

U.S. Stress Testing Regulations: A Comparative Overview



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1. Executive Summary

The financial crisis of 2007-2009 served to demonstrate how tightly woven the banking industry is to the fabric of the national and global economy. As a result, banking regulators realized that their risk management tools needed to be assessed and improved in order to mitigate the risk of future economic downturns. Stress testing, which was introduced as a requirement under the Basel II Accord, is a critical component of an effective risk management framework and is particularly important for assessing the potential impact of recessionary periods on the availability of capital and liquidity. Following the financial crisis, banking industry stress testing practices were critically evaluated and enhanced to provide banks with the appropriate warning they need to avoid unexpected losses, liquidity shortages, and potential insolvency during recessionary periods.

This paper provides an overview and comparison of the Comprehensive Capital Analysis and Review (CCAR) and the Dodd-Frank Act Stress Tests (DFAST) (the stress-testing components of the Dodd-Frank Wall Street Reform and Consumer Protection Act) as well as the stress testing practices introduced by the Basel Committee on Banking Supervision (BCBS) and U.S. Basel requirements that American regulators tailored to the U.S. banking industry.

DFAST and CCAR provide an assessment of the health of selected systemically important banks in the United States and the overall U.S. banking sector. Basel III stress tests, in contrast, focus on the capital and liquidity levels of an individual bank rather than assessing the effects of a common set of stresses on the banking sector as a whole. However, common stress testing principles allow banks to integrate Dodd-Frank and Basel processes into a comprehensive enterprise-wide stress testing framework.

Together, CCAR, DFAST and U.S. Basel III stress testing create stronger, healthier banks that can maintain their status as the lifeblood of the world economy, in any economic conditions.



2. Introduction

Analysis of the financial crisis concluded that stress testing programs did not produce large loss numbers compared to banks' capital buffers or actual loss experience

The disastrous financial crisis of 2007–2009, often referred to as the Great Recession, motivated banking regulators worldwide to improve their risk management tools and strengthen the resilience of financial companies to future economic downturns. First introduced in the Basel II capital framework, stress testing is one of the most important tools to assess a financial company's capital adequacy under adverse market conditions. Stress testing warns banks of adverse unexpected outcomes and provides an indication of how much capital is needed to absorb losses during an economic downturn. It is an essential tool that supplements other risk management approaches, thereby playing an 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 bank's risk tolerance
- Facilitating the development of risk mitigation or contingency plans across a range of stressed conditions

Despite these advantages, analysis of the financial crisis concluded that stress testing programs did not produce large loss numbers compared to banks' capital buffers or actual loss experience. The severe scenarios used in firm-wide stress tests intended to assess overall capital needs and possible fluctuations at the enterprise level were usually under-representative of observed results during economic downturn periods.

More specifically, there are four broad areas of weakness that were highlighted by the financial crisis.

- Use of stress testing and integration in risk governance
- Stress testing methodologies
- Scenario selection
- Stress testing of specific risks and products

Regulators have responded to these observed areas of weakness through the issuance of new rules and guidance aimed at improving financial industry stress testing frameworks.



3. Dodd-Frank Stress Testing Principles & Practices

The idea of stress testing was widely introduced by the *Basel Committee on Banking Supervision (BCBS)* in the Basel II capital framework. Soon after, U.S. regulators adopted the idea and incorporated stress testing exercises into banking industry requirements. Due to the shortcomings of banking industry stress testing programs observed during the financial crisis, the BCBS published principles for sound stress testing and U.S. regulators jointly issued a supervisory guidance on stress testing for banking organizations with over \$10 billion in assets. Additionally, two distinct stress testing exercises, the Comprehensive Capital Analysis and Review (CCAR) and Dodd-Frank Act Stress Tests (DFAST), became effective as the Dodd-Frank Wall Street Reform and Consumer Protection Act (Dodd-Frank Act) was signed into federal law in July 2010.

Comprehensive Capital Analysis and Review

Comprehensive Capital Analysis and Review stress testing was added to U.S. banking regulation in November 2011, with the adoption of the Capital Plan Rule. This rule applies to bank holding companies with consolidated assets of \$50 billion or more and requires them to submit detailed capital plans over a nine-quarter horizon across a range of stress scenarios. The submission must also include descriptions of internal policies and procedures related to the assessment of capital adequacy and a variety of model-related documentation. The Federal Reserve processes this information to assess the financial condition, risk profile, and capital adequacy of banking institutions on a forward-looking basis.

The Federal Reserve's quantitative assessment of capital plans is based on the outcome of stress tests conducted for three supervisory scenarios (Baseline, Adverse, Severely Adverse) and two internally generated scenarios (BHC Baseline, BHC Adverse). According to the regulation, federal supervisors must ensure that banks maintain a Tier 1 common ratio of at least 5 percent throughout all scenario forecasts. The Federal Reserve's qualitative assessment of capital plans revolves more around the adequacy of internal processes.

According to the regulation, there are four mandatory elements of a capital plan:

- An assessment of the expected uses and sources of capital over the planning horizon that considers a bank's size, complexity, risk profile, and scope of operations
- A detailed description of a bank's process for determining capital adequacy
- A bank's capital policy
- Details of any planned changes to a bank's business activities that would likely impact the bank's capital adequacy or liquidity position

Additionally, CCAR risk coverage includes: retail banking, wholesale banking, fair value option and loans held for sale, AFS/HTM securities, trading, counterparty credit risk, operational risk, pre-provision net revenue, mortgage servicing rights, and regulatory capital transitions.



In order to maintain an effective capital adequacy process, regulators recommend that a bank abide by seven key principles:

1. Sound foundational risk management
2. Effective loss-estimation methodologies
3. Solid resource-estimation methodologies
4. Sufficient capital adequacy impact assessment
5. Comprehensive capital policy and capital planning
6. Robust internal controls
7. Effective governance

Detailed descriptions of all of the above principles can be found in the Federal Reserve's "Comprehensive Capital Analysis and Review 2015 Summary Instructions and Guidance".

CCAR vs. DFAST

As mentioned previously, the Dodd-Frank Wall Street Reform and Consumer Protection Act introduced two stress testing exercises: CCAR and DFAST. While CCAR and DFAST are distinct exercises, the capital planning and stress testing required by each are complementary and frequently rely on similar processes, data, supervisory exercises, and requirements. The Federal Reserve coordinates these processes to reduce duplicative requirements and to minimize the regulatory burden. Thirty-one large bank holding companies participated in the 2015 CCAR exercise. DFAST requirements apply to a broader range of financial companies with total assets over \$10 billion.

The following exhibit offers a comprehensive comparison between the CCAR and DFAST stress testing programs. Note that (1) applies to banking organizations with total consolidated assets of more than \$50 billion and (2) applies to organizations with assets between \$10-\$50 billion.

While CCAR and DFAST are distinct exercises, the capital planning and stress testing required by each are complementary

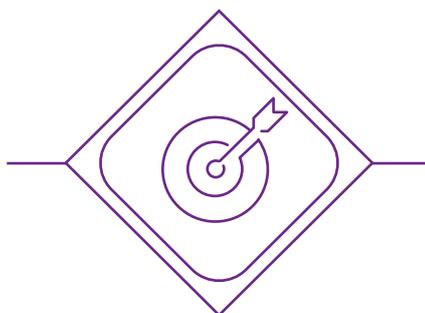


Exhibit 1: Comparison between CCAR and DFAST

	CCAR ¹	DFAST ²³⁴
Scope	BHCs with total consolidated assets of over \$50 billion FRB to announce participating BHCs	All banking organizations with total consolidated assets of over \$10 billion
Reporting Frequency	Annually, submit by April 5	(1) Semi-annually, submit by April 5 and October 5 (2) Annually, submit by July 31
Stress Test Exercises	Annual supervisory and company-run stress testing	(1) Annual supervisory/company-run and mid-cycle company-run stress testing (2) Annual company-run stress testing
Stress Scenarios	Three supervisory scenarios (Baseline, Adverse, Severely Adverse) and two internally generated scenarios (BHC Baseline, BHC Adverse)	(1) Three supervisory scenarios (Baseline, Adverse, Severely Adverse) for annual stress test and three internally developed scenarios (Baseline, Adverse, Severely Adverse) for mid-year company-run stress test (2) Three supervisory scenarios (Baseline, Adverse, Severely Adverse) for annual company-run stress test
Capital Action Assumptions	<ul style="list-style-type: none"> • BHC to present a capital action plan that describes all planned capital actions over a 9-quarter planning horizon • Supported with BHC's internal process for assessing capital adequacy and also policies governing capital actions • BHC's specific planned capital actions to stay as expected 	<ul style="list-style-type: none"> • A standardized set of capital action assumptions specified in the DFAST rules • Common stock dividend payments are at the same level as the previous year • Scheduled dividend, interest, or principal payments on any other capital instrument are assumed to be paid • Repurchases of common stock are zero • In general, no issuance of new common stock, preferred stock, or other instrument
Regulatory Agencies	FRB	FRB, OCC, FDIC
Reporting Templates	FR Y-14A, FR Y-14Q, FR Y-14M	(1) FR Y-14A, DFAST-14A (OCC & FDIC) (2) FR Y-16, DFAST 10-50 (OCC & FDIC)

¹ Board of Governors of the Federal Reserve System, "Comprehensive Capital Analysis and Review 2015 Summary Instructions and Guidance," 2014.

² Board, FDIC, OCC, "Supervisory Guidance on Implementing Dodd-Frank Act Company-Run Stress Tests for Banking Organizations With Total Consolidated Assets of More Than \$10 Billion but Less Than \$50 Billion," Federal Register, vol. 79, no. 49, 2014.

³ Board of Governors of the Federal Reserve System, "Supervisory and Company-Run Stress Test Requirements for Covered Companies," Federal Register, vol. 77, no. 198, 2012.

⁴ Board of Governors of the Federal Reserve System, "Annual Company-Run Stress Test Requirements for Banking Organizations With Total Consolidated Assets Over \$10 Billion Other Than Covered Companies," Federal Register, vol. 77, no. 198, 2012.

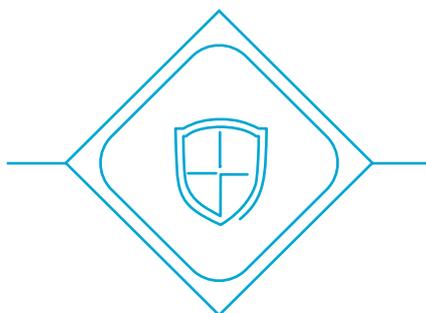
4. BCBS Principles for Sound Stress Testing

BCBS principles require stress testing to be an integral part of a bank's overall risk governance and management

In May 2009, the Basel Committee on Banking Supervision issued a total of 15 supervisory principles for banks to strengthen the weaknesses identified in the stress testing programs employed during the financial crisis. The first six principles relate to the use of stress testing and its integration with risk governance. These principles require stress testing to be an integral part of a bank's overall risk governance and management, and emphasize the active involvement of the Board and senior management. They require that stress testing include views from across the organization and cover a range of perspectives and techniques. One principle states that banks should have written policies and procedures governing the stress testing program and should appropriately document the process of stress testing analysis. In order to flexibly accommodate different and possibly changing stress tests at appropriate levels of granularity, banks need to have in place a suitably robust infrastructure. Additionally, banks should maintain and update their stress testing framework on a regular basis, and the effectiveness of the framework should be assessed regularly and independently.

The next four principles focus on stress testing methodology and scenario selection. It is required that stress tests target a range of risks and business areas and are also performed at the enterprise level. For enterprise-wide stress testing, banks should be able to integrate exposures effectively and in a meaningful fashion to create a complete picture of risk. It is also required that stress tests cover a range of scenarios, including forward-looking scenarios, and take system-wide interactions and feedback effects into consideration. In many cases, expert judgment can supplement stress tests to address deficiencies in the process and thereby improve risk identification. In addition, stress testing programs should feature a range of severities, including events that may cause the most possible damage. They should also determine which scenarios could challenge the viability of banks, thereby uncovering hidden risks and interactions among risks. Lastly, simultaneous pressures in funding and asset markets and the impact of a reduction in market liquidity on exposure valuation should be accounted for in the overall stress testing program.

The last five principles are recommendations to banks related to specific areas of risk mitigation and risk transfer that have been highlighted by the financial crisis. The effectiveness of risk mitigation techniques should be systematically challenged. Stress testing should explicitly cover complex and bespoke products such as securitized exposures. It should also cover pipeline and warehousing risks regardless of the probability of such exposures being securitized. A bank should enhance its stress testing methodologies to capture the effect of reputational risk and it should also integrate risks from off-balance sheet vehicles and other related entities. Stress testing approaches for highly leveraged counterparties should be enhanced by considering the bank's vulnerability to specific asset categories or market movements and in assessing potential wrong-way risk related to risk mitigation techniques.



5. U.S. Basel Stress Testing Requirements

Pillar 2 stress testing addresses not only the fluctuations in minimum regulatory capital requirements captured by Pillar 1 stress testing, but also capital needs for material risks identified in the economic capital process

In the U.S., Basel stress testing exercises are split into two parts—Pillar 1 and Pillar 2 stress testing. Each part addresses different objectives of the stress testing analyses in the Basel capital framework. Additionally, to align with the BCBS principles for sound stress testing, U.S. regulators jointly issued a supervisory guidance on stress testing for banking organizations with total consolidated assets over \$10 billion, which became effective on July 23, 2012.

Pillar 1 vs. Pillar 2 Stress Testing

Pillar 1 stress testing aims to understand how economic cycles, especially downturns, affect risk-based capital requirements, including migration across rating grades or segments and the credit risk mitigation benefits of double default treatment if applicable. Pillar 2 stress testing is incorporated into a bank's Internal Capital Adequacy Assessment Process (ICAAP), which focuses on the firm's overall capital needs and their possible fluctuations. Pillar 2 stress testing addresses not only the fluctuations in minimum regulatory capital requirements captured by Pillar 1 stress testing, but also capital needs for material risks identified in the economic capital (ECAP) process. Work conducted under Pillar 1 may have application to or provide a starting point for any Pillar 2 stress testing.

For the Pillar 1 process, banks are expected to manage their regulatory capital positions so that they remain at least adequately capitalized during all phases of the economic cycle. It is required that a bank use a range of plausible but severe scenarios and methods, which may be historical, hypothetical, or model-based. The scope of the Pillar 1 stress testing analysis should be broad and include all material portfolios. However, the bank can choose to use stress scenarios that apply to an entire portfolio or specific scenarios that apply to various sub-portfolios.

There are no prescriptive stress testing requirements in Pillar 2. Banks, however, should use stress testing or similar exercises in their Internal Capital Adequacy Assessment Process (ICAAP) to identify and measure material risk exposures such as liquidity risk, reputational risk and strategic risk in addition to risk exposures required under Pillar 1, and to consider the consequences of unlikely but severe events and outcomes as an input to the capital adequacy assessment process.

Joint Agencies Supervisory Guidance on Stress Testing

The Board, FDIC and OCC (collectively, the "agencies") have previously highlighted the use of stress testing as a means to better understand the range of a banking organization's potential risk exposures. The financial crisis further underscored the need for banking organizations to incorporate stress testing into their risk management. The agencies' joint supervisory guidance on stress testing is intended to be consistent with sound industry practices and with the principles set forth by the BCBS.



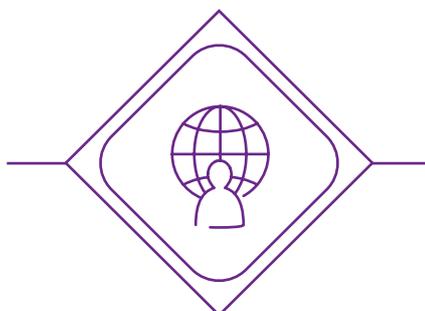
Stress testing should be applicable at various levels of aggregation within a banking organization and should contribute to capital and liquidity planning

Building upon previously issued supervisory guidance which discusses the uses and merits of stress testing in specific areas of risk management, the final guidance outlines broad principles for a satisfactory stress testing framework that a banking organization should follow. It also describes the manner in which stress testing should be employed as an integral component of risk management. Stress testing should be applicable at various levels of aggregation within a banking organization and should contribute to capital and liquidity planning.

- **Principle 1:** A banking organization's stress testing framework should include activities and exercises that are tailored to and sufficiently capture the banking organization's exposures, activities, and risks.
- **Principle 2:** An effective stress testing framework employs multiple conceptually sound stress testing activities and approaches.
- **Principle 3:** An effective stress testing framework is forward-looking and flexible.
- **Principle 4:** Stress test results should be clear, actionable, and well supported, and should inform decision-making.
- **Principle 5:** An organization's stress testing framework should include strong governance and effective internal controls.

The stress testing approaches and applications described in the final guidance include scenario analysis, sensitivity analysis, enterprise-wide stress testing and reverse stress testing. Banking organizations should employ several approaches and applications based on the purpose and scope of the test.

Given the importance of capital and liquidity to a banking organization's viability, stress testing should be applied in these two areas in particular, including an evaluation of the interaction between capital and liquidity and the potential for both to become impaired at the same time.



6. Synergies & Contrasts between Dodd-Frank & Basel Stress Testing

The Dodd-Frank Act makes it possible for regulators to address systemic risk through capital requirements, for instance, by identifying a set of institutions as systemically important

One specific and generally sensible rule that appears in both the Dodd-Frank Act and Basel III is that capital adequacy standards should be countercyclical. That is, the amount of capital required to be maintained by a company increases in times of economic expansion and decreases in times of economic contraction. One way of implementing countercyclical regulation is to ensure financial firms are well-capitalized against their losses in stress tests, where stress scenario severity is not adjusted to be moderate even in good times or booms. Another way is to create capital buffers in times of growth.

The Dodd-Frank Act makes it possible for regulators to address systemic risk through capital requirements, for instance, by identifying a set of institutions as systemically important and undertaking periodic stress tests to ensure these institutions are well-capitalized in aggregate stress scenarios. In contrast, the Basel III approach is more firm-specific and relies primarily on capital ratios, a capital conservation buffer, and a countercyclical buffer. The stress testing of Basel III is at the bank level and does not subject the banking sector as a whole to a set of common stresses as would be necessary for tying capital requirements to systemic risk.

Banks that must comply with both stress testing requirements have to develop an integrated and comprehensive stress testing framework that streamlines Dodd-Frank and Basel processes to reduce excessive and redundant work and to assess and manage their material risk exposures more effectively. Banks that successfully synergize all stress testing requirements will be able to convert a regulatory burden into a benefit for their businesses.



7. Future Enhancements & Leading Practices

The key difference between sensitivity analysis and scenario analysis is that sensitivity analysis changes variables, parameters, or inputs without an explicit underlying reason or narrative

In recognition of the shortcomings of the stress testing frameworks employed before and during the financial crisis, banks need to implement enhancements to the granularity of risk representation and the range of risks considered. Other areas in which banks are considering future improvement include:

- Constantly developing and reviewing stress scenarios
- Examining new products to identify potential risks
- Improving the identification and aggregation of correlated risks across books as well as the interactions between market, credit and liquidity risk
- Evaluating appropriate time horizons and feedback effects

As regulations have evolved over time, various types of stress testing have been established. These include, but are not limited to: scenario analysis, sensitivity analysis, enterprise-wide stress testing and reverse stress testing. The selection of approach depends on the specific purpose and the focus of the test.

Scenario analysis refers to a type of stress testing where the impact of historical or hypothetical scenarios is assessed. It can be applied at various levels of a banking organization and can be integrated into a bank's existing risk measurement tools, such as stressed value at risk.

Sensitivity analysis refers to a banking organization's assessment of its exposures, activities, and risks when certain variables, parameters, and inputs are "stressed" or "shocked". The key difference between sensitivity analysis and scenario analysis is that sensitivity analysis changes variables, parameters, or inputs without an explicit underlying reason or narrative.

Enterprise-wide stress testing is an application of stress testing that involves assessing the impact of certain specified stress scenarios on the banking organization as a whole, particularly with regard to capital and liquidity.

Reverse stress testing is a tool that allows a banking organization to deduce the types of event that could lead to an assumed known adverse outcome. Reverse stress tests can highlight previously unacknowledged sources of risk that could be mitigated through enhanced risk management.



8. Conclusion

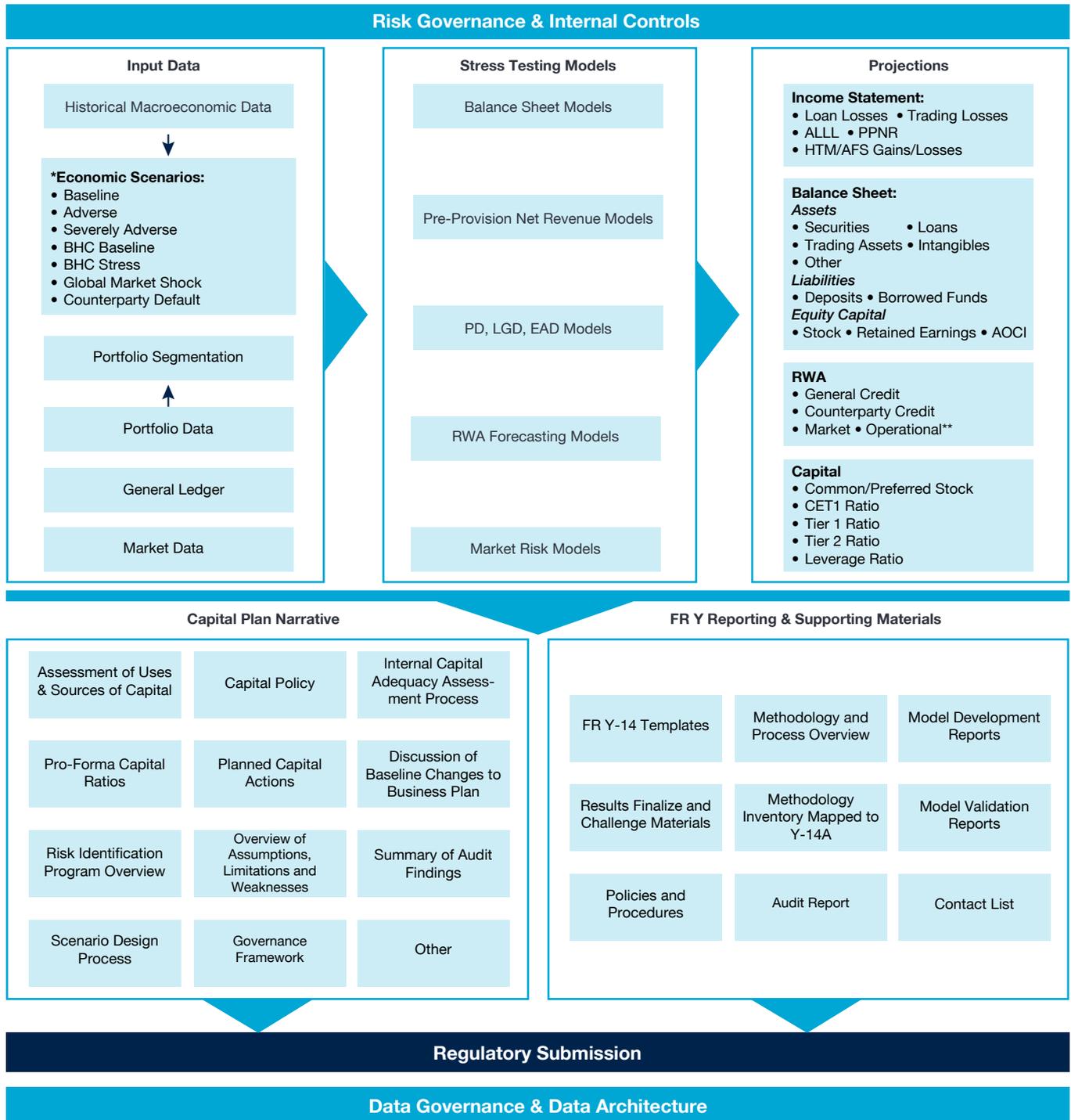
Consistent with the international supervisory standard, U.S. regulators have been enhancing their stress testing tools and creating new tools to strengthen the resiliency of the financial industry. The supervisory guidance on stress testing issued by U.S. agencies addresses weaknesses identified in stress testing programs during the financial crisis and aligns with the international principles for sound stress testing established by the BCBS. CCAR and DFAST are derivatives of the Dodd-Frank Act, which became a federal law in response to the financial crisis. The purpose of these two distinct stress testing exercises is to promote stability within the U.S. financial sector by conducting systemic analysis and control.

Given the complexities of various interrelated stress testing rules, banking organizations need to work closely with their primary regulators and credible third-party vendors in order to successfully implement an effective stress testing framework which helps them plan for predictable and unforeseen capital and liquidity needs.



Appendix

Exhibit 2: CCAR Process Diagram



* May be projected externally or internally forecast

**Applies to Advanced Approaches institutions only

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About the Author



Miles Ravitz is a Managing Consultant with Capgemini and has over 10 years of professional experience in areas that span risk regulation, enterprise risk management, credit risk, market risk, model development and validation, financial markets and financial technology.

As a consultant, Miles has worked on client engagements exclusively with banks and capital markets firms. Prior to joining Capgemini, he held a variety of roles at the New York Mercantile Exchange, worked as an adjunct professor and also enjoyed a stint in financial technology.

Miles' academic background includes a master's degree in financial engineering from New York University, a bachelor's degree in economics from Emory University, and a financial risk management (FRM) certification from the Global Association of Risk Professionals.

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For more information, contact us at: riskmgmt@capgemini.com
or visit: www.capgemini.com/risk



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