It is expected that this review would include an assessment of the overall adequacy of the exercise, e.g. back testing or other benchmark comparison, and an analysis of the sensitivity of the results to the assumptions.
- 8.3 Challenge from the business areas of the assumptions, and the plausibility of outcomes relative to market experience, benefit the interpretation of results and ensure the stress test is not a pure statistical or hypothetical exercise.
- 8.4 When bank-wide stress tests are used to inform strategic business decisions that may affect the financial strength of the institution, the board should provide challenge to the processes, assumptions (e.g. scenarios and sensitivities), and outcomes of the stress test.
- 8.5 As with any critical management process at a bank, the independent audit function should regularly review the bank's stress testing framework and its implementation. Such reviews should be comprehensive and provide feedback on areas of improvement for the bank. Areas for assessment could include:
- (i) the effectiveness of the stress testing framework;
 - (ii) documentation;
 - (iii) system implementation;
 - (iv) management oversight;
 - (v) data quality; and

- (vi) assumptions used.

PRINCIPLE 9

Stress testing practices and findings should be communicated.

- 9.1 Disclosure of results of stress tests can help to improve market discipline, provide confidence in the resilience of the bank to identified stresses, and enable the market to better understand its risk profile and management. Banks that disclose stress test results should carefully consider ways to ensure that market participants understand the data that are disclosed, including the limitations of and the assumptions on which it is based. The stress test's objectives and the framework may also be disclosed. This will help to reduce the risk that market participants draw ill-informed conclusions about the resilience of banks with differing or negative results.
- 9.2 Banks should have processes to support regular communication and coordination between group-level stress testing functions and individual banking subsidiaries or other relevant legal entities (whether within or across a jurisdiction).
- 9.3 It is important that banking groups have the ability to aggregate and report stress test results across legal entities and they should seek to establish consistency of approaches and impacts across jurisdictions, where this is applicable.