rma
THE RISK MANAGEMENT ASSOCIATION

# SCENARIO ANALYSIS AND STRESS TESTING WORKBOOK FOR COMMUNITY BANKS

## A BASIC GUIDE

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# THE RISK MANAGEMENT ASSOCIATION

The Risk Management Association (RMA) is a not-for-profit, member-driven professional association serving the financial services industry. Its sole purpose is to advance the use of sound risk principles in the financial services industry. RMA promotes an enterprise approach to risk management that focuses on credit risk, market risk, operational risk, securities lending, and regulatory issues. Founded in 1914, RMA was originally called the Robert Morris Associates, named after American patriot Robert Morris, a signer of the Declaration of Independence. Morris, the principal financier of the Revolutionary War, helped establish our country's banking system.

Today, RMA has approximately 2,500 institutional members. These include banks of all sizes as well as nonbank financial institutions. RMA is proud of the leadership role its member institutions take in the financial services industry. Relationship managers, credit officers, risk managers, and other financial services professionals in these organizations with responsibilities related to the risk management function represent these institutions within RMA. Known as RMA Associates, these 16,000 individuals are located throughout North America and financial centers in Europe, Australia and Asia.

Members actively participate in the RMA network of chapters. These chapters are run by RMA Associates on a volunteer basis and they provide our members with opportunities in their local communities for education, training, and networking throughout all stages of their financial services career. Chapters are located across the U.S. and Canada as well as in financial centers internationally.

RMA members also avail themselves of benefits offered through headquarters in Philadelphia, Pennsylvania. To assist members in advancing sound risk principles, RMA keeps members informed and provides access to industry information at this site; publishes a journal (The RMA Journal) and a variety of newsletters, books, and statistics; conducts many workshops and seminars; holds several conferences, an annual convention (Annual Risk Management Conference); and has numerous committees working on a variety of projects.

RMA welcomes all personnel involved in lending and risk management in member organizations to become RMA Associates.

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This material is part of RMA's educational resources for commercial bankers at every stage of their careers. For more information, contact the Customer Care Department, RMA, 1801 Market Street, Suite 300, Philadelphia, PA 19103. Or contact us by: Phone 800-677-7621 / Fax 215-446-4101 / E-mail courses@rmahq.org or our website: www.rmahq.org.

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Bill is an active supporter of RMA's enterprise risk management practice. His work with RMA over many years has covered a wide range of subjects including capital management, risk appetite, model risk management and stress testing, all with a focus on community banks.

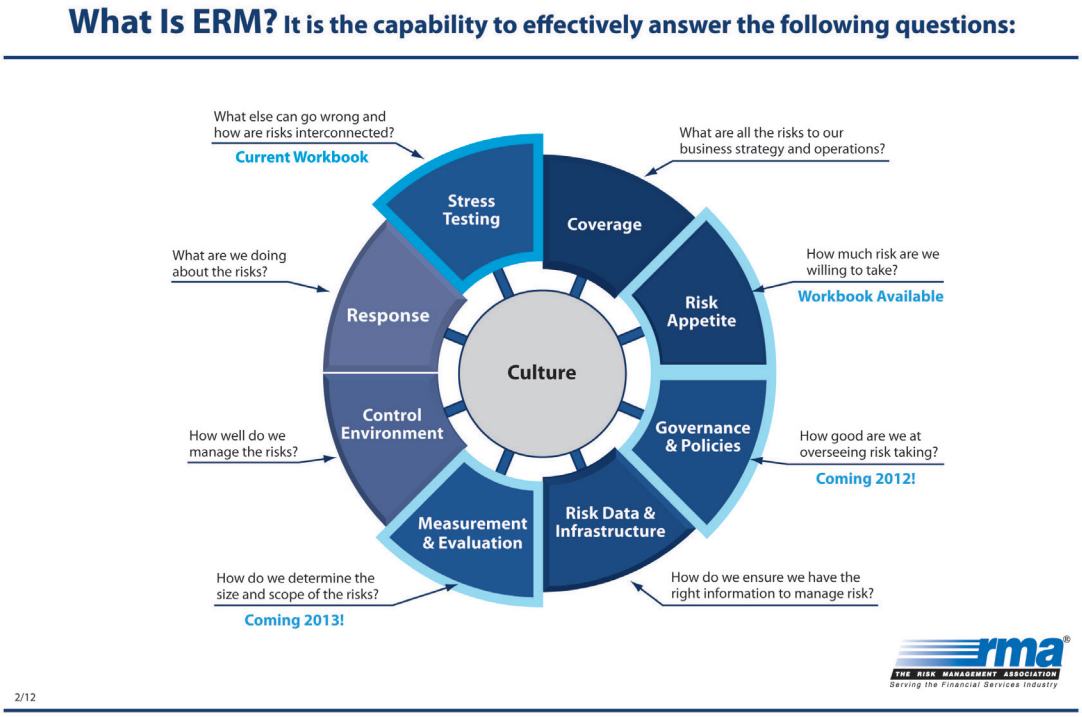
Bill has authored Journal articles, led round table and conference presentations, delivered audio-conference and web seminar instruction, served as faculty leader for the RMA ERM Seminar for Community Banks, provided board of director training for full boards and the risk management committee and advised RMA on regulatory matters.

Second Pillar
CONSULTING

# PREFACE

## ENTERPRISE RISK MANAGEMENT

Enterprise risk management (ERM) is the capability of an organization to understand, control, and articulate the nature and level of the risks taken in pursuit of a risk adjusted return. The risks can be categorized as Credit, Liquidity, Strategic / Business / Reputation, Market, Operational, Compliance / Legal, Financial, and Capital Adequacy.




The RMA Community Bank and Enterprise Risk Management Councils embarked on an effort to develop an ERM framework to help institutions manage their risk holistically by providing the tools to effectively answer the questions depicted above. The first ERM competency covered was risk appetite with the publication of the Risk Appetite Workbook in 2010.

Next, the focus turned to the stress testing and scenario analysis portion of the ERM capabilities. That is, to demonstrate how an organization can answer the question "what else can go wrong and how are risks interconnected? In publishing this workbook, our goal is to provide a highly practical guide to understanding and developing a stress testing and scenario analysis program.

The remaining ERM capabilities, including Governance & Policies and Measurement & Evaluation will be the subjects of upcoming workbooks. The workbooks will provide institutions with practical guides to managing risk across the organization.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# INTRODUCTION

Scenario analysis is the process of analyzing possible future events by considering alternative possible outcomes. Instead of trying to show one exact picture of the future, scenario analysis presents several alternative future developments. Stress testing, one component of an organization's ERM competencies, is an exercise whereby an organization seeks to estimate the likely impact of those scenarios on capital, liquidity, and earnings. These exercises should be regularly conducted by an organization using standard criteria to consistently measure changing risks to an organization.

"Bankers need to conduct their own stress tests… they force bankers to think through the implications of scenarios that may seem relatively unlikely but could pose serious risks if those scenarios materialized. Stress tests must be an integral part of firms' processes for ensuring their capital is adequate." - Federal Reserve Chairman Ben Bernanke[1]

Stress testing has been practiced by banks for some time in their analysis of interest rate risk; however, events leading up to the 2008 crisis illustrated that banks should expand analysis to holistically consider all risks and all areas of the bank concurrently. Further, stress testing gained notoriety with the implementation of the Supervisory Capital Assessment Program (SCAP) in spring of 2009[2] and the Comprehensive Capital Analysis and Review (CCAR) in fall of 2011.[3] Not only is stress testing a fundamentally sound process, it is required under the Dodd-Frank Act.[4] Banks with assets greater than $10 billion are required to conduct annual stress tests.[5] Federal regulators issued proposed guidance on stress testing in June 2011 applicable to all organizations with more than $10 billion in assets that "highlights the importance of stress testing as an ongoing risk management practice that supports a banking organization's forward-looking assessment of its risks."[6]

This workbook is not for those banks.[7] This workbook is for community banks with assets under $10 billion. While community banks are not yet required to conduct a level of stress testing equivalent to larger banks, there are several instances when community banks must conduct stress testing.

1 Remarks at the Federal Reserve Bank of Chicago 46th Annual Conference on Bank Structure and Competition, May 6, 2010.

2 Board of Governors of the Federal Reserve System , "Supervisory Capital Assessment Program," May 2009. http://www.federalreserve.gov/newsevents/press/bcreg/bcreg20090507a1.pdf

3 Board of Governors of the Federal Reserve System, "Federal Reserve System Comprehensive Capital Adequacy Assessment Review," June 2011. http://www.federalreserve.gov/newsevents/press/bcreg/bcreg20111122d1.pdf

4 The Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010. Pub. L. No. 111-203, 124 Stat. 1376 (2010).

5 Ibid, section §165(i)(2).

6 OCC 2011-0011, June 7, 2011, http://www.occ.gov/news-issuances/news-releases/2011/2011-67a.pdf

7 The level of rigor required and hence analytical resources and competency required to complete a stress test at these larger banks reaches beyond this workbook. However, banks should not use $10B as a bright line test. There may be smaller asset size institutions that are small in size and large in complexity that may require an elevated level of rigor in their stress testing that reaches beyond the methods contained in this workbook. Banks will use their own judgment to determine the type of stress testing and the level of rigor to apply.

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Community banks with high concentrations in commercial real estate must stress test their portfolios according to the guidance provided in SR 07-1.[8] Further, banks wishing to pay a dividend must stress test future income as prescribed under the guidance in SR 09-4.[9] Regardless, all banks are being strongly encouraged to implement stress testing as part of their risk management practice. Banks should also be prepared for increased expectations as regulators become accustomed to seeing stress tests as part of the overall risk management framework. Banks may find it difficult to demonstrate effective risk management processes, capital planning and adequacy, and the ability to pay dividends or repurchase stock without a comprehensive stress testing program.

Definition: Stress tests are "what if" scenarios that assist an institution in understanding the potential impact from unplanned events. These could include threats such as increased credit losses, declines in collateral values, illiquid markets, and strains on liquidity. Consideration also needs to be given to banks that are publicly traded and the potential impact on stock prices based on "what if" scenarios.

*Helpful Hint:* Unless the bank has a very complex portfolio of sophisticated risks, start with a simple spreadsheet model. When the process starts to take a significant amount of time or the input assumptions becomes too complex to handle, then consider procuring an outside vendor model. The experience gained will prove valuable when questioning vendors and understanding the features or the limitations of their products.

The goal of stress testing is to identify potential exposure from possible events that affect capital, earnings, or liquidity, and to assist management in developing contingency plans or other loss mitigation strategies to deal with these events prior to and (or when) they occur.

Well functioning stress testing programs provide great benefits. As the figure on the following page illustrates, stress testing shapes the risk profile of the bank by allowing for the analysis of every day "what if" events, as well as extreme events. It enables a look into the future that allows management to better prepare for events. The stress testing program is the intersection within the bank that provides for the integration of business strategy, risk management, and capital planning. This permits management to better see high risk concentrations and better prepare for contingencies.

One of the most important benefits of stress testing are the conversations about risk that will occur internally. These conversations take place from top to bottom within the organization as management and analysts work to develop the scenarios that should be approved by the board with the board reviewing the final outcomes and direction the bank takes in mitigating the risks at hand. When these conversations are well documented, it also provides increased transparency to regulators that the bank is managing its risk.

Finally, where there is risk there is also opportunity. Stress testing can and should help the bank identify additional business opportunities and provides a platform to better understand the risks associated with new products.

8 "Concentrations in Commercial Real Estate." See SR 07-1
http://www.federalreserve.gov/boarddocs/srletters/2007/SR0701.htm

9 "Applying Supervisory Guidance and Regulations on the Payment of Dividends, Stock Redemptions, and Stock Repurchases at Bank Holding Companies", SR 09-4.
http://www.federalreserve.gov/boarddocs/srletters/2009/SR0904.htm


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# BENEFITS

Shapes the risk profile of the bank through better understanding of risk by providing a forward looking view of the organization and focusing management on the future strategy of the bank.

- Allows for the analysis of extreme events.

Identifies risk concentrations across various business lines and allows management to form contingency plans.

- When done well provides for the integration of business strategy, risk management, and capital planning.

Promotes discussion about risk that leads to enhanced internal and external risk communication.

When there is risk there is opportunity!

- Stress testing can and should assist in identifying strategic opportunities.

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## OVERVIEW OF THE STRESS TESTING PROCESS

Is lead by the board and senior management and must become a part of the management risk outline

Forms an integral part of the overall governance and risk manage

Assists in setting the risk appetite and exposure limits

Feeds into the capital, strategic, annual, and liquidity planning

Must be governed by adequate policies, procedures, and controls

Should start simply and then become more sophisticated

## MUST RESULT IN ACTIONABLE AND INFORMED DECISIONS

For community banks in particular, stress testing is a good risk management practice for several reasons. First, many community banks have the added risk of concentrated loan portfolios. While this concentration is natural for community banks, management needs to find effective strategies for managing capital, earnings, and funding. Second, bank management needs to ensure the bank is not only well capitalized today but remains well capitalized in the future, especially in a difficult economic environment. Capital is precious at the best of times and extremely difficult to raise under adverse conditions. This is particularly true of privately held community banks which have an even more difficult time raising capital and must do so through retained earnings. For these banks, understanding the balance between returns to shareholders and retained capital is critical.[10] Stress testing enhances banks' understanding of this relationship.

10 This is especially true for banks with S-corp. structures that are pass-through entities to ensure their investors have sufficient cash to pay for taxes, while at the same time maintaining a sufficient level of capital and reserves.


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## STRESS TESTING - WHAT IT IS AND WHAT IT IS NOT

| What it is ***not*** | What it is |
|---|---|
| A static, one-time exercise. | A regularly scheduled review of the impact of possible adverse events on earnings, capital, and liquidity allowing an organization to effectively develop risk management strategies. Stress testing should become a part of the strategic planning process and become a tool to incorporate risk into future plans. |
| An isolated exercise by the risk group. To be effective, stress testing will involve many areas and levels of responsibility within the organization. | To be an effective tool for management, stress testing should foster internal debate and challenge prior assumptions such as the quality of earnings, secondary sources of liquidity and the cost and speed with which new capital can be raised. It should also be used to determine if the bank is operating within its risk appetite. |
| Tests carried out by separate units focusing on particular business lines or risk types (the silo problem). | An institution should have a comprehensive coordinated stress test in order to identify risks across the institution. The view should cut across credit, market, and liquidity risks. While individual units will stress their individual businesses, effective stress testing will pull these together to provide a comprehensive understanding for the organization and will utilize scenario assumptions and methods consistent across the organization. |
| A check-the-box exercise with limited usefulness completed to satisfy regulatory concerns. | Stress testing should be actionable with the results affecting the decision making of an organization. |
| A thoughtless exercise using arbitrary shocks or scenarios. | Creation of practical and pragmatic scenarios that are believable and vetted internally prior to their implementation. The results will aid decision makers in taking decisive action to mitigate risk. |

Stress testing should become a consistent practice within the bank. It is inextricably linked to the establishment of risk appetite and is critical to the ongoing monitoring of risk appetite. Stress testing is also a great way to incorporate risk into the planning process by providing the "what if" scenarios for the strategic and capital planning process. Finally, stress testing should lead to the bank taking action. This may take the form of developing contingency plans, reducing concentrations, determining the appropriate dividend, or raising capital.

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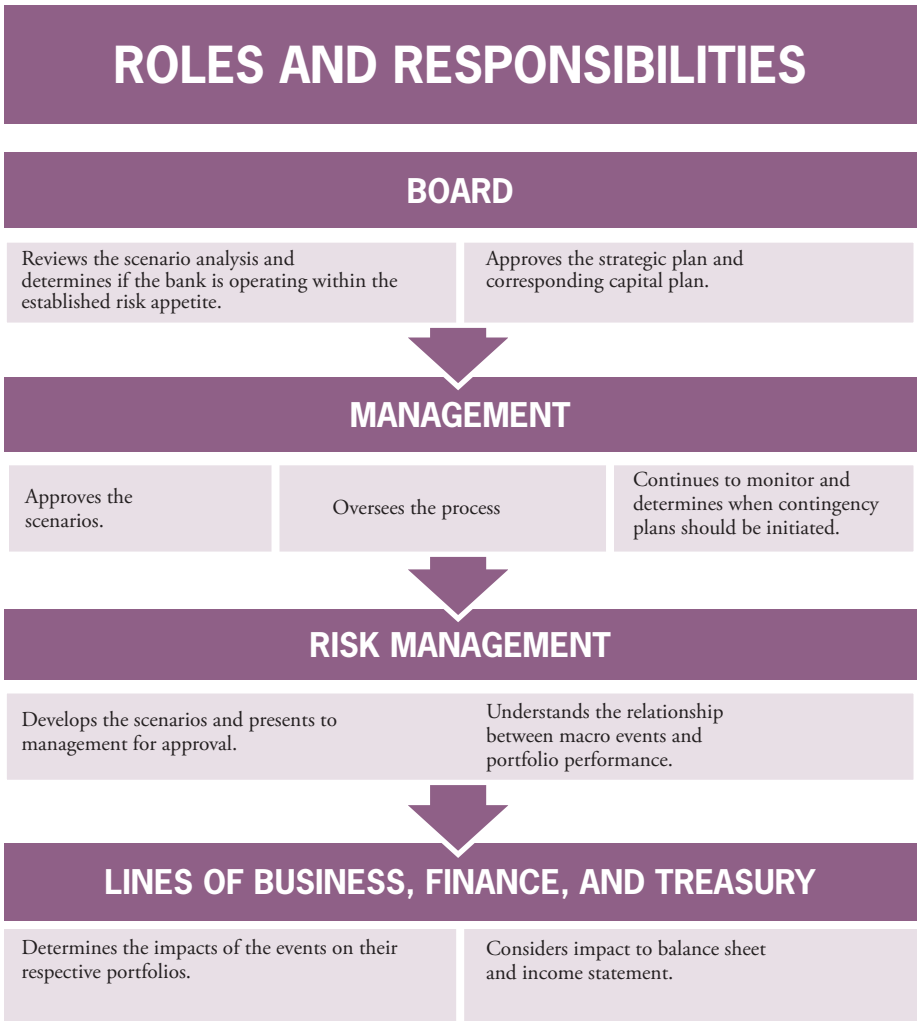
# CONSIDERATIONS

## ROLES & RESPONSIBILITIES

Stress testing first begins with the leaders of an organization understanding its business model and the risks to its success. Put simply, it starts with the strategic plan. Understanding the goals of the organization is the only way to think about events or hurdles that may prevent the organization from reaching those goals. A thorough understanding of these allow for the proper selection of the data that should be manipulated in a test to provide meaningful results that lead to the development of risk management strategies.

After the organization reaches consensus on these important factors, the board has the ultimate responsibility for the stress testing program and should review and approve the stress testing parameters. Senior management is responsible for the implementation, management, and oversight of the testing program. Senior management is also responsible for reporting back to the board the outcomes of the actual stress tests. Combined, the board and management own the scenarios, the process, and, most importantly, the actions taken, i.e., the risk mitigation outcomes.





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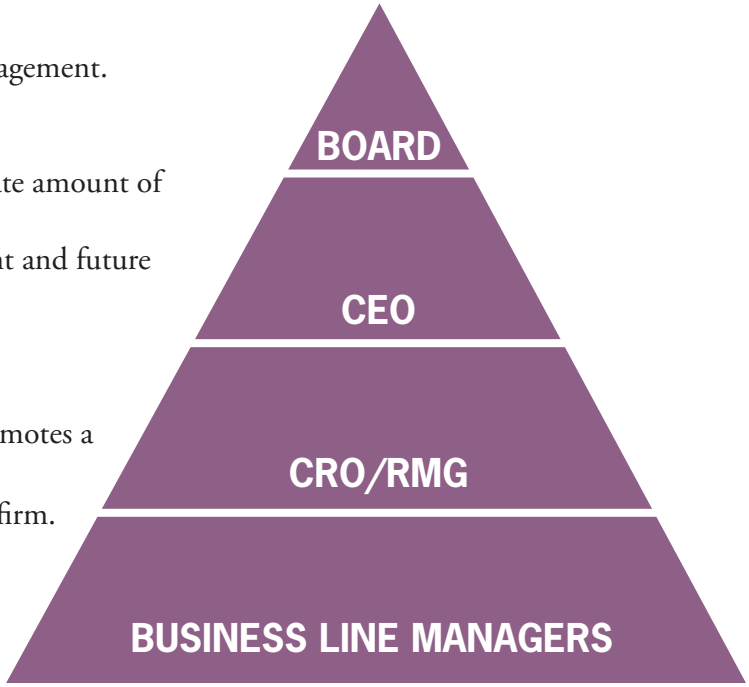
Risk Management[11] plays an important role in investigating the events or macro economic conditions that would drive the scenarios. This can be a purely qualitative analysis or a data intensive exercise depending upon the complexity of the risk and methods chosen. Stress tests should become routine within the bank and when and where possible should be standardized, similar to the standard ALCO tests. Stress tests will frequently stress the same events, conditions, etc., and include models already in use by the bank such as with the ALCO tests. Therefore, risk management must work with lines of business or department heads such as the chief financial officer (CFO), and heads of Lending, Retail, and Investments who are generally responsible for the risk associated with their business strategies, to determine how the events will be consistently applied across all business units. This ensures that each unit considers the events concurrently to determine the overall effect on the bank. Finally, Internal Audit should be enrolled and assess the overall effectiveness of the stress testing as it relates to the risk management framework for the organization.

Although directed at large, complex financial companies, community banks should be aware of the requirements in the Dodd-Frank Act regarding risk management.[12] The Dodd-Frank Act requires the Board of Governors of the Federal Reserve System (the Fed) to establish overall risk management requirements to ensure that strong risk management standards are part of the regulatory and supervisory framework.[13] The Fed's proposed rules seek to address the risk management problems by mandating the major responsible parties within a company for its enterprise-wide risk management: the risk committee of the board of directors and the chief risk officer (CRO).[14] The board risk committee would have certain responsibilities including the oversight and documentation of the enterprise-wide risk management practices of the company. The Fed would also establish various requirements for the risk committee, including membership with appropriate risk management expertise and an independent chair. The CRO would implement appropriate enterprise-wide risk management practices and report to the risk committee and CEO.

11. We use the term risk management loosely. As the call out box on the next page suggests there are a number of departments that can coordinate the stress test in a community bank.
12. 12 U.S.C. 5365(b)(1)(A).
13. 12 U.S.C. 5365(h).
14. Enhanced Prudential Standards and Early Remediation Requirements for Covered Companies by the Board of Governors of the Federal Reserve System, 12 C.F.R. Part 252, December 20, 2011.

**Board**

- Ultimate responsibility for oversight of risk management.
- Must stay informed and educated on ERM.
- Establishes the firm's risk appetite.
- Ensures management is dedicating the appropriate amount of resources to risk management.
- Ensures the firm's adequacy is in line with current and future risks.




**CEO**

- Establishes the risk culture from the top and promotes a positive risk culture.
- Accountable for approving the risk limits of the firm.
- Ensures that day to day investment returns are commensurate with risk.
- May be the chief risk officer in a smaller bank.

**CRO/RMG**

- Synthesizes risk issues for the board.
- Aggregates the measurement of risk for the corporation.
- Establishes ERM policies and tolerances.
- Reviews significant risk issues.
- Ensures governance and infrastructure for the ongoing management of the risk profile.
- Has a strong voice: - "I think we've taken on too much risk" or "Now is the time to take on more risk".

**Business Line Managers**

- Owns the risk and mitigation.
- Performs frequent risk assessments.
- Provides assertions on risk exposure for their business area.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As these requirements are not yet mandated, most community banks will coordinate their stress tests through one of the areas set out in the chart that follows.

## WHO SHOULD COORDINATE THE STRESS TEST IN A COMMUNITY BANK? IT DEPENDS, THERE IS NO RIGHT OR WRONG ANSWER.

### Chief Risk Officer or Risk Department

- If the bank has a CRO or risk management group, they should work to coordinate the stress test with other units.
- The risk group is best positioned for this analysis; they should have a ready understanding of the risks inherent in the portfolio, where the data exists, and how to aggregate the data.
- The risk department needs to clearly communicate the assumptions to the other groups.

### Chief Credit Officer or Credit Department

- At times the Chief Credit Officer will run the analysis if the stress is focused on the loan portfolio and the impact on credit risk.
- However, the CCO needs to consider the other risks inherent in the portfolio when conducting a bank wide analysis.
- Again they need to make sure the assumptions are communicated clearly and respondents provide information in a consistent form to enable an apples to apples comparison of the results.

### Chief Financial Officer or Finance Department

- CFOs may coordinate the stress test because of the financial data and the information they possess, their role in coordinating the planning function, and maintaining the IR Risk and Liquidity stress information.
- The Finance department needs to recognize that risk data is sometimes different than financial data when aggregating the bank's consolidated risk.
- They are still required to provide clear and consistent assumptions.

**Key Points:**

- Choose a coordinator that has the time and resources to complete the analysis, has a feel for the appropriate scenarios, and can codify and explain the macroeconomic environment.
- Provide clearly articulated consistent assumptions of what should be stressed.
- Data returned to the stress test coordinator in consistent forms.
- Consideration of all risks in the portfolio.

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# CHOOSING THE TYPE OF STRESS TESTING

There are several types of stress tests that can be applied:

- Benchmarking
- Historical
- Simulation
- Factor Analysis
- Grade Migration

The type chosen will depend upon the type of risk being investigated, the complexity and impact the risk may have to the institution, data availability, the resources, and in-house competencies available to run the analysis.

At its most basic level, stress testing is simply an accumulation of the results of other risk management processes such as credit review and ALCO. The complexity and sophistication of stress testing is not necessarily related to bank size and should be determined by the complexity and volatility of the bank's business and its environment. For example, if a small community bank were executing a complex and risky lending strategy funded by wholesale deposits in a fast growing market, it would need more robust stress testing than a larger organization, with a plain vanilla loan portfolio, in a stable market funded with core deposits.

All of the above considerations will influence, and ultimately determine, the type of stress testing the bank chooses to implement.


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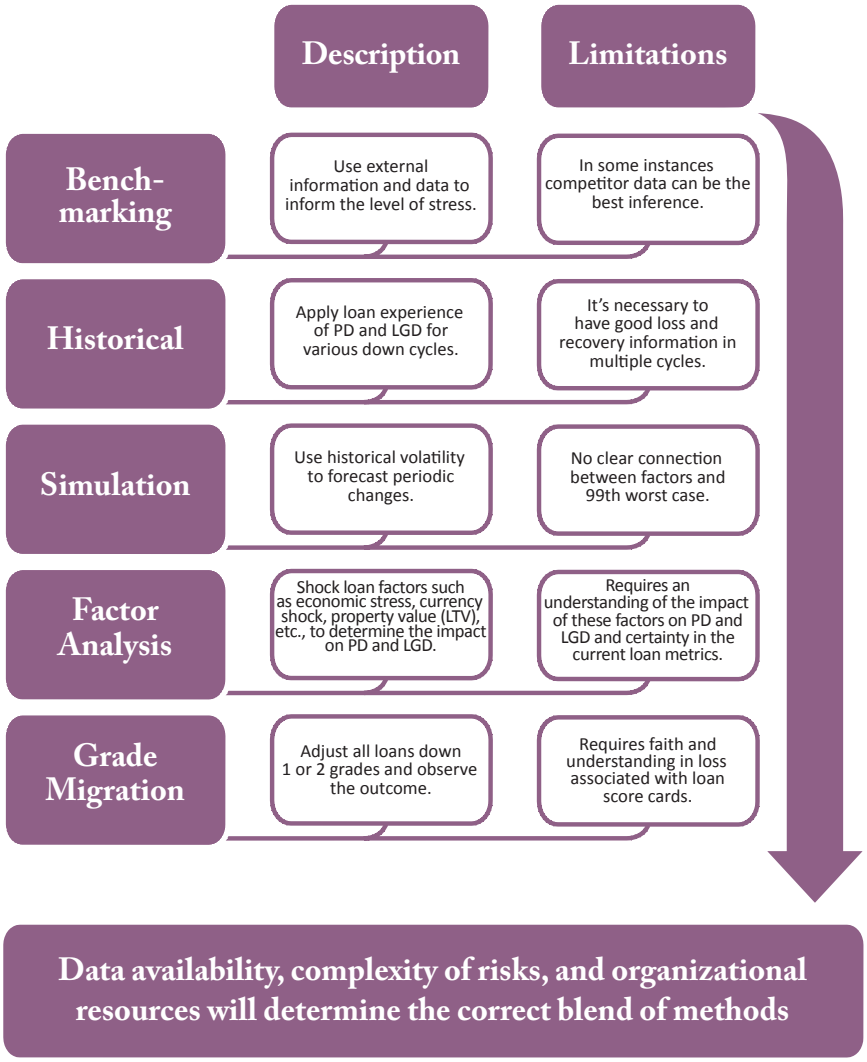
Many organizations will choose a combination of stress testing types to gain a top down and bottoms up view of risk in the organization. The following section provides an overview of the types of stress testing methods.




## BENCHMARKING

The stress testing technique of benchmarking utilizes available public information, rules of thumb, or consultant provided or developed shocks and ratios to determine the level of stress. One of the important elements of external benchmarking was provided by the regulators and Treasury in their release of the base and adverse scenarios by loan type in the Supervisory Capital Assessment Program (SCAP).[15] This stress test is of critical importance to U.S. banks because it provides a window into supervisory thinking and expectations around stress testing. Further, it provides supervisory vetted stress testing assumptions that can be used by banks to determine their level of stress. The SCAP is an important tool in community bank stress testing analysis. The following section will explain its use.

15. The Supervisory Capital Assessment Program: Design and Implementation, Board of Governors of the Federal System. Published April 24, 2009.

**SCAP**

The purpose of the SCAP was to stress test the balance sheets of the nation's largest banks to determine if they had enough capital to ride out a prolonged two (2) year economic downturn whose loss rates would be worse than what was experienced during the Great Depression. There were 19 banks in the assessment. The federal bank regulatory agencies[16] selected these 19 banks because of their size and belief that their failure could lead to systemic risk in the banking system and further weakness of any of these banks would continue to deteriorate consumer confidence and spending.

The SCAP process started with examiners providing banks with a range of loss rate experience by loan type as shown in Table 1 below. These were the outcomes predicted to occur over the forecasted base period of 2009-2010. More importantly the SCAP specified the level of stress in an adverse economic situation that was equivalent to or in some cases worse than that experienced during the Great Depression.

**Table 1: Indicative Loss Rates Provided to BHCs for SCAP (cumulative two year, in percent)**

| | Baseline | More Adverse |
|---|---|---|
| First Lien Mortgages | 5-6 | 7-8.5 |
| Prime | 1.5-2.5 | 3-4 |
| Alt-A | 7-5-9.5 | 9.5-13 |
| Subprime | 15-20 | 21-28 |
| Second/Junior Lien Mortgages | 9-12 | 12-16 |
| Closed-end Junior Liens | 18-20 | 22-25 |
| HELOCs | 6-8 | 8-11 |
| C&I Loans | 3-4 | 5-8 |
| CRE | 5-7.5 | 9-12 |
| Construction | 8-12 | 15-18 |
| Multi-family | 3.5-6.5 | 10-11 |
| Non-farm, Non-residential | 4-5 | 7-9 |
| Credit Cards | 12-17 | 18-20 |
| Other Consumer | 4-6 | 8-12 |
| Other Loans | 2-4 | 4-10 |

Source: The Supervisory Capital Assessment Program: Overview of Results Federal Reserve Board, May 2009

16. The federal bank regulatory agencies that participated in the SCAP are the Board of Governors of the Federal Reserve System, the Federal Reserve Banks, the Federal Deposit Insurance Corporation, and the Office of the Comptroller of the Currency.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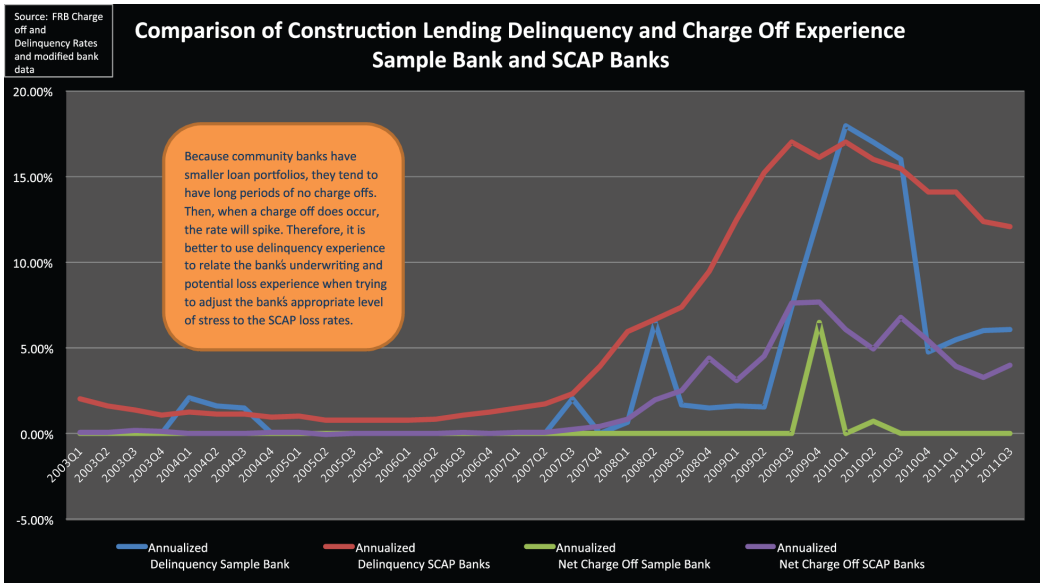
The 19 banks were then required to examine their portfolios in relation to the above loss rates and the economic forecasts of GDP, housing prices, and unemployment provided by the Fed. After extensive review by both sides, the regulatory agencies published the loss rates by individual bank. These results provide community banks with a great deal of information to customize the SCAP bank results to their portfolio.[17]A cornerstone of any benchmark methodology should be to take the stress rates developed by the examiners in Table 1 (prior) and modify those rates (lower or higher) based upon the bank's understanding of its own portfolio and the rates published in the Table in Appendix C.

As an example, the SCAP rates for multi-family CRE range from 10-11%, however the rates for the individual banks range from 2% to 45%. Banks should carefully examine these ranges and custom tailor these results to their underwriting and macroeconomic experience. For example a bank portfolio containing agricultural land in the Midwest, which is currently enjoying a booming economy due to high commodity prices, might have lower levels of stress than a bank in harder hit areas with significant construction lending.

Comparing loss experience between a community bank and the 19 large banks can be challenging. This is because some community banks have little or no losses in their small portfolios. Therefore, the loss experience is frequently zero in most quarters then spikes when there is a loss. This is the result of having a smaller portfolio than the larger banks, however when a loss does occur in the portfolio it can be a big shock. The figure below provides an example of a sample bank[18] and the SCAP banks. The green line indicates no losses over time then several loss blips in nearby quarters. However the blue line indicates that the bank has had a history of delinquencies in the portfolio. Because of this limited loss experience it would be better for this community bank to compare its delinquency experience to these larger banks. Then the bank should compare it's average delinquencies with the bigger banks and use this result to adjust the loss experience on a percentage basis accordingly.




17. See Appendix C – SCAP Results by Bank.

18. Sample bank data is modified community bank experience.

As an example, the following table provides the average delinquency and net charge off experience for the sample bank and the SCAP banks for construction lending. This example typifies the loss experience of most community banks and the problems with loss spikes. Comparing the bank over a long period (2003 to 2011Q3) to the SCAP banks reveals the sample bank to have delinquencies of 3.37% compared to 6.27% for the SCAP banks. That is a reduction of 47%. Therefore the bank may wish to use the midpoint of the range for construction lending of 16.5% and adjust the shock for the bank by 47%[19] to 7.76% (16.5%*47%=7.76%). If the bank chooses to be more aggressive they can select the bottom part of the range (15); or if they choose to be more conservative, they can select the top of the range (18).

*Note:* The release of these stress-test ranges provides the practitioner with critical benchmarks to validate personal assumptions. The SCAP process received considerable scrutiny from supervisors, Treasury, and the banks themselves. Because of this scrutiny and validation by examiners, banks should consider these shocks when stress testing their portfolios.

It's always good to verify the estimated shock with actual experience. In this example the bank's worst annual two year charge off rate is 3.1%. Therefore the worst case stress is well within what the bank has experienced. Analysts conducting the stress test should provide management with the loss information and alternatives then allow management to choose a level of conservatism consistent with their risk appetite. For example, the analyst should provide management with all three outcomes - aggressive (7.05%), midpoint (7.76%), and conservative (8.46%) - and let them chose the appropriate stress based upon their risk appetite.

19. The 47% is arrived at by taking the individual bank's experience divided by the SCAP bank's delinquency experience or 3.37%/6.27%.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**Comparison of Delinquency and Charge off Experience for Construction Lending for a Sample Bank and the SCAP Banks**

| | Annualized Delinquency | | Annualized Net Charge Off | |
|---|---|---|---|---|
| | **Sample Bank** | **SCAP Banks** | **Sample Bank** | **SCAP Banks** |
| 2003Q1 | 0.00% | 2.03% | 0.00% | 0.09% |
| 2003Q2 | 0.00% | 1.65% | 0.00% | 0.10% |
| 2003Q3 | 0.00% | 1.40% | 0.00% | 0.17% |
| 2003Q4 | 0.00% | 1.10% | 0.00% | 0.15% |
| 2004Q1 | 2.10% | 1.29% | 0.00% | 0.04% |
| 2004Q2 | 1.60% | 1.15% | 0.00% | 0.00% |
| 2004Q3 | 1.50% | 1.14% | 0.00% | 0.03% |
| 2004Q4 | 0.00% | 0.98% | 0.00% | 0.05% |
| 2005Q1 | 0.00% | 1.06% | 0.00% | 0.07% |
| 2005Q2 | 0.00% | 0.80% | 0.00% | -0.04% |
| 2005Q3 | 0.00% | 0.82% | 0.00% | 0.01% |
| 2005Q4 | 0.00% | 0.80% | 0.00% | 0.01% |
| 2006Q1 | 0.00% | 0.78% | 0.00% | 0.02% |
| 2006Q2 | 0.00% | 0.83% | 0.00% | 0.04% |
| 2006Q3 | 0.00% | 1.07% | 0.00% | 0.05% |
| 2006Q4 | 0.00% | 1.28% | 0.00% | 0.04% |
| 2007Q1 | 0.00% | 1.49% | 0.00% | 0.08% |
| 2007Q2 | 0.00% | 1.76% | 0.00% | 0.10% |
| 2007Q3 | 2.02% | 2.35% | 0.00% | 0.25% |
| 2007Q4 | 0.00% | 3.95% | 0.00% | 0.46% |
| 2008Q1 | 0.70% | 5.96% | 0.00% | 0.85% |
| 2008Q2 | 6.50% | 6.67% | 0.00% | 1.96% |
| 2008Q3 | 1.70% | 7.38% | 0.00% | 2.52% |
| 2008Q4 | 1.50% | 9.48% | 0.00% | 4.43% |
| 2009Q1 | 1.60% | 12.51% | 0.00% | 3.13% |
| 2009Q2 | 1.59% | 15.21% | 0.00% | 4.52% |
| 2009Q3 | 7.37% | 17.05% | 0.00% | 7.65% |
| 2009Q4 | 12.79% | 16.11% | 6.50% | 7.69% |
| 2010Q1 | 18.00% | 17.04% | 0.00% | 6.10% |
| 2010Q2 | 17.00% | 16.02% | 0.75% | 4.93% |
| 2010Q3 | 16.00% | 15.49% | 0.00% | 6.80% |
| 2010Q4 | 4.77% | 14.08% | 0.00% | 5.42% |
| 2011Q1 | 5.46% | 14.10% | 0.00% | 3.94% |
| 2011Q2 | 6.04% | 12.39% | 0.00% | 3.28% |
| 2011Q3 | 6.08% | 12.11% | 0.00% | 3.99% |

Average from 2003 to 2011

| **Sample Bank** | **SCAP Banks** | **Sample Bank** | **SCAP Banks** |
|---|---|---|---|
| 3.27% | 6.27% | 0.21% | 1.97% |

Percentage Change in Loss Experience

| **Delinquency** | **Net Charge Off** |
|---|---|
| **-47.88%** | **-89.48%** |

Source: SNL and modified bank data

## BENCHMARKING RULES OF THUMB

There are some benchmarking rules of thumb community banks can use when determining the impact of a credit or operational risk event. The Basel capital rules provide simple benchmarks that can be applied to the loan portfolio to determine the overall credit-risk shock or to the annual average gross net income of the bank in determining the potential incidence of loss or the amount of capital required for operational risk.[20]

### Credit Risk

The Asymptotic Single Risk Factor (ASRF) models can be used as a benchmark to determine the level of credit stress in a portfolio. Armed with a working knowledge of these formulas and some of the industry proxies, banks can use these formulas as another means by which to create stress events. A community bank is never going to have the level of data as required under the Basel rules; however there are enough proxies available to piece together a reasonable estimate to be used in a stress test. For example, a bank can use its historical loss experience or use estimates from its reserve model as the basis to estimate expected loss.[21] Then the bank can either use its own experience with recoveries to calculate the Loss Given Default (LGD) or use external benchmarks like the data released in Quantitative Impact Study 4[22] to arrive at an estimate of LGD.[23]

*Helpful Hint:* Using the ASRF methodology is not for the faint of heart. Care should be taken when using these methods to benchmark potential unexpected loss. It's important to emphasize that these estimates are not being used to calculate a prescriptive level of capital for the bank but to provide another data point in understanding the bank's potential for loss.

Armed with the probability of default (PD), the loss given default (LGD), the exposure at default (EAD), and a confidence interval, banks can plug these components into the ASRF formulas and determine a level of unexpected credit loss for the bank. The appropriate formulas to use for the ASRF model are published in the Basel guidance.[24] A full description and use of the ASRF formulas are beyond this workbook but analysts are encouraged to explore the guidance provided in the Basel document.

20. As banks get larger and more complex or begin to approach the $10B threshold they should start to consider these additional more advanced methods

21. Use caution when using expected loss estimates from the model during periods of elevated portfolio stress. These losses are already currently elevated, therefore, calculating PD from these estimates can lead to over estimating the unexpected loss. A better method would be to use average or through-the-cycle PD experience.

22. See FFIEC, "Summary Findings of the Fourth Quantitative Impact Study," 2006. http://www.occ.gov/news-issuances/news-releases/2006/nr-ia-2006-23a.pdf for an analysis of results banks were considering for PD and LGD in QIS4. This document provides benchmark data for all loan types.

23. Note QIS4 was conducted during a benign credit environment. Practitioners should use caution when using these data and should utilize more recent data of housing price declines and recovery experience to further refine the PDs and LGDs to make the data fit the current experience. Further, QIS4 provides the LGD for the 75th percentile of the banks reporting. These may be more relevant in determining a stressed LGD.

24. The following document contains the ASRF formulas for the various products, Basel Committee on Banking Supervision, "International Convergence of Capital Measurement and Capital Standards," Bank for International Settlements, June 2006.


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## Operational Risk

A proxy for operational risk can be estimated using the Basel II estimates. This method relates gross net income to operational loss. Gross net income is simply net interest income plus non-interest income. Note that non-interest income is not net of expenses but is the gross amount. A bank can average a three year history of gross net income (note negative quarters are not included in the average) and multiplying it by 15% provides a rule of thumb for operational risk stress. The 15% operational risk factor originates from the basic indicator approach in Basel and provides a proxy for operational risk events. If the bank has data by lending line of business or if the bank specializes in a predominant type of lending they may wish to use the operational risk beta factors from the Standardized approach. These factors are presented below.[25]

| BUSINESS LINES | BETA FACTORS |
|---|---|
| Corporate finance | 18% |
| Trading and sales | 18% |
| Retail banking | 12% |
| Commercial banking | 15% |
| Payment and settlement | 18% |
| Agency services | 15% |
| Asset management | 12% |
| Retail brokerage | 12% |

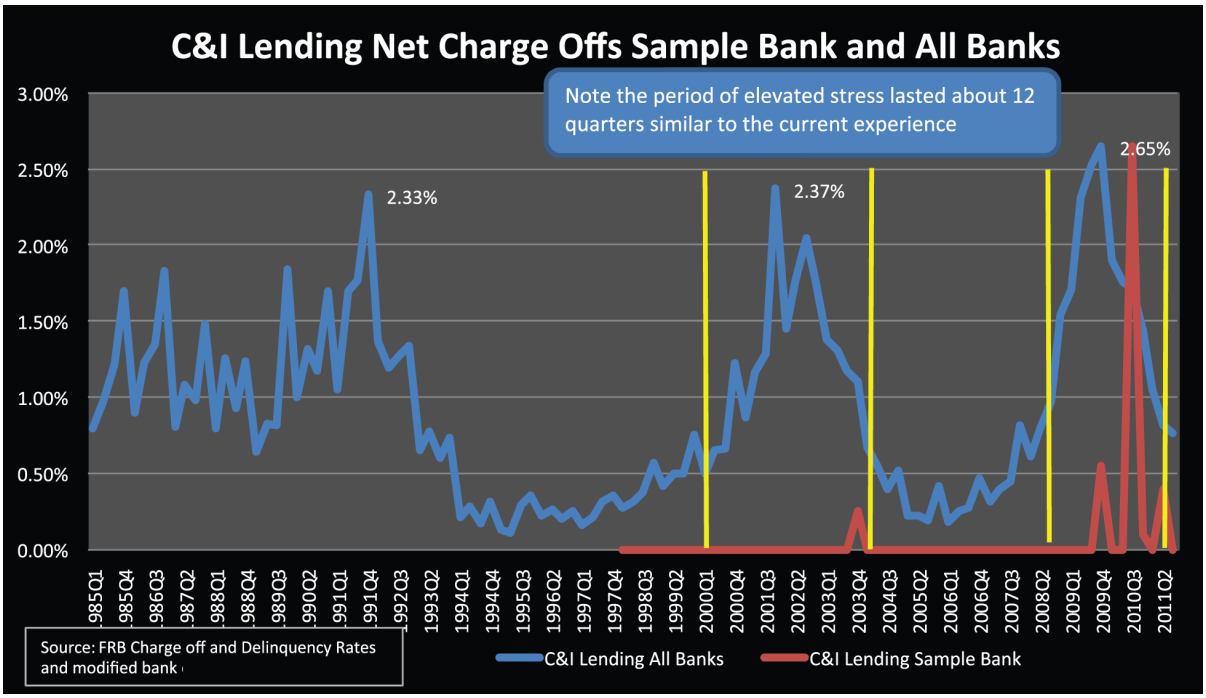
25. Rates are from the Basel Committee on Banking Supervision, "International Convergence of Capital Measurement and Capital Standards," Bank for International Settlements, June 2006.

## HISTORICAL

Historical data can be used to determine the level of stress. Historical data can come from the bank or public sources or both. Banks can use their internal experience with stressed losses to determine the appropriate amount of stress to apply to a portfolio.

*Helpful Hint:* Using historical data can be the easiest means by which to develop a stress test. Start simple by examining loss in the overall portfolio or what's referred to as top of the house analysis. Then as stress testing becomes more comfortable, start to conduct bottoms up and more holistic stress tests Bottom line: don't become paralyzed by the effort, start small.

Limitations of using a bank's internal data is the amount of history available to the bank, the quality of data, if the data captures a full credit cycle, and if the data is still representative of the portfolio. Because of these limitations, banks sometimes can use a combination of internal and public data to infer the loss. For example, a de novo or bank with limited loss experience in a particular portfolio may wish to combine the bank's own experience overlaid with industry shocks.





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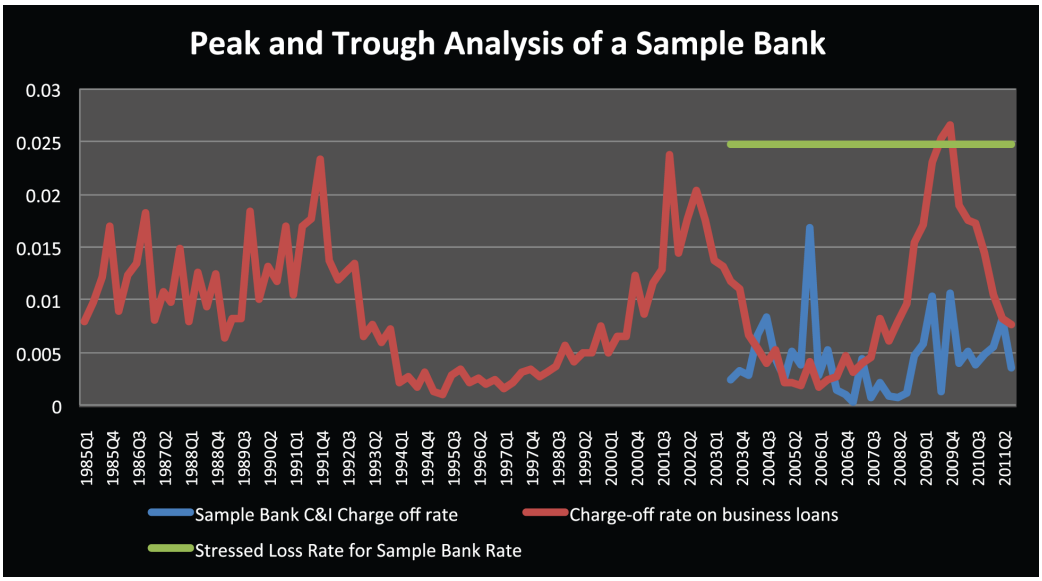
Public historical data from previous recessions or crises are integral in determining the appropriate level of stress.[26] As an example a bank can estimate the average level of losses over a complete business cycle using the public data and then infer that rate onto the current portfolio. To do this the practitioner should calculate the average level of loss over the entire business cycle for the public data. Then determine the percentage increase in loss from the average to the peak loss experience. Next the bank should calculate its average loss experience then apply the percentage increase in loss calculated from the public data to the portfolio. At times the bank may have to use the absolute percentage if its loss experience over time is zero. The above data for commercial real estate will be used as an example.

Prior to 2004 this bank had no loss experience in C&I therefore applying a percentage change from the average experience to the peak does not yield a valid result. Therefore, prior to the current period this bank may wish to apply the elevated shock experienced by the industry of 2.37% and determine if the C&I portfolio could sustain a prolonged shock of this magnitude. Then as the bank begins to build a loss history the additional history can be substituted.

Another technique is to stress a bank's loss rate using a peak to trough stress inferred from the public data. The average trough experiences a loss rate of 0.35% while the average peak loss experience is 1.98%. These averages are determined by taking the public data, defining the periods of peak and trough and averaging the data points. This process yields a 562% loss differential between peak and trough. The sample bank in the following figure has slightly more historical loss information that allows for the calculation of a valid loss average. The average loss experience of this bank is 0.44%.

Using this loss rate and applying the above peak to trough methodology would yield a peak stress loss of 2.5% (562%*0.44%=2.5%). The blue line in the graph is the bank's historical loss experience and the green line is the calculation of the stressed loss, confirming the actual loss is within the bounds of the stressed loss.

26. Public data sources are described in the data section of this workbook




Instead of using a loss shock, a bank may wish to use a loss ramp. As the figures show, rarely do losses spike overnight and stay at an elevated level, they normally ramp up then down. A sustained spike at the maximum over a prolonged period may be too severe for the bank. Therefore, the bank may choose to replicate the ramp up and down of the loss experience over the 12-quarter duration of elevated stress. Using the above historical information is a great way to determine the severity and duration of the stress.

One additional stress testing technique that uses historical data is Value at Risk (VaR) or a reduced version that can be referred to as maximum probable loss. Maximum probable loss is a simplified version of VaR that examines the volatility of the historical industry losses over time to understand their movement from the mean. A bank may not have sufficient loss data to enable it to use its own experience to inform a sufficient amount of stress. In this instance, the bank may combine its average loss data with the industry volatility to develop the worst case scenario. As an example, using the historical industry loss information the standard deviation of percentage changes in charge-offs in C&I lending is calculated as 0.0062. Next a confidence interval of 99.9% was selected along with the sample bank loss rate of 0.44%. Plugging this information into the Excel function that calculates the inverse normal[27] yields a stressed loss of 2.4%. In contrast the bank's own loss deviation is only 0.0035 which yields a 99.9% worst case loss of 1.52%. Using this technique allows the practitioner to use additional information to formulate worst case events. This technique can also be used to determine probable moves in losses, interest rates, income, etc.

27. The Excel function that yields the above result is as follows: =NORMINV(0.999,0.0044,0.0062)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| HISTORICAL ANALYSIS | |
|---|---|
| STEP 1 | Obtain the historical loss data for the industry losses and the bank's own experience. |
| STEP 2 | Calculate mean and standard deviation of the series. |
| STEP 3 | Determine the appropriate confidence level e.g. 95%, 99%, or 99.9%. |
| STEP 4 | Plug the information into the Excel formula = Norminv (confidence interval, mean, standard deviation) to arrive at the stressed answer. |
| STEP 5 | Apply the stress to the portfolio losses. |
| STEP 6 | Repeat steps 1 through 5 for the various loan types in the portfolio, e.g., mortgages, auto, C&I, etc. |
| STEP 7 | Aggregate the losses to determine the overall impact. Note: This method assumes worst case correlations, a more complex analysis could consider correlations or movements between products that is less than one. |

Historical data has its benefits, however, one important caveat when using historical data is that past events do not always accurately predict future performance. The graph on the previous page shows that the loss rate experienced in 2009 eclipsed the previous stress environments. At the same time, the duration of the previous uptick in C&I losses was of longer duration than the current experience.

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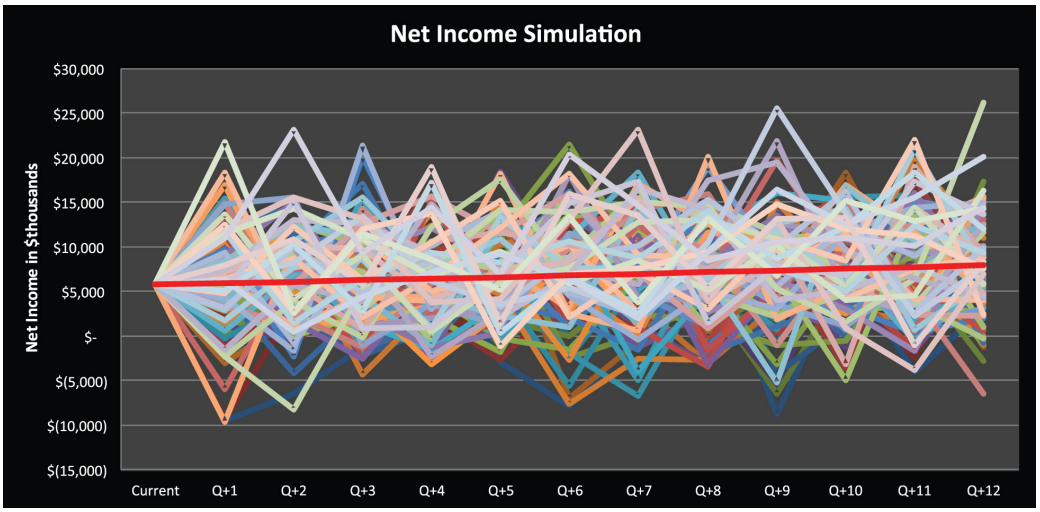
## SIMULATION

Simulation analysis is another means of stress testing. Bankers are familiar with the results of simulation analysis - simulation is frequently the methodology used in the estimation of interest rate risk. These same methods can be extended to simulate additional performance metrics.

The premise of simulation analysis is to use historical volatility of the data to forecast future periodic changes in the item being stressed. Multiple scenarios or paths are run to construct a distribution of outcomes. The more paths estimated the better the accuracy of the resulting distribution of outcomes. After running the simulation these outcomes can be rank ordered to determine best and worst case events. Simulations can be constructed using a number of Excel add-ins or by using the random number generator in Excel. The following is an example of a simulation conducted using the Excel random number generator on the net income of a bank for which 100 paths were run simulating income over a three year period. The red line in the graph depicts the mean expectation of net income and the other lines are the 100 paths. Selecting the 99th worst path is equivalent to selecting the 99th percentile worst outcome. Likewise upside cases can be selected as well. The following table provides selected results from the simulation.




The table presents the base case, an upside case that is one standard deviation above the mean, a severe case at the 75th percentile below the mean and a worst case which is at the 99th percentile below the mean. This simulation was conducted very simply in Excel using the random number generator function in Data Analysis to develop the random paths. The random number generator requires that a mean and standard deviation be specified and, for this exercise, a normal distribution was selected. The mean is based upon the mean expected net income forecast and the standard deviation is estimated from the banks historical data.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| | CURRENT | Q+1 | Q+2 | Q+3 | Q+4 | Q+5 | Q+6 | Q+7 |
|---|---|---|---|---|---|---|---|---|
| Base Case | $5,770 | $5,929 | $6,087 | $6,249 | $6,416 | $6,587 | $6,763 | $6,944 |
| Upside | $5,770 | $2,857 | $10,526 | $15,549 | $7,456 | $10,858 | $4,793 | $4,012 |
| Severe | $5,770 | $3,768 | $6,852 | $9,120 | $1,694 | $6,968 | $2,836 | $4,120 |
| Worst | $5,770 | $(9,500) | $(6,529) | $(1,276) | $10,456 | $(3,000) | $(7,930) | $(328) |

| | Q+8 | Q+9 | Q+10 | Q+11 | Q+12 | SUM | YEARLY AVERAGE |
|---|---|---|---|---|---|---|---|
| Base Case | $7,129 | $7,320 | $7,515 | $7,716 | $7,922 | $82,577 | $27,526 |
| Upside | $6,191 | $12,558 | $14,262 | $680 | $5,883 | $95,626 | $31,875 |
| Severe | $5,941 | $3,023 | $8,329 | $1,148 | $4,600 | $58,400 | $19,367 |
| Worst | $11,133 | $(8,759) | $7,667 | $(4,154) | $2,946 | $(9,274) | $(3,091) |

A comprehensive discussion of simulation and simulation techniques is well beyond the scope of this workbook, however we present it as an alternative. Different types of techniques and correlations can be incorporated as well. Interested analysts should refer to a text book on simulation to better understand these techniques.

One limitation of simulation analysis is the meaning of the 99th worst case path. While the method is good at determining the distribution of outcomes it is unclear what lead to that particular path occurring. There is no clear connection as to how the macro factors or internal factors lead to the simulation result. All we know is that based upon the volatility of the historical data that path is possible.

## FACTOR ANALYSIS

The stress testing technique of factor analysis shocks individual drivers of loss to determine what the overall impact might be. For example, in analyzing the impact of drivers of credit loss in commercial real estate, the analyst may shock factors such as property value, debt service coverage, vacancy rates, net income or cap rates to determine the impact on credit loss. In analyzing consumer credit losses, factors such as income, unemployment, debt to income, change in LTV, etc., may be shocked to determine the overall impact on loss. Other factors might be a shock in interest rates or foreign exchange rates and investigating the impact those might have.

| FACTOR ANALYSIS | |
|---|---|
| STEP 1 | Develop a simple model interval that allows loan ratings to be a function of factors such as cap rate, debt service, coverage ratio, loan to value, etc. |
| STEP 2 | Determine the appropriate amount of shock to apply by using historical information regarding the factor. As an example, pull information on historical shock in LTV using the steps listed prior. |
| STEP 3 | Determine how change in the individual factors will impact the loan ratings and, hence, expected loss. |
| STEP 4 | Aggregate the individual loan losses to determine the overall impact to the stress. |

One drawback of factor analysis is the ability of the practitioner to fully understand the relationship between the factor and subsequent loss. Trying to develop the relationship quickly gets into more sophisticated regression analysis to understand the main drivers and their relationship. These models can be difficult to develop and require long histories of rich data to fully understand the relationships. However, when examining relationships in a plain vanilla portfolio, simple relationships can be drawn and assumptions made. For example, a bank may wish to examine the impact of a rise in interest rates and related credit risk on variable rate loans. The analyst could examine the change in the debt service coverage ratio from a rate shock. Then make an inference about the number of loans that may go into delinquency and others into default from the increase in debt servicing. Simple analyses like these can reveal the degree to which the portfolio is sensitive to factor shocks. Again the conversations that will take place in trying to determine the relationship are just as important as the stress. Analysts, product managers, and management will have discussion on what is appropriate and what factors most impact performance and risk.


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## GRADE MIGRATION

Grade migration examines the impact on loss as loans migrate to lower buckets. Grade migration may shock a portfolio of loans down one or two risk grades and may determine the worst case impact on reserves and capital. A more realistic case is to pick something in between, such as 33% of the loans remain in the current bucket, 33% migrate down one grade, 33% migrate two grades, and 1% migrates up one grade. Again, depending upon the conservatism of management, they can pick and choose a scenario that is relevant to their risk appetite.

| GRADE MIGRATION | |
|---|---|
| STEP 1 | Develop a migration matrix in Excel the size of the current grading system. |
| STEP 2 | Populate the matrix with balances for each loan grade. |
| STEP 3 | Associate an expected loss rate to each grade. |
| STEP 4 | Determine the level of stress for the shock, 1% up, 33% same, 33% one grade lower, and 33% two grades lower. The severity of the stress will determine the size of the shift. Moderate stress may only shift 10% down one and two grades. |
| STEP 5 | Calculate the sum product of the new balance in each bucket times the loss rate. This total is the aggregate loss from the grade migration. |

Grade migration can be a little cumbersome to conduct outside of a vendor supplied model. These more sophisticated models use statistical techniques called Markov chains to determine the probability of transitioning from one bucket to the next over multiple time periods. A description of this type of stress testing is beyond this workbook and requires explanation by the software vendor. This workbook provides a simplified version of a grade migration analysis that can be conducted in Excel.

Banks that wish to conduct this exercise in Excel should start with a snap shot of the loan book from their data provider. Load the snapshot into Excel and make varying assumptions about the potential migration and subsequent loss rates. Be sure to keep track of the loan status and rating and aggregate the amount of loans within each bucket. Then consider the impact the loss rates might have on reserves and capital. An example of a migration table is shown on the next page. The data used in the tables are fictitious.

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As the table below indicates, the first step is to determine the loan balances in each bucket and the expected loss associated with each grade. The sum product yields the aggregate expected loss.

Starting Balances

| | | Future | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pass | | | | | | Special Mention | Sub Standard | Doubtful | Loss | |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Current | 1 | $300,000 | | | | | | | | | | |
| Pass | 2 | | $400,000 | | | | | | | | | |
| | 3 | | | $500,000 | | | | | | | | |
| | 4 | | | | $1,000,000 | | | | | | | |
| | 5 | | | | | $700,000 | | | | | | |
| | 6 | | | | | | $600,000 | | | | | |
| Special Mention | 7 | | | | | | | $250,000 | | | | |
| Sub Standard | 8 | | | | | | | | $350,000 | | | |
| Doubtful | 9 | | | | | | | | | $300,000 | | |
| Loss | 10 | | | | | | | | | | $100,000 | |
| | Totals | $300,000 | $400,000 | $500,000 | $1,000,000 | $700,000 | $600,000 | $250,000 | $350,000 | $300,000 | $100,000 | |
| | Loss Factor | 0.10% | 0.15% | 0.25% | 0.50% | 0.75% | 1.00% | 1.50% | 2.50% | 5.00% | 10.00% | |
| | | | | | | | | | | | | Sum |
| | Expected Loss | $ 300 | $ 600 | $ 1,250 | $ 5,000 | $ 5,250 | $ 6,000 | $ 3,750 | $ 8,750 | $ 15,000 | $ 10,000 | $55,900 |

Next calculate the severity of the stress test by determining the percentage of balances that will migrate. The table depicts a loss migration of 1% up, 33% down one grade, and 33% down two grades. Observe bucket 10 has 66% because there is no state lower than 10.

Migration Rate Table

| | | | | | | | | Special Mention | Sub Standard | Doubtful | Loss |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Current | 1 | 0.34 | 0.33 | 0.33 | | | | | | | |
| Pass | 2 | 0.01 | 0.33 | 0.33 | 0.33 | | | | | | |
| | 3 | | 0.01 | 0.33 | 0.33 | 0.33 | | | | | |
| | 4 | | | 0.01 | 0.33 | 0.33 | 0.33 | | | | |
| | 5 | | | | 0.01 | 0.33 | 0.33 | 0.33 | | | |
| | 6 | | | | | 0.01 | 0.33 | 0.33 | 0.33 | | |
| Special Mention | 7 | | | | | | 0.01 | 0.33 | 0.33 | 0.33 | |
| Sub Standard | 8 | | | | | | | 0.01 | 0.33 | 0.33 | 0.33 |
| Doubtful | 9 | | | | | | | | 0.01 | 0.33 | 0.66 |
| Loss | 10 | | | | | | | | | | 1 |


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The next step is to calculate the new balances in each grade. Finally, the sum product of these balances with the associated expected loss rates and the result is the new stressed expected loss. In this example, the starting expected loss was $55.9MM and, after the stress, the expected loss increased to $91.7MM, an increase of almost $36MM. Note that these changes only consider loss in the current balance. Typically as a loan approaches default the borrower starts to draw down on the open lines. These open lines can be considered as well using a credit conversion factor that translates the open line into principal balance to determine the overall exposure. This adds an additional step because the bank must calculate the balance in undrawn lines then apply a factor (say 75%) to determine the amount that would translate to additional exposure.

Ending Balances after Migration

| | | Future | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Pass | | | | | | | Special Mention | Sub Standard | Doubtful | Loss |
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | |
| Current | Pass | 1 | $102,000 | $ 99,000 | $ 99,000 | | | | | | | |
| | | 2 | $ 4,000 | $132,000 | $132,000 | $ 132,000 | | | | | | |
| | | 3 | | $ 5,000 | $165,000 | $ 165,000 | $165,000 | | | | | |
| | | 4 | | | $ 10,000 | $ 330,000 | $330,000 | $330,000 | | | | |
| | | 5 | | | | $ 7,000 | $231,000 | $231,000 | $231,000 | | | |
| | | 6 | | | | | $ 6,000 | $198,000 | $198,000 | $198,000 | | |
| | Special Mention | 7 | | | | | | $ 2,500 | $ 82,500 | $ 82,500 | $ 82,500 | |
| | Sub Standard | 8 | | | | | | | $ 3,500 | $115,500 | $115,500 | $115,500 |
| | Doubtul | 9 | | | | | | | | $ 3,000 | $ 99,000 | $198,000 |
| | Loss | 10 | | | | | | | | | | $100,000 |
| | | Totals | $106,000 | $236,000 | $406,000 | $ 634,000 | $732,000 | $761,500 | $515,000 | $399,000 | $297,000 | $413,500 |
| | | Loss Factor | 0.10% | 0.15% | 0.25% | 0.50% | 0.75% | 1.00% | 1.50% | 2.50% | 5.00% | 10.00% |
| | | | | | | | | | | | | Sum |
| | | Expected Loss | $ 106 | $ 354 | $ 1,015 | $ 3,170 | $ 5,490 | $ 7,615 | $ 7,725 | $ 9,975 | $ 14,850 | $ 41,350 | $91,650 |
| | | Change | $ (194) | $ (246) | $ (235) | $ (1,830) | $ 240 | $ 1,615 | $ 3,975 | $ 1,225 | $ (150) | $ 31,350 | $35,750 |

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# ADDITIONAL CONSIDERATIONS ON STRESS TESTING

Since most community banks use outside vendors to stress test their risk to interest rates the most frequent risk subject to internal stress testing is an organization's loan portfolio. Factors to be considered in testing the portfolio include: loan types, loan concentration–both industry and market-and the correlations between loan types or borrowers.

## MODEL GOVERNANCE

Like any model within the bank, stress testing models should be shrouded with adequate governance and controls. These would include policies related to the stress testing process and procedures on running the models. This workbook will only highlight some of the governance features; however, practitioners are encouraged to refer to the supervisory guidance contained in SR Letter 11-7 "Guidance on Model Risk Management."[28] SR 11-7 details the oversight and process banks should consider in managing model risk. These same principles apply to stress testing models.

### MODEL VALIDATION AND BACK TESTING

All models used in stress testing should be validated to ensure that the theory and code used to develop the model are adequate. Bank management should also ensure that the analysts overseeing the stress testing models have the appropriate competencies and experience in model development, methodology, and maintenance. Data and data integrity are also critical to this process. Analysts should also understand model limitations and communicate those limitations to management to make sure decision makers have an appreciation for the limitations when making decisions.

Back testing is also an important component of a well-functioning stress testing program. Back testing ensures that the risks are sufficiently considered. Breaches in outcomes going outside the stressed bounds indicate that the level of stress being considered in the model is inadequate. In these instances the model should be recalibrated with the new data to better capture the risk inherent within the bank, especially the risk in the tails. The only way to monitor this is to periodically back test the results to ensure the actual results are within the envelop of potential results. If not, additional stress or variance should be applied-what is referred to as "tweaking the tails".

28. SR Letter 11-7 "Guidance on Model Risk Management," April 2011. http://www.federalreserve.gov/bankinforeg/srletters/sr1107.htm


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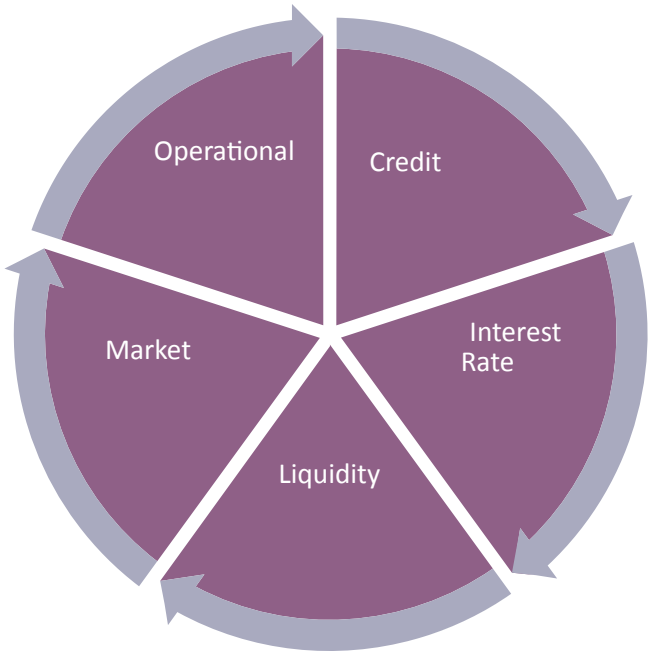
## DOCUMENTATION

Good documentation is critical to the success of any stress testing program. It is imperative that the rationale for particular choices and their implications be explained and documented so the board and senior management are aware of the limitations of the stress tests performed (i.e., the key underlying assumptions, the extent of judgment in evaluating the impact of the stress test, or the likelihood of the event occurring). Senior management should consider an appropriate number of well-understood, documented, utilized, and sufficiently severe scenarios that are relevant to their bank. Further, the stress testing process should be well governed by policies, procedures, and controls. Analysts should document their model methodologies and prepare a how to guide to ensure consistency each time the model is run. In addition, analysts should document any assumptions or adjustments made to the model. Finally, documentation is critical to explain the data used, its source, and how it was manipulated. These codifying assumptions are critical to minimizing model risk and preventing unexplained swings in stress test results due to inconsistently applied assumptions.

# CORRELATIONS

Correlation is the measure of how two or more factors may relate or be connected to each other. Thus, correlations (consider the likelihood of borrowers defaulting at the same time) should be taken into account when establishing stress tests. When developing the stress tests, management should recognize the reality that negative events may not occur one at a time but may be related. For example, if there are credit problems, the economy may be in a recession, so interest rates may be low. Low interest rates can stress liquidity. This means that not only should the process consider the impact of credit, it would also need to factor in the cost of liquidity during a recessionary time. How the bank chooses to view risk will determine the type of analysis to conduct. Although not ideal different types of analysis may be combined on the same problem because of limitations in systems or data.

**Watch out for correlations among the risk types**

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Correlations may exist between loan types, for instance, the relationship between retail and commercial credit losses. Correlations can also occur between borrowers within a credit class. As an example, if real estate values in an area drop precipitously then losses within that class would be expected to rise as more properties go into default. Finally, correlations may exist across risk classes. For example the relationship higher interest rates may have on increased credit losses because of the increase in debt service coverage of variable rate loans. Regardless of the type, management should consider and analyze the correlations that exist within the portfolio and incorporate those correlations into the stress testing. If correlations are not considered, interrelated factors may be stressed multiple times. This method poses a bit of a problem because it can lead to overstressing the portfolio and result in outcomes that are unusable. Consider that if each loan type in the portfolio is stressed to its worst case, correlation is being considered; however, the assumption is that the correlations are one. Management should recognize this and understand the level of conservatism being considered.

Describing the in-depth steps on how to deal with the various types of correlations is beyond the scope of this workbook. However, statistical books and even some Excel add-in simulation packages take correlations into account. Note that if the bank uses one of these packages or a vendor model that considers correlations, the bank should stress test correlations to determine what may happen if historical correlations breakdown. This is good to understand, especially if the data is coming from a benign credit environment, in order to better consider the overall implications of a worst case scenario. Since the last crisis, regulators are asking banks to better understand these correlations during severe shocks or events with good reason. As the tables in Appendix D indicates correlations between loan products were low during the period of 1991 to 2006. As an example, the correlation between commercial real estate loans and single family residential mortgages was 0.57 during this period. In fact, credit cards had negative correlation with CRE and had almost a zero correlation with charge-offs on farmland. However, as the table in Appendix D indicates, these relationships all changed in the 2007 to 2011 period; as during this time the correlation between CRE and single family rose to 0.95. The correlation between credit cards and CRE rose to 0.89 and the correlation between credit cards and farmland went from near zero to 0.80. Therefore when considering correlations, consider stress testing the correlations as well because they tend to go to one in extreme environments.


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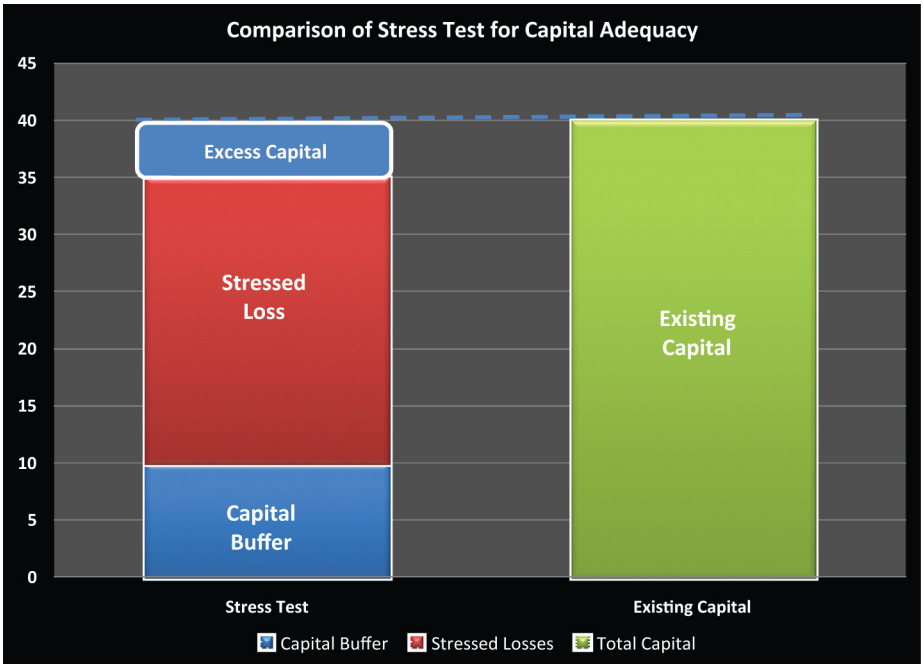
# LINKING THE STRESS TEST TO CAPITAL

The main tenant of stress testing is to use the results to inform the capital adequacy of the bank. The SCAP provides insight into how banks should make that linkage. Recall the SCAP was designed by regulators, therefore, it provides a window into their expectations in using stress testing to determine capital adequacy. The SCAP required banks to compare the existing capital of the SCAP banks to the required capital under the stress test. Further, after the stress tests, banks were required to maintain a 4% common equity buffer as a protection against solvency. The figure below depicts the stress and required buffer.




The SCAP requires the stressed loss to be in addition to a capital buffer maintained by the bank. The SCAP states, *"A BHC was considered to require an additional SCAP buffer if its pro forma Tier 1 ratio was below 6 percent or if its pro forma Tier 1 Common ratio was below 4 percent at the end of 2010."* This dual requirement may be overly conservative for community banks. Therefore, banks wishing to use the SCAP methodology to determine capital adequacy may wish to choose 4% or 5% Tier 1 common to risk weighted assets for the following reasons.

Therefore, because of the limited risk to the financial system and the limitations on many small banks due to their legal structure, it is recommended that community banks either hold a capital buffer equal to 4% or 5% of their risk weighted assets in the form of Tier 1 common equity after the stress. At the end of the day, the buffer that management chooses to hold should be in line with the bank's risk appetite.

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## Steps in using a SCAP like Stress Test to Inform Capital Adequacy

1. Gather bank delinquency experience.
2. Compare this to the SCAP delinquency experience and calculate an adjustment factor.
3. Select the appropriate range to benchmark, e.g. bottom, midpoint, or top of the range and adjust the level of loss using the adjustment factor.
4. Apply the loss ratio to the appropriate balances.
5. Repeat steps 1-4 for all lending types.
6. Aggregate the amount of portfolio credit loss.
7. Calculate the corresponding two year forward pre-provision earnings associated with the credit loss.
8. Establish the level of reserves required at the end of year two.
9. Add up the sources of uses of capital and determine if the capital expense is greater than 4% of Tier 1 common to risk weighted assets.
10. Finally, use the results of the stress test to learn more about the bank's capital adequacy.

When using a stress test to infer capital adequacy a bank should stress each loan portfolio then aggregate the loss results. While the SCAP only considered credit losses it is recommended that changes in equity due to operational losses and interest rate risk should be included when considering the aggregate level of loss. After aggregating the stressed loss, the bank needs to determine the level of retained earnings the bank will generate over the next two years and use those as an offset to the required capital. Any dividends or other capital distributions should be considered as well. Next, determine the level of reserves to be held by the bank at the end of two years to ensure an ongoing ability to absorb loss. Finally, these numbers should be aggregated and compared to the minimum capital buffer and determine if the bank is adequately capitalized.


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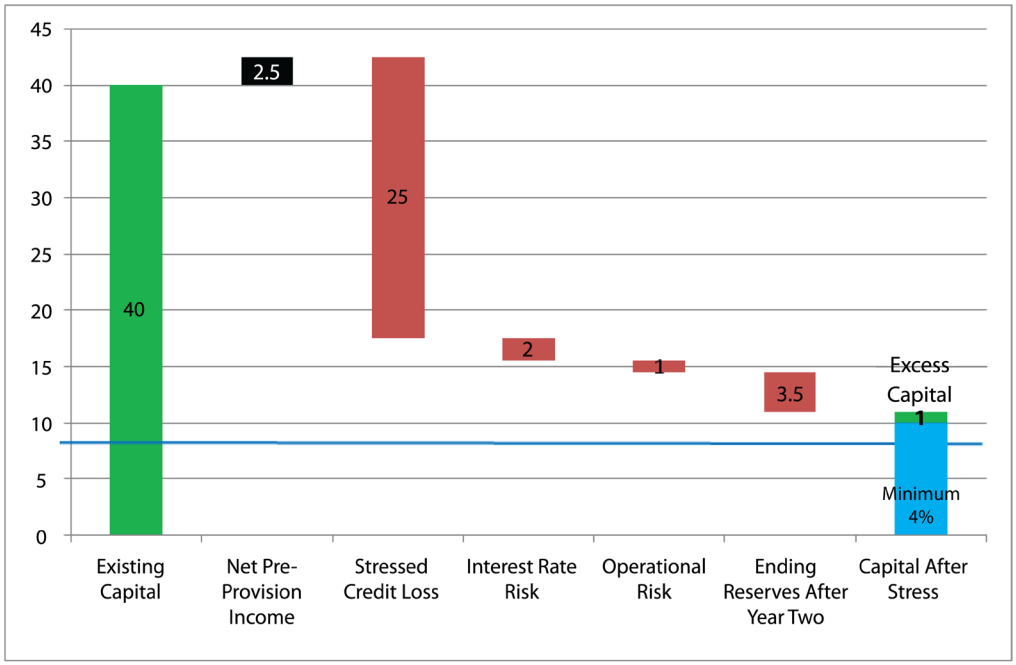
The waterfall chart below depicts the process for a sample bank. The bank begins with $40MM in Tier 1 common equity and is projected to have $2.5MM in pre-provision net income in the next two years. This is permitted to be added as a capital cushion because earnings are the first line of defense to absorb losses. Next the stressed credit loss of $25MM is subtracted based upon the stress test, $2MM is subtracted based upon losses arising from its interest rate risk stress, and finally the bank estimates $1MM in potential losses from operational risk. Next the bank will also need to maintain an expected reserve at the end of the two-year stress which is adequate to absorb the expected loss anticipated at that time. In this instance the bank calculates it to be $3.5MM. The residual is $11MM after the stress. The bank calculates it requires a $10MM buffer to achieve the 4% Tier 1 common threshold which leaves a capital buffer of $1MM. Management and board should review this buffer and determine its adequacy.




This type of scenario analysis is useful for determining the potential impact to the portfolio. Management should consider the depth of the shock, the duration of the shock, and their ability to raise capital under adverse conditions prior to determining if the bank is adequately or inadequately capitalized. Unlike the SCAP banks, if there is a shortfall the bank should not immediately go out and raise capital. Bankers should however, understand the drivers of the capital shortfall, timing of the stress, limitations of the analysis, and explore potential mitigation plans and their ability to reposition the portfolio or hedge the loss.

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# REVERSE STRESS TESTING

Reverse stress testing is a relatively new concept that is gaining popularity in regulatory circles since the banking crisis. The concept of reverse stress testing is to identify scenarios that will "break the bank." Literally, the concept is to identify scenarios or situations which will cause the bank to become insolvent. The industry has yet to fully embrace reverse stress testing because of several shortcomings of the analysis. One of the main tenets of stress testing is developing plausible scenarios that can point out weaknesses in bank strategy or lead to effective risk mitigation. The key is creating "plausible" scenarios that management believes in and will, therefore, own the outcome and take the necessary steps to develop contingencies to ensure the viability of the bank. Reverse stress testing can be at odds with this tenet because of the sometimes extreme events necessary to force insolvency.

The criticism resides in utilizing extreme events to break the bank, which may not mirror reality. As a result, management may not take the outcomes seriously and never follow through with the steps necessary to protect against such events. However, extreme events do occur. Prior to 2007, decision makers might have found it difficult to develop mitigation plans for any of the following scenarios individually because their probability of occurrence would have seemed unimaginable: default of a AAA company, default of a prestigious and historic investment bank while several others must be bought out within months of each other, mortgage insurers are reduced to junk, the commercial paper market freezes, securitization markets cease to exist, banks fail to lend to one another, and U.S. debt becomes downgraded by one of the rating agencies. Managers would have to have been prescient to envision this perfect storm prior to 2007. Therefore, while it may be hard to conceive, severe events should be considered.

There may be benefits of reverse stress testing. First, reverse stress testing helps to identify new sensitivities and trigger points that may lead to the bank being in crisis. Identifying these trigger points early on or with enough lead time can lead to a revision of bank strategy and, thus, mitigation of the inherent risk. Further, reverse stress testing can help a bank revise its current trigger points used in stress testing. It may also lead to a deeper analysis into the limits and tolerances established in the bank's risk appetite. As the bank begins to dig deeper into the causes or triggers, they may recognize that business level limits or tolerances should be modified to aid in risk mitigation. This may lead to changing concentration levels and limits to reduce exposure to various segments of risk or lead to determining ways to reduce or hedge exposure. The findings of a reverse stress test can also assist in enhancing a bank's capital and liquidity planning. Finally, reverse stress testing raises management's awareness to low probability high severity events. These are the types of events management may or may not want to insure against. Events like the avian flu and other catastrophic events fall into this category of low probability, high severity type events and should be analyzed as well.

However, by going through the steps, reverse stress testing brings these events to light allowing management and the board to consider the potential costs and benefits.


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# FREQUENCY

The frequency of stress testing depends upon the size, complexity, and growth rate of the financial institution as well as the state of the economy. An institution in a high growth mode and/or experiencing turbulent economic conditions should conduct stress testing more often than another institution in a stable growth mode and a stable economic situation. The minimum frequency to conduct a comprehensive stress test should be annually and coincide with the strategic planning or annual budgeting process. Interest rate risk should be run at more frequent intervals depending upon the composition of the loan book or securities portfolio.

Factors to consider when determining frequency:

- The inherent risks of the institution's business.
- The composition of the balance sheet and income statement.
- The speed with which circumstances could change.
- The speed with which the institution could respond to the changing circumstances.
- The internal and external limitations placed on the organization that could limit its ability to adjust to changing circumstances.
- Regulatory requirements.
- An acquisition or divestiture.

Stress tests should be conducted on a regular time schedule and should test an agreed upon menu of possible events. The timing is based upon the nature of the institution's business, the resources available to conduct the test, and the purpose for which the stress test will be used. In the event the market becomes more volatile, the organization should have the ability to stress test its business more frequently.

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# TIME HORIZONS

Stress testing should include various time horizons depending on the risk characteristics of the analyzed exposures and whether the particular test is intended for tactical or strategic use.

Considerations for the length of time horizons:

- If the stress is to assist in the strategic planning process the practitioner should choose events or scenarios that will last for the planning period. For example create base case, worst case, and upside of the future forecasts that lasts the duration of the planning horizon.

- The recommended length of time for stressing capital adequacy is a two- to three-year period. A two- to three-year planning window provides a sufficient time period to understand the impact on the balance sheet and income statement. That also provides the practitioner sufficient time to build in things like the potential of a double dip recession during the planning cycle. Establishing a two- to three-year outlook is supported by the two-year horizon prescribed in the SCAP and the desire of many examiners to see three-year capital plans for banking institutions. Also consider the following chart in that the duration of recessions in the past 50 years has been 11 months. However, the last recession (2007-2009) lasted 18 months. Provided this recent history, banks should consider 18-month peak to trough cycles. While recessions may only last an average 18 months, trough to peak to trough cycles in C&I can last 10-12 quarters.

- When stressing at the loan level, consider loan maturity dates to provide a forward view as to when loans will mature and the balances re-written. The stress should capture a preponderance of those dates to consider how loans will perform and the impact to the balance sheet.

- Further, when considering the potential impact of interest rates and loan performance consider the dates loans will re-price in order to understand the broad band into which they will fall and whether rates will rise during the period prior to re-pricing. As alluded to earlier, a rise in interest rates may place pressure on the debt service coverage ratio and, hence, credit.

- When stressing the securities portfolio, consider investment maturity dates; and ensure that the stress period covers those dates to inform potential adverse effects from reinvesting those funds at an inopportune time.


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## US Business Cycle Expansions and Contractions

| Business Cycle Reference Dates | | Duration In Months | | | |
|---|---|---|---|---|---|
| **Peak** | **Trough** | **Contraction** | **Expansion** | **Cycle** | |
| *Quarterly dates are in parentheses* | | *Peak to Trough* | *Previous Trough to this Peak* | *Trough from Previous Trough* | *Peak from Previous Peak* |
| | December 1854 (IV) | -- | -- | -- | -- |
| June 1857(II) | December 1858 (IV) | 18 | 30 | 48 | -- |
| October 1860(III) | June 1861 (III) | 8 | 22 | 30 | 40 |
| April 1865(I) | December 1867 (I) | 32 | 46 | 78 | 54 |
| June 1869(II) | December 1870 (IV) | 18 | 18 | 36 | 50 |
| October 1873(III) | March 1879 (I) | 65 | 34 | 99 | 52 |
| March 1882(I) | May 1885 (II) | 38 | 36 | 74 | 101 |
| March 1887(II) | April 1888 (I) | 13 | 22 | 35 | 60 |
| July 1890(III) | May 1891 (II) | 10 | 27 | 37 | 40 |
| January 1893(I) | June 1894 (II) | 17 | 20 | 37 | 30 |
| December 1895(IV) | June 1897 (II) | 18 | 18 | 36 | 35 |
| June 1899(III) | December 1900 (IV) | 18 | 24 | 42 | 42 |
| September 1902(IV) | August 1904 (III) | 23 | 21 | 44 | 39 |
| May 1907(II) | June 1908 (II) | 13 | 33 | 46 | 56 |
| January 1910(I) | January 1912 (IV) | 24 | 19 | 43 | 32 |
| January 1913(I) | December 1914 (IV) | 23 | 12 | 35 | 36 |
| August 1918(III) | March 1919 (I) | 7 | 44 | 51 | 67 |
| January 1920(I) | July 1921 (III) | 18 | 10 | 28 | 17 |
| May 1923(II) | July 1924 (III) | 14 | 22 | 36 | 40 |
| October 1926(III) | November 1927(IV) | 13 | 27 | 40 | 41 |
| August 1929(III) | March 1933 (I) | 43 | 21 | 64 | 34 |
| May 1937(II) | June 1938 (II) | 13 | 50 | 63 | 93 |
| February 1945(I) | October 1945 (IV) | 8 | 80 | 88 | 93 |
| November 1948(IV) | October 1949 (IV) | 11 | 37 | 48 | 45 |
| July 1953(II) | May 1954 (II) | 10 | 45 | 55 | 56 |
| August 1957(III) | April 1958 (II) | 8 | 39 | 47 | 49 |
| April 1960(II) | February 1961 (I) | 10 | 24 | 34 | 32 |
| December 1969(IV) | November 1970(IV) | 11 | 106 | 117 | 116 |
| November 1973(IV) | March 1975 (I) | 16 | 36 | 52 | 47 |
| January 1980(I) | July 1980 (III) | 6 | 58 | 64 | 74 |
| July 1981(III) | November 1982(IV) | 16 | 12 | 28 | 18 |
| July 1990(III) | March 1991(I) | 8 | 92 | 100 | 108 |
| March 2001(I) | November 2001(IV) | 8 | 120 | 128 | 128 |
| December 2007 (IV) | June 2009 (II)[29] | 18 | 73 | 91 | 81 |

| **Average, all cycles:** | | | | |
|---|---|---|---|---|
| 1854-2009 (33 cycles) | 16 | 42 | 56 | 55* |
| 1854-1919 (16 cycles) | 22 | 27 | 48 | 49** |
| 1919-1945 (6 cycles) | 18 | 35 | 53 | 53 |
| 1945-2009 (11 cycles) | 11 | 59 | 73 | 66 |

* 32 cycles
** 15 cycles

## THIRD-PARTY VENDOR MODELS

There are numerous third-party vendors that provide stress testing models. However, if an institution decides to utilize a vendor for this process, it is imperative that the vendor assure the bank that an external party has validated the vendor's model.[30] Regardless, the model design must be well understood by the institution, including senior management, and there must be complete transparency and thorough documentation of the design. Ask the vender for its test calculations and how well the validating party was able to replicate the results. Banks should perform some of their own tests to determine if the model is performing as expected using simple (+/-) shocks and determining if the output is consistent with logic and internal expectations.

One word of caution when using third party vendor models is to fully understand the degree to which the portfolio should be stressed. At times vendors have developed the models with predesigned stress test toggles of say 5, 10, and 20 percent. Do not fall into the trap of thinking 5% is sufficient for a slight stress and 20% is sufficient for a severe stress. Banks need to conduct their own due diligence on what is the appropriate level of stress for their book of business based upon the portfolio composition, underwriting standards, geography, and current macro economic conditions. At times a 5% stress may be considered severe and a 20% stress insufficient to cover the actual loss experienced. Therefore, use the above resources discussed prior to determine the appropriate level of stress to be applied in the model. The next section covers potential data sources that can be useful in inferring the level of stress to apply.

## DATA REQUIREMENTS

Data is the second most important element of stress testing (model methodology is the first). Data aggregation and data integrity are critical elements of the stress testing process and the data collected must be appropriate, up-to-date, and accurate. The data required will depend on the requirements of each particular scenario tested. An institution must carefully determine how the data integrity will be maintained so that accurate and current data is used for each test. Technology and existing available data should not make stress testing an excessive burden or cost.

29. The determination that the last expansion began in June 2009 is the most recent decision of the Business Cycle Dating Committee of the National Bureau of Economic Research. Source: NBER

30. Supervisory Guidance on Model Risk Management, SR 11-7, April 4, 2011, http://www.occ.treas.gov/news-issuances/bulletins/2011/bulletin-2011-12a.pdf.


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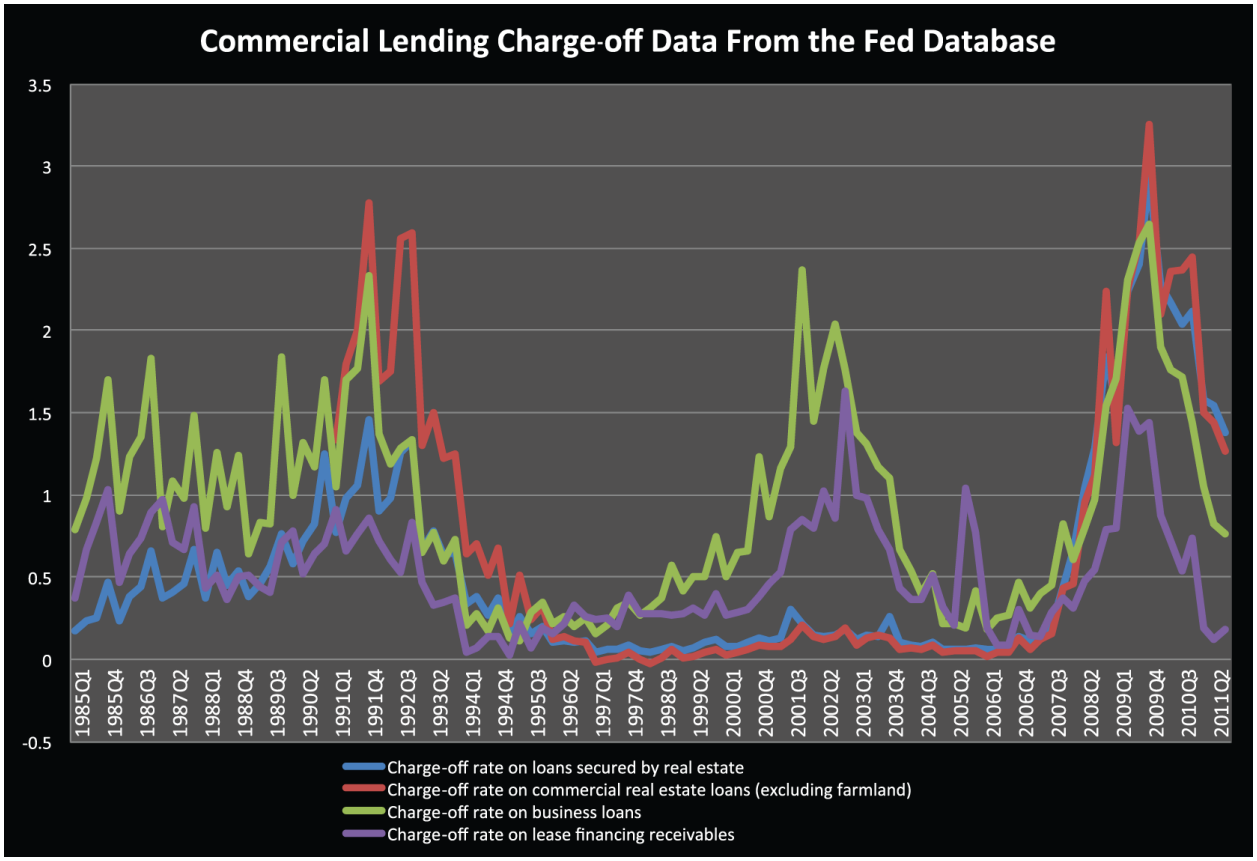
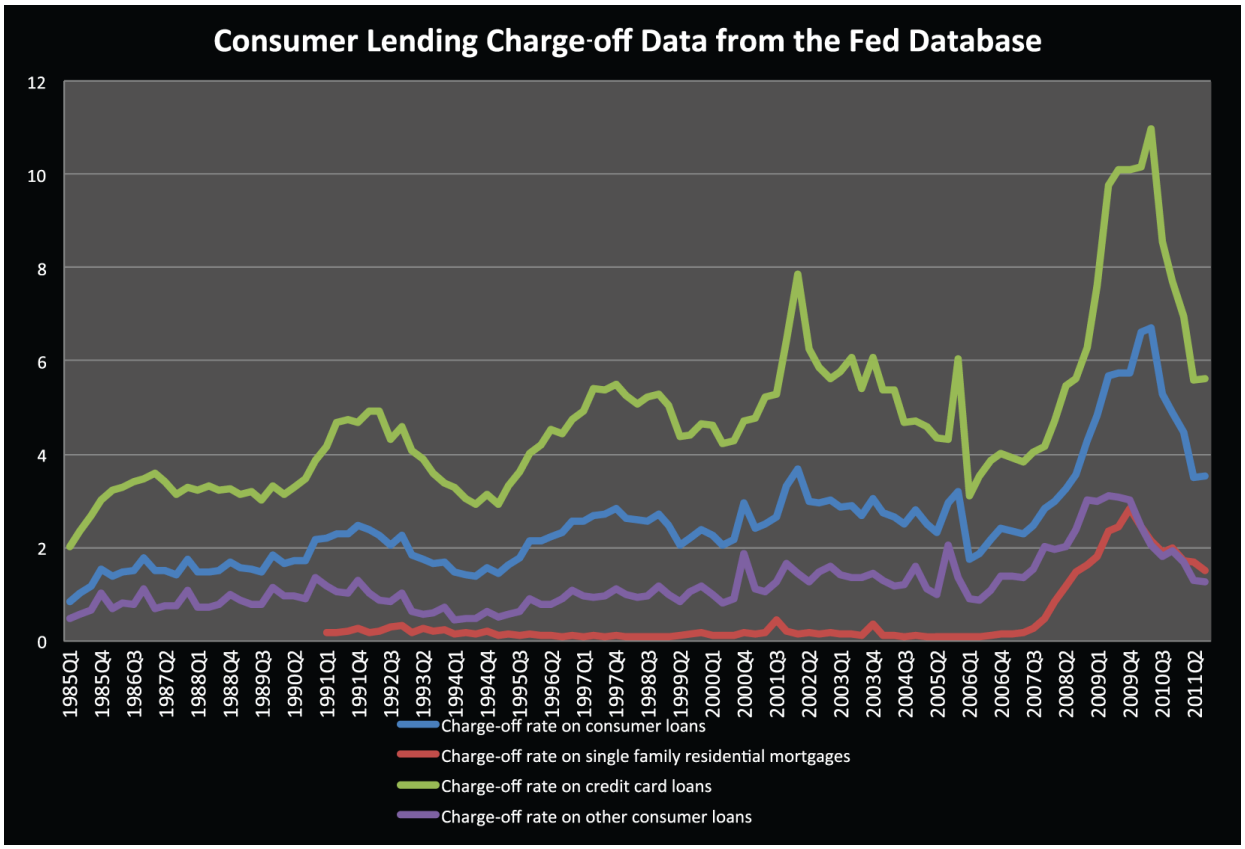
All banks should start simply with the data available at their fingertips in their call reports. Call report data is a great database of information regarding bank performance and is critical in establishing a baseline. Further, call report data is consistently defined and therefore enables peer to peer comparisons that can lead to valuable insights regarding risk. Peer or industry call report information is available free from the FFIEC website.[31] In addition to the data on the FFIEC website there are various pay services that collect and scrub this data and enable the practitioner to quickly use and manipulate the results.

A significant amount of aggregated industry data exists on various government websites. The Federal Reserve maintains a database of statistical release data[32] which is key to any beginning scenario analysis. It even has a data download program which downloads the data into Excel spreadsheets. Further, practitioners are able to customize and specify the form in which they would like the data.




31. Call Report and Thrift Financial Report data is available free from the following website: https://cdr.ffiec.gov/public/

32. Statistical release data download program can be found at http://www.federalreserve.gov/datadownload/ Although not represented on the following graphs, the data comes in raw and seasonally adjusted forms as well as a designation for the top 100 banks and all banks. In addition, charge offs and delinquencies in agricultural lending are provided from data captured from commercial banks (Farm Credit Agencies excluded).




The old saying about data and modeling, "garbage in garbage out," still holds true. If a bank does not have quality data, using the most sophisticated methodologies will result in false results and potentially false decisions. The amount of cost and effort a bank puts into its data should be based upon the size and complexity of the bank. If a bank is pursuing a low risk bank strategy and does not have good internal measures of loss, or, if the bank's loss experience is negligible, or they do not have a long history, then it may be appropriate for the bank to use public data to supplement their stress testing inputs. However, as the size or the complexity of the bank increases, the bank should spend the time and resources to develop internal data bases to capture the required information. The higher volatility of returns associated with more aggressive portfolios should be used in the analysis instead of potentially lower public data.

| | |
|---|---|
| **Low Risk Bank Strategy** | Banks with well-defined risks and core deposit funding can conduct simplistic stress tests based on public data. |
| **Moderate to Medium Risk Bank Strategy** | Banks with more concentrated or high-risk asset structures will require more specialized stress testing that has the ability to incorporate loan and security level data. |
| **High Risk Bank Strategy** | Banks with volatile business strategies that can lead to volatile assets and liabilities valuations or volatile income streams that may be subject to an inordinate amount of operational risk will need to stress asset quality, funding, operational, and reputational events based on a variety of scenarios which incorporate economic uncertainty, declining asset quality, an operational event, or lack of confidence in the bank. |

For some institutions an IT investment may be necessary to enhance the quality and accuracy of the data capture system to enable timely analysis and assessment of the impact of new stress scenarios in a rapidly changing environment. The end result of an IT investment should be improved data quality, accurate data entry, the ability to capture more robust data, accurate end-of-period reconciliations, and better accessibility to data. As the bank becomes larger, serious consideration should be given to developing a data mart to house key data elements. Sound policies and procedures on maintaining the integrity and viability of the database should accompany any process.

Participants in a recent RMA/AFS survey on data quality reported that the primary benefit of increasing the quality of data was more timely identification of emerging problems.[33] Thus, improvements in data quality, if necessary, should occur in conjunction with the implementation or expansion of a comprehensive stress testing program.

In addition to the accuracy of the data used in stress testing, it is important to consider that the data must be current as well as accurate. Depending on the data and the test being conducted, prior quarter data should be sufficient. Data that is two or more quarters old may be too stale for an effective stress test.

Banks should also consider the sample size used in the stress test. Depending upon the size of the portfolio, a bank may decide to stress the entire portfolio or entire segments of loan types. At times the bank may wish to only test high risk portfolio segments versus the entire balance sheet.

33. Data Quality: Is the Glass Half Empty or Half Full? Report on the fourth annual RMA/AFS state of enterprise data to support credit risk management. February 2011

The data required will be dependent on the final stress testing methodologies selected. The following is the list of data that will likely be utilized from both internal and external sources to complete top-of-the-house and bottom-up analysis. The granularity of assumptions between portfolio and loan level stress testing drives the granularity of the required data.

| Top of the House | Bottoms Up Analysis |
|---|---|
| • Current asset and liability balances by loan or liability type.<br>• Current and projected income streams.<br>• Schedule of asset and liability re-pricing dates.<br>• Current reserve and capital levels.<br>• Historical loss rates.<br>• Public data on loss rates by type.<br>• Peer data from call reports. | • Original appraised value including capitalization rate (cap rate) and date.<br>• Original LTV and date.<br>• Current loan value.<br>• Current loan balance.<br>• Borrower risk rating.<br>• Loan term or maturity.<br>• Current reserves.<br>• Re-pricing schedule of liabilities. |

Data that may be universal pto either type of analysis include current and forecast macro economic environment such as unemployment, house price indices, CRE price indices, GDP, interest rates, etc.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## TIMELINESS OF DATA

The data used in a stress test or scenario analysis should be the best available, timely, and unbiased version of the truth obtainable for the analysis. Utilizing stale or old data starts to add to model risk and inherently means the bank should be more conservative in applying assumptions regarding stress. As an example, stressing the LTV of a loan with an appraisal that is several years old would not produce the same level of confidence as stressing the LTV of a loan with an appraisal that is a few months old. In an ideal world, every bank would have current appraisals for the entire portfolio. In reality, this will not be the case, especially for performing loans with long-term maturities. Therefore, it is up to the practitioner to use prudent judgment when considering these separate cases and determine the appropriate amount of stress to apply. Finally, management should also be made aware of these limitations and any steps taken in the analysis to potentially put the comparison on par. Management may decide not to adjust the stress to keep things on par; however, they can make an informed decision armed with the knowledge that, potentially, some of the appraisals are old.

The next section details additional data requests to consider when analyzing specific types of stress tests.[34] [35]

34. DSC is the amount of cash flow available to meet annual interest and principal payments on debt. It is calculated as NOI divided by Total Debt Service. Ideally the ratio should be over 1 which means the property is generating enough income to pay its debt obligations. Negative DSC means the project is not generating enough income to cover the entire debt payments and the borrower is delving into personal funds each month to keep the project afloat. Banks should spend considerable time analyzing loans with negative DSC.

35. NOI is defined as income (earnings) before depreciation and interest expenses.

## Example of data elements required for Investor Commercial Real Estate portfolios:

- DSC
- LTV
- Current lease rates
- Current cap rates
- Current occupancy rates
- Current construction inventory of office buildings

## Example of data elements required for Owner Occupied Real Estate and Home Equity portfolios:

- Original and current LTV.
- Original and current FICO scores.
- Current real estate values.
- Foreclosure rates.
- Default rates.
- Percentage of higher LTV values combined with lower FICO scores.
- Re-pricing date.
- Maturity date.
- Current tax assessed value to determine if the property is declining in value between loan origination and maturity date and amount of decline. In many parts of the country appraisal values will mirror tax assessed values. Thus, if a new appraisal is ordered, there is a high likelihood that a capital call will be required if the loan amount is now below the tax assessed value.

## Example of data elements required for Commercial and Industrial (C&I) portfolios:

- Economic factors (GDP, per capita disposable income, housing starts).
- Industry risk ratings.
- Obligor risk ratings.


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# OUTCOMES

Once the stress test scenarios are completed they should be aggregated and reviewed to determine the following:

1. If the numbers in the outcome are realistic or if the inputs into the stress test should be reevaluated.
2. If one or more strategies need to be developed to address and alter balance sheet positions.
3. How quickly and the length of time the strategies should run based on the severity and likelihood of the scenario.
4. If there are regulatory issues that need to be addressed.
5. When findings should be reported to the board or committee of the board. Some banks have established early warning systems, each with specific triggers and pre-determined pathways, regarding their capital ratios, liquidity, concentrations, interest rate sensitivity, etc.

The outcomes of the stress test should be used to answer critical questions about the bank. Some of these questions are in the table on the following page.

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## CONCLUSIONS SHOULD BE INCORPORATED INTO STRATEGIC DECISION MAKING

| | |
|---|---|
| **Strategic Planning** | • Should earnings and growth forecasts be adjusted given the base scenarios and stress results?<br>• Should our risk tolerances be adjusted? |
| **Capital Planning** | • How will our earnings be affected under various stress scenarios and what effect will it have on our capital?<br>• Are contingency plans in place to ensure that capital remains appropriate for the level and nature of risk? |
| **Risk Management** | • Which products and markets are most at risk in a stressed environment?<br>• To what extent will our asset quality be adversely affected? |
| **Individual Lending Decisions** | • Do we have the ability to strengthen or restructure individual credits that may be at risk? |
| **Investment Portfolio** | • Can we mitigate the results of a stress test by changes in the investment portfolio? |
| **Mergers, Acquisitions & Divestitures** | • Is a portfolio acquisition appropriate for our bank at this time?<br>• Does our bank need to divest itself of assets to meet internal or external targets? |


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The following liquidity stress scenario is a good example of how results should be used to formulate a game plan. The first steps are to determine the type of liquidity event that will be analyzed, either firm specific, market-wide, or a specific type of funding. The bank should actually look at several of these shocks. Armed with the results of the shock, the bank should develop a playbook or solution to deal with each specific case.

Management should consider multiple types of liquidity actions or contingencies available in developing their playbook. Things to consider are dialing back asset growth or cutting lines of credit, asset sale, possibly a debt issuance, procuring brokered deposits, drawing on the bank's line of credit, or possibly suspending the dividend to conserve cash. When developing these actions management should look at current practice and determine the potential or costs associated with each action. For instance, during a liquidity crisis, additional debt issuance may be expensive given the spreads associated with additional bank borrowing. Also consider if various limits would prohibit acquiring additional sources of funding. An example of this may be internal limits or targets on brokered deposits or limits imposed by regulators. With a sense of the alternatives and constraints, the bank can develop the playbook.

Consider the size of the current liquidity portfolio and the types of assets in the portfolio. Ask the following questions. Is the liquidity portfolio large enough to withstand the crisis? Are the assets in the portfolio truly liquid? How will the prices of the assets hold up in a prolonged market event? Does the bank require additional lines of credit? What is the bank's capacity to borrow from the window? What assets can be pledged and what is the quality of those assets? Is there additional borrowing capacity from FHLB? Answers to these questions will help determine the required size of the liquidity portfolio. It will also help management in determining the size of the balance sheet to determine if assets and liabilities are of the appropriate size and quality.

Finally, the bank should use this information to develop the contingent funding plan. The plan should be a comprehensive playbook the bank uses in the face of a liquidity crisis. First, ensure that the playbook has established accountabilities for liquidity risk. Consider who will be responsible and the governance structure. Who has authority to determine and approve the governance and controls over liquidity? Which committee will the results be entrusted with management and monitoring and does their charter support this role? Who will monitor the liquidity position? How will the steps be communicated? What communication will the board receive?

Next determine the appropriate triggers and actions the bank will take as a liquidity crisis develops. Consider the phases or triggers and the actions the bank will take as each limit is breached. In establishing the triggers talk to peers, regulators, and consultants to aid in defining the appropriate benchmarks. Again the targets and steps should be approved by the board.

Lastly, conduct periodic tests. Periodic testing of line availability or hitting the window should be tested to ensure staff fully understand how the procedures work. Conducting these tests ahead of time is good preparation to understand the mechanism because staff will probably be dealing with multiple issues when faced with a liquidity crisis. Consider a periodic testing schedule and consider conducting additional tests if personnel are new and unfamiliar with the bank's policies and procedures.

These steps or solutions are for protecting for a liquidity crisis. However a bank should follow the same process in developing playbooks or solutions for other types of stress testing. Recall the most important result of stress testing is to have internal conversations about the results and put actions into place to help avoid the risk. Combining stress testing with advanced preparations will help the bank better understand, monitor, and respond to risks as they develop.

## DEVELOP A LIQUIDITY STRESS MODEL AND SUBSEQUENT CONTINGENT FUNDING PLAN, THEN USE THE MODEL TO DRIVE "WHAT IF" TYPE SCENARIOS TO REFINE THE PLAN

### IDENTIFY THE SHOCK

- Firm-specific - name event, look at other single name bank events to determine the impact.
- Market-wide - these are the systemic events that occur to the industry - look to the experience during the 2007 liquidity crisis to determine appropriate scenarios.
- Focus on certain funding types (wholesale, retail, securitization, conduit) - again look toward the experience of the recent liquidity crisis to determine scenarios that may cause a particular type of funding to dry up.

### DEVELOP A SOLUTION

#### ARTICULATING AND SIZING THE LIQUIDITY ACTIONS THAT CAN EFFECTIVELY RESPOND TO THE VARIOUS CONTINGENCIES

| | | | | | |
|---|---|---|---|---|---|
| Dialing back asset growth | Asset sale | Debt issuance | Brokered deposits | Drawing lines of credit | Divided suspension |

#### MODIFYING THE CURRENT BALANCE SHEET STRUCTURE

| | |
|---|---|
| Size and composition of liquidity portfolio | Acquisition of credit lines |

#### CREATING THE CONTINGENT FUNDING PLAN

Comprehensive plan that identifies accountabilities, triggers conditions, tests remedial actions that sustain liquidity in the face of various contingencies


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# PRESENTATION TO THE BOARD

The final objective of a robust stress testing framework is to provide senior management and/or the board with the results of the stress testing exercise and recommendations. The cost and benefit of any recommendations must be well-thought out and objectively and explicitly described. The board or committee of the board should receive a standardized set of reports similar to the ALCO reports.

When presenting to the board or committee of the board consideration should be given to the following:

- Clear, concise, and impact-oriented presentations.
- Suggest practical action points, with early warning indicators and proposed responses.
- Focus on actionable results from the tests:
  - Did the results assist in calculating the ALLL?
  - Did the results support management's analysis of the adequacy of capital?
  - Did the results lead to conclusions regarding which businesses to expand or contract?
  - Did the results fit within the bank's strategy and risk appetite?
  - How much is the potential impact to earnings and budget?
  - How much is the potential impact to capital?

- Plans to respond to stress events should include the following:
  - What will the bank do?
    - Hedge, change lending policy, increase collections activity.
  - When will the bank do it?
    - Are there identifiable early warning triggers?
  - Who is responsible?
  - Will the bank be able to do it?
    - How does the market behave under stress?
    - How will management react to stress?
    - How will competitors react to stress?

- Are the outcomes within the bank's risk appetite?
  - How big of an impact is there to earnings based on each scenario?
  - If the company is publicly traded, how much of an impact will there be on the stock price based on the reduction in earnings?
  - How big of an impact is there to the capital structure?


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Stress testing reports should provide senior management with an overview of the material risks the institution is or might be exposed to. Make sure to overlay any bank targets or triggers that might be breached during or after the stress. Also try to show changes in risks or trends to provide an idea of the likelihood of a risk increasing or decreasing.

With a solid risk culture and executive buy-in, an organization's stress testing exercise will result in informed enterprise-wide risk management decisions.

To assist the board and management in determining the potential impact to the bank's earnings, a basic worksheet has been developed, which is detailed on the next page and can be utilized on a portfolio or consolidated basis.

The one page worksheet details key data for the following items:

- Net interest income
- Other income
- Total revenue
- Provision – specific loans
- Provision – portfolios
- Provision – investment write-downs
- Non-interest expenses
- Net income before tax
- Taxes
- Net income after tax

This worksheet or a similar one gives the board and management the ability to see the potential impact of stress testing on one page.

# EARNINGS IMPACT ANALYSIS

| | 20XX | | 20XX | | 20XX | | Aggregate |
|---|---|---|---|---|---|---|---|
| | Base | Stress | Base | Stress | Base | Stress | Change |
| Revenue | | | | | | | |
| Interest Income | | | | | | | |
| Interest Expense | | | | | | | |
| Net Interest Income | | | | | | | |
| Non Interest Income | | | | | | | |
| Total Revenue | | | | | | | |
| Provision | | | | | | | |
| Specific Loans | | | | | | | |
| Portfolios | | | | | | | |
| Investment Write-downs | | | | | | | |
| Total Provision | | | | | | | |
| Expense | | | | | | | |
| Non Interest Expense | | | | | | | |
| Net Income Before Tax | | | | | | | |
| Income Tax | | | | | | | |
| Net Income After Tax | | | | | | | |


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# CONCLUSIONS

The motivation for this workbook was to provide community banks that may be tasked with implementing a stress testing program with practical tools and guides to make a successful start. The workbook has presented compelling reasons for banks to consider stress testing their organizations.

Banks can use stress testing to identify opportunities and to limit inherent risks. However, it's not until a stress testing program is well implemented into the risk culture of a bank and management and the board are having thoughtful conversations about risk that a bank reaps the greatest benefit. For most banks stress testing programs can start out simple and evolve over time as the bank grows in size and complexity.

The main takeaway is not to be overwhelmed by the size of the project and therefore become paralyzed by the effort. Start from a simple scenario and continue to build experience and practice in both developing the scenarios and discussion about risk.

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OCC 2011-0011, June 7, 2011


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# APPENDIX A

## SMALL COMMUNITY BANK

| | SCENARIO | CONSIDER | DETERMINE | NOTES |
|---|---|---|---|---|
| **Basic Stress Testing Scenarios** | Loss rate on loans increase by XX % or XX basis points (BP) or PDs or LGDs. | Review balance sheet for potential issues in the areas of:<br>• Concentrations of credit<br>– Loan portfolio<br>– Investment portfolio<br>• Volume and number of large loans<br>• Large watch loans<br>• Large problem loans | From this review determine loans that should be stress tested to determine potential loss exposure to earnings or capital based on the scenarios that have been developed. | Historical worst loss case should be utilized and then adjusted depending on current economic issues and projections. |
| **Base Case – Large Loans/ Top Relationships** | Stress test largest lending relationships | Obtain listing of all loans or lending relationships and select the 20 largest. | Determine if there are common elements among the 20 largest relationships:<br>• High reliance on oil prices.<br>• High reliance on commodity prices.<br>• High reliance on major employer. | |
| **Base Case – Large Loans/ Top Relationships** | Stress test income statement based on decline in revenues and determine if DSC falls below 1:1. | | Determine if collateral values still cover loan values.<br>Determine if loans would have to be placed on non-accrual.<br>Determine loss potential.<br>Determine potential impact on earnings.<br>Determine potential impact on capital.<br>Determine if asset quality rating would be at risk of being downgraded. | Aggregate losses to determine potential impact to the ALLL and the potential provision that needs to be expensed.<br>Recalculate classified asset ratio (substandard, doubtful and loss as a percentage of Tier 1 capital and ALLL). |

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| | SCENARIO | CONSIDER | DETERMINE | NOTES |
|---|---|---|---|---|
| **Base Case – Residential Development Loans** | Stress test a concentration in residential development loans. | Obtain listing of all loans or lending relationships within the Residential Development Portfolio.<br><br>Obtain projected decline in market value utilizing market data from a reliable firm (i.e. S&P / Case Schiller) over the next 6-12 months. | Determine current market value of each obligor's projects/developments.<br><br>Aggregate losses to determine potential impact to the ALLL and the potential provision that needs to be expensed.<br><br>Determine potential impact on earnings.<br><br>Determine potential impact on capital.<br><br>Determine if asset quality rating would be at risk of being downgraded. | Recalculate classified asset ratio (substandard, doubtful and loss as a percentage of Tier 1 capital and ALLL). |
| **Severe Case – Residential Development Loans** | Bank has a concentration in residential development loans. | Based on base case, apply a higher percentage of declines in market value.<br><br>• The increased decline in market value could be based on greater market declines in other geographies or greater historical declines in local geography or market area. | Determine potential impact on earnings.<br><br>Determine potential impact on capital.<br><br>Determine if asset quality rating would be at risk of being downgraded. | Aggregate losses to determine potential impact to the ALLL and the potential provision that needs to be expensed.<br><br>Recalculate classified asset ratio (substandard, doubtful, and loss as a percentage of Tier 1 capital and ALLL). |
| **Worse Case – Residential Development Loans** | Bank has a concentration in residential development loans. | Based on severe case, apply a higher percentage of declines in market value.<br><br>• The increased decline in market value could be based on greater market declines in other geographies or greater historical declines in local geography or market area. | Determine potential impact on earnings.<br><br>Determine potential impact on capital.<br><br>Determine if asset quality rating would be at risk of being downgraded. | Aggregate losses to determine potential impact to the ALLL and the potential provision that needs to be expensed.<br><br>Recalculate classified asset ratio (substandard, doubtful, and loss as a percentage of Tier 1 capital and ALLL). |

**Frequency:** Test fast growing segments or products sooner and with more frequency.
Scenario testing should be done, at a minimum, on an annual basis, but probably more frequently to understand what is going on with the organization.


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# MEDIUM COMMUNITY BANK

| | SCENARIO | CONSIDER | DETERMINE | NOTES |
|---|---|---|---|---|
| **Basic Stress Testing Scenarios** | Loss rate on loans increase by XX % or XX basis points (BP) PDs or LGDs<br><br>Number or percentage of pass rated loans being downgraded. | Review Balance Sheet for potential issues in the areas of:<br><br>Concentrations of credit:<br><br>• Loan portfolio.<br><br>• Investment portfolio. | From this review determine loans that should be stress tested to determine potential loss exposure to earnings or capital based on the scenarios that have been developed. | Historical worst loss case should be utilized and then adjusted higher depending on current economic issues and projections.<br><br>For example, mortgage loans and CMOs.<br><br>• Volume and number of large loans:<br><br>– Community banks should review the loans at legal lending limit or within an XXX% of the legal lending limit. |

**Frequency:** Scenario testing should be done, at a minimum, on an annual basis.

If significant concentrations exist, scenario testing should be updated at least semi-annually.

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# LARGE COMMUNITY BANK / SMALL REGIONAL BANK

| | SCENARIO | CONSIDER | DETERMINE | NOTES |
|---|---|---|---|---|
| **Basic Stress Testing Scenarios** | Probability of Default (PD) increasing by XX%.<br><br>Loss Given Default (LGD) on loans increase by XX % or XX basis points (BP) or LGDs. | This should be done based on types of loans or investments.<br><br>• C&I<br><br>• Investor Commercial Real Estate:<br><br>– Office<br><br>– Hotel<br><br>– Apartments<br><br>– Warehouse<br><br>– Retail strip centers<br><br>– Etc. | From this review determine loans that should be stress tested to determine potential loss exposure to earnings or capital based on the scenarios that have been developed. | Historical worst loss case should be utilized and then adjusted higher depending on current economic issues and projections. |

**Frequency:** Scenario testing should be done, at a minimum, on an annual basis using multiple time horizons. If significant concentrations exist, scenario testing should be updated at least semi-annually.


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# APPENDIX B

## IMPORTANT DATA SOURCES FOR STRESS TESTING

- SCAP - http:www.federalreserve.gov/newsevents/press/bcreg/bcreg20090507a1.pdf
- CCAR - http:www.federalreserve.gov/newsevents/press/bcreg/bcreg20111122d1.pdf
- Federal Reserve Database - http:www.federalreserve.gov/datadownload/
- QIS 4 Results - http://www.occ.gov/news-issuances/news-releases/2006/nr-ia-2006-23a.pdf
- Call Report Data - http://cdr.ffiec.gov/public/
- Macro economic data from the St. Louis Fed e.g. interest rates - http://research.stlouisfed.org/fred2/

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# APPENDIX C

| Supervisory Capital Assessment Program | Estimates for 19 Participating Bank Holding Companies | | | | | | | | | | Billions of Dollars |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | AmEx | BofA | BB&T | BNYM | CapOne | Citi | FifthThird | GMAC | Goldman | JPMC | KeyCorp |
| Tier 1 Capital | 10.1 | 173.2 | 13.4 | 15.4 | 16.8 | 118.8 | 11.9 | 17.4 | 55.9 | 136.2 | 11.6 |
| Tier 1 Common Capital | 10.1 | 74.5 | 7.8 | 11.0 | 12.0 | 22.9 | 4.9 | 11.1 | 34.4 | 87.0 | 6.0 |
| Risk - Weighted Assets | 104.4 | 1,633.8 | 109.8 | 115.8 | 131.8 | 996.2 | 112.6 | 172.7 | 444.8 | 1,337.5 | 106.7 |
| Estimated for 2009 and 2010 for the More Adverse Scenario | | | | | | | | | | | |
| Total Loss estimates (Before purchase accounting adjustments) | | | | | | | | | | | |
| First Lien Mortgages | na | 22.1 | 1.1 | 0.2 | 1.8 | 15.3 | 1.1 | 2.0 | na | 18.8 | 0.1 |
| Second/Junior Lien Mortgages | na | 21.4 | 0.7 | na | 0.7 | 12.2 | 1.1 | 1.1 | na | 20.1 | 0.6 |
| Commercial & Industrial Loans | na | 15.7 | 0.7 | 0.4 | 1.5 | 8.9 | 2.8 | 1.0 | 0.0 | 10.3 | 1.7 |
| Commercial Real Estate Loans | na | 9.4 | 4.5 | 0.2 | 1.1 | 2.7 | 2.9 | 0.6 | na | 3.7 | 2.3 |
| Credit Card Loans | 8.5 | 19.1 | 0.2 | na | 3.6 | 19.9 | 0.4 | na | na | 21.2 | 0.0 |
| Securities (AFS and HTM) | na | 8.5 | 0.2 | 4.2 | 0.4 | 2.9 | 0.0 | 0.5 | 0.1 | 1.2 | 0.1 |
| Trading & Counterparty | na | 24.1 | na | na | na | 22.4 | na | na | 17.4 | 16.7 | na |
| Other (1) | 2.7 | 16.4 | 1.3 | 0.4 | 4.3 | 20.4 | 0.9 | 4.0 | 0.3 | 5.3 | 1.8 |
| First Lien Mortgages | na | 6.8% | 4.5% | 5.0% | 10.7% | 8.0% | 10.3% | 10.2% | na | 10.2% | 3.4% |
| Second/Junior Lien Mortgages | na | 13.5% | 8.8% | na | 19.9% | 19.5% | 8.7% | 21.2% | na | 13.9% | 6.3% |
| Commercial & Industrial Loans | na | 7.0% | 4.5% | 5.0% | 9.7% | 5.8% | 11.0% | 2.7% | 1.2% | 6.8% | 7.9% |
| Commercial Real Estate Loans | na | 9.1% | 12.6% | 9.9% | 6.0% | 7.4% | 13.9% | 33.3% | na | 5.5% | 12.5% |
| Credit Card Loans | 20.2% | 23.5% | 18.2% | na | 18.2% | 23.0% | 22.3% | na | na | 22.4% | 37.9% |
| Memo: Purchase Accounting Adjustments | 0.0 | 13.3 | 0.0 | 0.0 | 1.5 | 0.0 | 0.0 | 0.0 | 0.0 | 19.9 | 0.0 |
| Resources Other Than Capital to Absorb Losses in the More Adverse Scenario (3) | 11.9 | 74.5 | 5.5 | 6.7 | 9.0 | 49.0 | 5.5 | -0.5 | 18.5 | 72.4 | 2.1 |
| SCAP Buffer Added for More Adverse Scenario | | | | | | | | | | | |
| (SCAP Buffer is defined as additional Tier 1 Common/contingent Common) | | | | | | | | | | | |
| Less: Capital Actions and Effects of Q1 2009 Results (4) (5) (6) (7) | 0.2 | 12.7 | 0.1 | -0.2 | -0.3 | 87.1 | 1.5 | -4.8 | 7.0 | 2.5 | 0.6 |
| SCAP Buffer (8) (9) (10) | 0.0 | 33.9 | 0.0 | 0.0 | 0.0 | 5.5 | 1.1 | 11.5 | 0.0 | 0.0 | 1.8 |

(1) Includes other consumer and non-consumer loans and miscellaneous commitments and obligations
(2) Includes losses on other consumer and non-consumer loans
(3) Resources to absorb losses include pre-provision net revenue less the change in the allowance for loan and lease losses
(4) Capital actions include completed or contracted transactions since q4 2008
(5) For BOFA, includes capital benefit from risk-weighted asset impact of eligible asset guarantee
(6) For citi, includes impact of preferred exchange offers announced on february 27, 2009
(7) Total includes only capital actions and effects of q1 2009 results for firms that need to establish a scap buffer
(8) There may be a need to establish an additional tier 1 capital buffer, but this would be satisfied by the additional tier 1 common capital buffer unless otherwise specified for a particular bhc
(9) GMAC needs to augment the capital buffer with $11.5 Billion of tier 1 common/contingent common of which $9.1 Billion must be new tier 1 capital
(10) Regions needs to augment the capital buffer with $2.5 Billion of tier 1 common/contingent common of which $400 million must be new tier 1 capital

Note: numbers may not sum due to rounding
Source: the supervisory capital assessment program: overview of results federal reserve board, may 2009


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**Supervisory Capital Assessment Program Estimates for 19 Participating Bank Holding Companies Billions of Dollars**

| | MetLife | Morgan Stanley | PNC | Regions | State St | SunTrust | USB | Wells | Total |
|---|---|---|---|---|---|---|---|---|---|
| Tier 1 Capital | 30.1 | 47.2 | 24.1 | 12.1 | 14.1 | 17.6 | 24.4 | 86.4 | 836.7 |
| Tier 1 Common Capital | 27.8 | 17.8 | 11.7 | 7.6 | 10.8 | 9.4 | 11.8 | 33.9 | 412.5 |
| Risk - Weighted Assets | 326.4 | 310.6 | 250.9 | 116.3 | 69.6 | 162.0 | 230.6 | 1,082.3 | 7,814.8 |
| Estimated for 2009 and 2010 for the More Adverse Scenario | | | | | | | | | |
| Total Loss estimates (Before purchase accounting adjustments) | | | | | | | | | |
| First Lien Mortgages | 0.0 | na | 2.4 | 1.0 | na | 2.2 | 1.8 | 32.4 | 102.3 |
| Second/Junior Lien Mortgages | 0.0 | na | 4.6 | 1.1 | na | 3.1 | 1.7 | 14.7 | 83.2 |
| Commercial & Industrial Loans | 0.0 | 0.1 | 3.2 | 1.2 | 0.0 | 1.5 | 2.3 | 9.0 | 60.1 |
| Commercial Real Estate Loans | 0.8 | 0.6 | 4.5 | 4.9 | 0.3 | 2.8 | 3.2 | 8.4 | 53.0 |
| Credit Card Loans | na | na | 0.4 | na | na | 0.1 | 2.8 | 6.1 | 82.4 |
| Securities (AFS and HTM) | 8.3 | na | 1.3 | 0.2 | 1.8 | 0.0 | 1.3 | 4.2 | 35.2 |
| Trading & Counterparty | na | 18.7 | na | na | na | na | na | na | 99.3 |
| Other (1) | 0.5 | 0.2 | 2.3 | 0.8 | 6.0 | 2.1 | 2.8 | 11.3 | 83.7 |
| First Lien Mortgages | 5.0% | na | 8.1% | 4.1% | na | 8.2% | 5.7% | 11.9% | 8.8% |
| Second/Junior Lien Mortgages | 14.1% | na | 12.7% | 11.9% | na | 13.7% | 8.8% | 13.2% | 13.8% |
| Commercial & Industrial Loans | 0.0% | 2.4% | 6.0% | 7.0% | 22.8% | 5.2% | 5.4% | 4.8% | 6.1% |
| Commercial Real Estate Loans | 2.1% | 45.2% | 11.2% | 13.7% | 35.5% | 10.6% | 10.2% | 5.9% | 8.5% |
| Credit Card Loans | na | na | 22.3% | na | na | 17.4% | 20.3% | 26.0% | 22.5% |
| Memo: Purchase Accounting Adjustments | 0.0 | 0.0 | 5.9 | 0.0 | 0.0 | 0.0 | 0.0 | 23.7 | 64.3 |
| Resources Other Than Capital to Absorb Losses in the More Adverse Scenario (3) | 5.6 | 7.1 | 9.6 | 3.3 | 4.3 | 4.7 | 13.7 | 60.0 | 362.9 |
| SCAP Buffer Added for More Adverse Scenario | | | | | | | | | |
| (SCAP Buffer is defined as additional Tier 1 Common/contingent Common) | | | | | | | | | |
| Less: Capital Actions and Effects of Q1 2009 Results (4) (5) (6) (7) | 0.6 | 6.5 | 1.7 | 0.4 | 0.2 | 1.3 | 0.3 | 3.6 | 110.4 |
| SCAP Buffer (8) (9) (10) | 0.0 | 1.8 | 0.6 | 2.5 | 0.0 | 2.2 | 0.0 | 13.7 | 74.6 |

# APPENDIX D

**Charge-off Rate Correlations Between Loan Types 1991 to 2006**

| | Charge-off rate on commercial real estate loans (excluding farmland) | Charge-off rate on business loans | Charge-off rate on lease financing receivables | Charge-off rate on consumer loans | Charge-off rate on single family residential mortgages | Charge-off rate on credit card loans | Charge-off rate on other consumer loans | Charge-off rate on farmland | Charge-off rate on loans to finance agricultural production |
|---|---|---|---|---|---|---|---|---|---|
| Charge-off rate on commercial real estate loans (excluding farmland) | 1 | | | | | | | | |
| Charge-off rate on business loans | 0.4555 | 1 | | | | | | | |
| Charge-off rate on lease financing receivables | 0.2430 | 0.7768 | 1 | | | | | | |
| Charge-off rate on consumer loans | -0.3100 | 0.4492 | 0.6115 | 1 | | | | | |
| Charge-off rate on single family residential mortgages | 0.5691 | 0.5679 | 0.3742 | -0.0208 | 1 | | | | |
| Charge-off rate on credit card loans | -0.2159 | 0.5270 | 0.6044 | 0.9324 | 0.0713 | 1 | | | |
| Charge-off rate on other consumer loans | -0.2311 | 0.4776 | 0.6719 | 0.8582 | 0.0424 | 0.6603 | 1 | | |
| Charge-off rate on farmland | 0.6954 | 0.5934 | 0.3748 | 0.0356 | 0.5300 | 0.0560 | 0.1214 | 1 | |
| Charge-off rate on loans to finance agricultural production | 0.2011 | 0.6583 | 0.4767 | 0.3259 | 0.6753 | 0.3678 | 0.3365 | 0.4690 | 1 |


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**Charge-off Rate Correlations Between Loan Types 2007-Q3 2011**

| | Charge-off rate on commercial real estate loans (excluding farmland) | Charge-off rate on business loans | Charge-off rate on lease financing receivables | Charge-off rate on consumer loans | Charge-off rate on single family residential mortgages | Charge-off rate on credit card loans | Charge-off rate on other consumer loans | Charge-off rate on farmland | Charge-off rate on loans to finance agricultural production |
|---|---|---|---|---|---|---|---|---|---|
| Charge-off rate on commercial real estate loans (excluding farmland) | 1 | | | | | | | | |
| Charge-off rate on business loans | 0.9045 | 1 | | | | | | | |
| Charge-off rate on lease financing receivables | 0.7627 | 0.9304 | 1 | | | | | | |
| Charge-off rate on consumer loans | 0.8871 | 0.8954 | 0.7446 | 1 | | | | | |
| Charge-off rate on single family residential mortgages | 0.9463 | 0.9017 | 0.7587 | 0.9151 | 1 | | | | |
| Charge-off rate on credit card loans | 0.8923 | 0.9248 | 0.7970 | 0.9867 | 0.9180 | 1 | | | |
| Charge-off rate on other consumer loans | 0.6115 | 0.8155 | 0.8925 | 0.6088 | 0.6322 | 0.6226 | 1 | | |
| Charge-off rate on farmland | 0.8905 | 0.7126 | 0.4872 | 0.8194 | 0.8670 | 0.8049 | 0.2702 | 1 | |
| Charge-off rate on loans to finance agricultural production | 0.7898 | 0.7289 | 0.5645 | 0.8450 | 0.7717 | 0.8008 | 0.4078 | 0.8282 | 1 |

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# SUPPLEMENT

## COMPREHENSIVE CAPITAL ANALYSIS AND REVIEW 2012:

Methodology and Results for Stress Scenario Projections

March 13, 2012

Board of Governors of the Federal Reserve System


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On March 13, 2012, the Board of Governors of the Federal Reserve System (the Fed) released the results of the second round of stress tests – the Comprehensive Capital Analysis and Review 2012 (CCAR)[1]. Although the CCAR program may have been designed to test the largest banks for systemic risk, like its predecessor, SCAP, CCAR can be retrofitted to community bank stress testing needs.

The CCAR stress scenario projections were calculated by Fed analysts using input data provided by the 19 bank holding companies[2] and a set of models developed or selected by the Fed. The projects were based on a hypothetical, severely adverse macroeconomic and financial market scenario, featuring a deep recession in the United States, significant declines in asset prices and increases in risk premium, and a slowdown in global economic activity (the "Supervisory Stress Scenario").

The Supervisory Stress Scenario includes trajectories for 25 variables, including 13 variables capturing economic activity, asset prices, and interest rates in the U.S. economy and financial markets, and three variables (real GDP growth, inflation, and the U.S./foreign currency exchange rate) in each of four counties/country blocks (the euro area, the United Kingdom, developing Asia, and Japan). The scenario starts in the fourth quarter of 2011 and extends through the fourth quarter of 2014, which permits the calculation of loan-loss reserves at the end of 2013. For the domestic U.S. variables, the scenario includes:

- Five measures of economic activity and prices: Real and nominal Gross Domestic Product (GDP), the unemployment rate of the civilian non-institutional population aged 16 and over, nominal disposable personal income, and the Consumer Price Index (CPI);
- Four aggregate measures of asset prices or financial conditions: The CoreLogic National House Price Index, the National Council for Real Estate Investment Fiduciaries Commercial Real Estate Price Index, the Dow Jones Total Stock Market Index, and the Chicago Board Options Exchange Market Volatility Index; and
- Four measures of interest rates: the rate on the three-month Treasury bill, the yield on the 10-year Treasury bond, the yield on a 10-year BBB corporate security, and the interest rate associated with a conforming, conventional, fixed-rate, 30-year mortgage.

There were additional international variables as well for those banks with large trading, private equity, and derivatives activities.

1 Comprehensive Capital Analysis and Review 2012: Methodology and Results for Stress Scenario Projections, Board of Governors of the Federal Reserve System, published March 13, 2012.

2 The bank holding companies that participated in CCAR 2012 are Ally Financial Inc., American Express Company, Bank of America Corp., The Bank of New York Mellon Corp., BB&T Corp., Capital One Financial Corp., Citigroup Inc., Fifth Third Bancorp, The Goldman Sachs Group, Inc., JPMorgan Chase & Co., Keycorp, Metlife, Inc., Morgan Stanley, The PNC Financial Services Group, Inc., Regions Financial Corp., State Stress Corp., SunTrust Banks, Inc., U.S. Bancorp, and Wells Fargo & Co.

The tables that follow contain a description of the variables included in the Supervisory Stress Scenario, as well as the trajectories for those variables between Q4 2011 and Q4 2012 and the results of the CCAR stress tests.

The CCAR program is a good model for quantitative scenario analysis. The Fed established a severe scenario in CCAR that, while severe, is still plausible. A community bank should review the Fed's worst-case scenario and, for example, look at unemployment rates as a good starting point for discussions regarding what it would mean for the bank if unemployment hit that level. The bank should consider whether they have sufficient capital and then consider dividends, growth and reserve ratios, and how they would look under the Fed's stress scenario. Correlations must also be considered.

When adopting the CCAR scenario, consider isolating some of the variables into separate stress tests to determine where the institution is most vulnerable. In addition, although CCAR mostly focused on credit risk, it also looked at operational risk. Banks should consider what qualitative measures they may take to understand and mitigate operational risk.

Also, the institution should note that the CCAR stress test used a two year planning horizon. This will provide the institution with sufficient data to ensure a robust, forward-looking capital planning process that accounts for the institution's unique risks while demonstrating that the institution has sufficient capital to continue operating throughout times of economic and financial market stress.

The CCAR scenarios will provide institutions with a tremendous opportunity to engage in a bank-wide risk discussion and demonstrate to regulators a commitment to understanding and correcting the institution's vulnerabilities.


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**Supervisory Stress Scenario**

| OBS | Real GDP growth | Nominal GDP growth | Real disposable income growth | Nominal disposable income growth | Unemployment rate | CPI inflation rate | 3-month Treasury yield | 10-year Treasury yield | BBB corporate yield | Mortgage rate | Dow Jones Total Stock Market Index | Market Volatility Index (VIX) | House Price Index | Commercial Real Estate Price Index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Q1 2001 | -1.31 | 1.40 | 3.05 | 5.96 | 4.23 | 3.88 | 4.82 | 5.30 | 7.44 | 7.24 | 10,645.85 | 32.84 | 113.46 | 130.98 |
| Q2 2001 | 2.65 | 5.47 | -1.08 | 0.82 | 4.41 | 2.86 | 3.66 | 5.50 | 7.49 | 7.37 | 11,407.15 | 34.72 | 115.20 | 130.12 |
| Q3 2001 | -1.10 | 0.15 | 10.58 | 10.66 | 4.81 | 1.08 | 3.19 | 5.26 | 7.26 | 7.19 | 9,562.95 | 43.74 | 117.58 | 129.20 |
| Q4 2001 | 1.41 | 2.66 | -4.59 | -4.38 | 5.53 | -0.25 | 1.91 | 5.06 | 7.19 | 7.00 | 10,707.68 | 35.31 | 119.99 | 127.36 |
| Q1 2002 | 3.46 | 4.93 | 11.23 | 12.25 | 5.70 | 1.25 | 1.72 | 5.39 | 7.58 | 7.20 | 10,775.74 | 26.09 | 122.44 | 129.05 |
| Q2 2002 | 2.14 | 3.99 | 2.21 | 5.44 | 5.84 | 3.20 | 1.72 | 5.35 | 7.61 | 7.03 | 9,384.03 | 28.42 | 125.74 | 129.24 |
| Q3 2002 | 2.04 | 3.82 | -1.37 | 0.64 | 5.72 | 2.15 | 1.64 | 4.55 | 7.28 | 6.48 | 7,773.63 | 45.08 | 129.10 | 130.49 |
| Q4 2002 | 0.14 | 2.46 | 0.95 | 2.86 | 5.84 | 2.40 | 1.34 | 4.29 | 7.04 | 6.25 | 8,343.19 | 42.64 | 131.56 | 131.77 |
| Q1 2003 | 1.68 | 4.55 | 1.48 | 4.43 | 5.87 | 4.13 | 1.16 | 4.16 | 6.47 | 5.99 | 8,051.86 | 34.69 | 134.59 | 134.63 |
| Q2 2003 | 3.43 | 4.64 | 6.19 | 6.50 | 6.15 | -0.59 | 1.04 | 3.80 | 5.65 | 5.65 | 9,342.42 | 29.13 | 137.48 | 135.93 |
| Q3 2003 | 6.75 | 9.14 | 5.71 | 8.47 | 6.10 | 2.99 | 0.93 | 4.40 | 6.02 | 6.18 | 9,649.68 | 22.72 | 141.68 | 137.10 |
| Q4 2003 | 3.67 | 5.80 | 2.32 | 4.22 | 5.81 | 1.57 | 0.92 | 4.44 | 5.84 | 6.09 | 10,799.63 | 21.07 | 146.32 | 139.04 |
| Q1 2004 | 2.66 | 6.28 | 1.79 | 5.19 | 5.68 | 3.43 | 0.92 | 4.14 | 5.45 | 5.75 | 11,039.42 | 21.58 | 152.67 | 141.22 |
| Q2 2004 | 2.60 | 6.11 | 4.01 | 7.11 | 5.58 | 3.16 | 1.08 | 4.75 | 6.08 | 6.31 | 11,138.91 | 19.96 | 159.10 | 143.52 |
| Q3 2004 | 3.01 | 6.03 | 2.70 | 5.25 | 5.43 | 2.58 | 1.49 | 4.45 | 5.77 | 6.06 | 10,895.48 | 19.34 | 164.33 | 146.53 |
| Q4 2004 | 3.31 | 6.43 | 5.71 | 9.15 | 5.38 | 4.39 | 2.01 | 4.30 | 5.44 | 5.89 | 11,971.14 | 16.58 | 170.25 | 147.61 |
| Q1 2005 | 4.19 | 8.09 | -4.79 | -2.51 | 5.27 | 2.05 | 2.54 | 4.39 | 5.43 | 5.91 | 11,638.27 | 14.65 | 180.11 | 148.12 |
| Q2 2005 | 1.79 | 4.55 | 2.85 | 5.40 | 5.10 | 2.68 | 2.86 | 4.24 | 5.46 | 5.87 | 11,876.74 | 17.74 | 186.45 | 174.64 |
| Q3 2005 | 3.21 | 7.52 | 2.41 | 7.10 | 4.95 | 6.24 | 3.36 | 4.29 | 5.48 | 5.92 | 12,289.26 | 14.17 | 192.51 | 175.76 |
| Q4 2005 | 2.07 | 5.54 | 2.21 | 5.84 | 4.94 | 3.72 | 3.83 | 4.60 | 5.88 | 6.40 | 12,517.69 | 16.47 | 197.07 | 186.38 |
| Q1 2006 | 5.15 | 8.31 | 7.71 | 9.52 | 4.71 | 2.13 | 4.39 | 4.67 | 5.97 | 6.42 | 13,155.44 | 14.56 | 201.82 | 195.50 |
| Q2 2006 | 1.63 | 5.24 | 3.60 | 6.70 | 4.64 | 3.68 | 4.71 | 5.15 | 6.48 | 6.80 | 12,849.29 | 23.81 | 199.55 | 198.00 |
| Q3 2006 | 0.05 | 3.11 | 1.94 | 4.90 | 4.63 | 3.83 | 4.91 | 4.96 | 6.43 | 6.77 | 13,345.97 | 18.64 | 198.29 | 199.43 |
| Q4 2006 | 2.75 | 4.59 | 5.35 | 5.26 | 4.44 | -1.69 | 4.90 | 4.70 | 6.12 | 6.43 | 14,257.55 | 12.67 | 198.93 | 215.76 |
| Q1 2007 | 0.54 | 5.23 | 1.82 | 5.83 | 4.49 | 3.92 | 4.98 | 4.76 | 6.11 | 6.40 | 14,409.27 | 19.63 | 196.43 | 222.91 |
| Q2 2007 | 3.65 | 6.50 | 0.60 | 4.08 | 4.47 | 4.76 | 4.74 | 4.92 | 6.30 | 6.55 | 15,210.65 | 18.89 | 191.35 | 229.81 |
| Q3 2007 | 2.96 | 4.34 | 1.59 | 3.85 | 4.65 | 2.44 | 4.31 | 4.84 | 6.54 | 6.75 | 15,362.02 | 30.83 | 185.77 | 221.46 |
| Q4 2007 | 1.70 | 3.64 | 2.23 | 6.52 | 4.80 | 4.92 | 3.40 | 4.41 | 6.37 | 6.41 | 14,819.58 | 31.09 | 179.99 | 222.88 |
| Q1 2008 | -1.76 | 0.58 | 5.90 | 10.00 | 4.95 | 4.51 | 2.07 | 3.87 | 6.54 | 6.04 | 13,332.01 | 32.24 | 173.04 | 223.71 |
| Q2 2008 | 1.32 | 4.03 | 8.22 | 13.11 | 5.31 | 5.31 | 1.62 | 4.09 | 6.84 | 6.26 | 13,073.54 | 31.01 | 165.31 | 217.79 |
| Q3 2008 | -3.66 | -0.57 | -8.82 | -4.86 | 6.03 | 6.46 | 1.49 | 4.05 | 7.19 | 6.50 | 11,875.41 | 46.72 | 158.25 | 217.11 |
| Q4 2008 | -8.89 | -8.43 | -0.23 | -5.79 | 6.91 | -9.07 | 0.30 | 3.72 | 9.39 | 6.03 | 9,087.17 | 80.86 | 149.51 | 189.54 |
| Q1 2009 | -6.67 | -5.23 | -3.81 | -5.42 | 8.22 | -2.50 | 0.21 | 3.23 | 8.96 | 5.18 | 8,113.14 | 56.65 | 142.77 | 186.93 |
| Q2 2009 | -0.69 | -1.14 | 0.25 | 2.15 | 9.29 | 1.97 | 0.17 | 3.65 | 8.15 | 5.14 | 9,424.92 | 42.28 | 143.51 | 154.64 |
| Q3 2009 | 1.70 | 1.93 | -5.42 | -2.57 | 9.69 | 3.67 | 0.16 | 3.81 | 6.76 | 5.28 | 10,911.69 | 31.30 | 144.81 | 157.50 |
| Q4 2009 | 3.80 | 4.88 | -0.58 | 2.18 | 10.01 | 2.72 | 0.06 | 3.69 | 6.13 | 5.03 | 11,497.41 | 30.69 | 145.34 | 152.24 |
| Q1 2010 | 3.94 | 5.52 | 4.86 | 6.81 | 9.70 | 1.28 | 0.11 | 3.87 | 5.78 | 5.11 | 12,160.97 | 27.31 | 146.66 | 157.50 |
| Q2 2010 | 3.79 | 5.43 | 5.57 | 5.91 | 9.66 | -0.51 | 0.15 | 3.62 | 5.55 | 5.02 | 10,750.01 | 45.79 | 146.10 | 171.27 |
| Q3 2010 | 2.51 | 3.86 | 2.27 | 3.27 | 9.59 | 1.42 | 0.16 | 2.90 | 5.07 | 4.54 | 11,947.14 | 32.86 | 141.78 | 160.45 |
| Q4 2010 | 2.35 | 4.16 | 1.50 | 3.47 | 9.63 | 2.68 | 0.14 | 2.97 | 5.04 | 4.50 | 13,290.03 | 23.54 | 139.61 | 178.95 |
| Q1 2011 | 0.36 | 3.09 | 1.24 | 5.19 | 8.93 | 5.25 | 0.13 | 3.53 | 5.40 | 4.95 | 14,036.43 | 29.40 | 137.93 | 177.17 |
| Q2 2011 | 1.34 | 3.96 | 0.59 | 3.91 | 9.06 | 4.02 | 0.05 | 3.28 | 5.15 | 4.76 | 13,968.11 | 22.73 | 137.56 | 173.82 |
| Q3 2011 | 2.46 | 5.04 | -1.73 | 0.59 | 9.09 | 3.09 | 0.02 | 2.48 | 4.87 | 4.40 | 11,771.86 | 48.00 | 136.86 | 174.08 |
| Q4 2011 | -4.84 | -1.70 | -6.02 | -3.37 | 9.68 | 2.21 | 0.10 | 2.07 | 5.65 | 4.65 | 9,501.48 | 75.86 | 135.13 | 168.40 |
| Q1 2012 | -7.98 | -5.39 | -6.81 | -5.30 | 10.58 | 1.78 | 0.10 | 1.94 | 6.83 | 5.12 | 7,576.38 | 90.50 | 131.61 | 161.04 |
| Q2 2012 | -4.23 | -2.54 | -4.29 | -3.46 | 11.40 | 1.02 | 0.10 | 1.76 | 6.81 | 5.16 | 7,089.87 | 80.00 | 127.50 | 153.42 |
| Q3 2012 | -3.51 | -2.24 | -3.16 | -2.44 | 12.16 | 0.89 | 0.10 | 1.67 | 6.75 | 5.17 | 5,705.55 | 81.23 | 123.12 | 146.53 |
| Q4 2012 | 0.00 | 0.09 | -0.57 | -0.36 | 12.76 | 0.35 | 0.10 | 1.76 | 6.45 | 5.08 | 5,668.34 | 69.82 | 119.08 | 139.36 |
| Q1 2013 | 0.72 | 0.58 | 0.74 | 0.84 | 13.00 | 0.23 | 0.10 | 1.74 | 6.07 | 4.93 | 6,082.47 | 62.75 | 115.15 | 136.75 |
| Q2 2013 | 2.21 | 2.01 | 1.66 | 1.74 | 13.05 | 0.21 | 0.10 | 1.84 | 5.83 | 4.82 | 6,384.32 | 57.76 | 111.92 | 135.20 |
| Q3 2013 | 2.32 | 2.14 | 2.69 | 2.88 | 12.96 | 0.30 | 0.10 | 1.98 | 5.74 | 4.77 | 7,084.65 | 53.82 | 109.77 | 134.02 |
| Q4 2013 | 3.45 | 3.26 | 2.27 | 2.48 | 12.76 | 0.32 | 0.10 | 1.98 | 5.51 | 4.66 | 7,618.89 | 49.84 | 108.48 | 134.36 |
| Q1 2014 | 3.36 | 2.94 | 2.77 | 2.62 | 12.61 | -0.03 | 0.10 | 1.97 | 5.28 | 4.54 | 8,014.71 | 45.87 | 108.08 | 134.45 |
| Q2 2014 | 3.71 | 3.18 | 3.53 | 3.25 | 12.36 | -0.16 | 0.10 | 1.88 | 4.94 | 4.38 | 9,925.73 | 34.96 | 108.40 | 135.91 |
| Q3 2014 | 4.64 | 4.09 | 2.82 | 2.53 | 12.04 | -0.17 | 0.10 | 1.86 | 4.72 | 4.26 | 10,874.38 | 24.22 | 109.24 | 139.53 |
| Q4 2014 | 4.64 | 4.00 | 4.48 | 4.01 | 11.66 | -0.34 | 0.10 | 1.89 | 4.58 | 4.17 | 12,005.11 | 17.51 | 110.29 | 143.35 |

**Notes:**

Sources for data through 2011: Q3 (as released through 11/08/2011). 2011:Q3 international GDP data based on staff calculations.
Values after that date equal assumptions for the supervisory stress scenario.
Variables reported as growth rates are expressed as percent changes at an annual rate.

**Real GDP growth:** Gross Domestic Product, billions of chain-weighted 2005 dollars, Bureau of Economic Analysis
**Nominal GDP growth:** Gross Domestic Product, billions of dollars, Bureau of Economic Analysis
**CPI inflation rate:** Bureau of Labor Statistics
**Real Disposable Personal Income growth:** Billions of chain-weighted 2002 dollars, equals nominal disposable personal income divided by the price index for personal consumption expenditures, Bureau of Economic Analysis
**Nominal Disposable Personal Income growth:** Billions of dollars, Bureau of Economic Analysis
**Unemployment Rate:** Bureau of Labor Statistics (quarterly average of monthly data)
**3-Month T-Bill Rate:** Quarterly average of 3-month Treasury bill secondary market rate discount basis, Federal Reserve Board
**10-yr Treasury Bond Rate:** Quarterly average of yield on 10-yr U.S. Treasury bond, constructed for FRB/US model by Federal Reserve staff
**BBB Corporate Bond Rate:** Yield on 10-yr BBB-rated corporate bond, constructed for FRB/US model by Federal Reserve staff
**Mortgage Rate:** Freddie Mac
**Dow Jones Total Stock Market Index:** End of quarter value, Dow Jones
**National House Price Index:** CoreLogic (seasonally adjusted by Federal Reserve staff)
**CRE Price Index:** Composite index created by Federal Reserve staff using the office, retail, and industrial NCREIF Transaction Based Indexes.
**VIX:** Chicago Board Options Exchange
**Euro Area Real GDP Growth**: staff calculations based on Statistical Office of the European Communities via Haver
**Euro Area Inflation**: staff calculations based on Statistical Office of the European Community via Haver
**Developing Asia Real GDP Growth**: staff calculations based on Bank of Korea via Haver, Chinese National Bureau of Statistics via CEIC, Indian Central Statistical Organization via CEIC, Census and Statistics Department of Hong Kong via CEIC, and Taiwan Directorate-General of Budget, Accounting and Statistics via CEIC.
**Developing Asia Inflation**: staff calculations based on Bank of Korea via CEIC, Chinese Statistical Information and Consultancy Service via CEIC, and IMF Recent Economic Developments, Labour Bureau of India via CEIC and IMF, Census and Statistic Department of Hong Kong via CEIC, Census and Statistics Department of Hong Kong via CEIC, and Taiwan Directorate-General of Budget, Accounting and Statistics via CEIC.
**Japan Real GDP Growth**: Cabinet Office via Haver
**Japan Inflation**: Ministry of Internal Affairs and Communications via Haver
**UK Real GDP Growth**: Office of National Statistics via Haver
**UK Inflation**: Office of National Statistics (uses Retail Price Index to extend series back to 1960) via Haver
**Exchange Rates:** Bloomberg

**Comprehensive Capital Analysis and Review 2012**
**Table 1: Federal Reserve Estimates in the Supervisory Stress Scenario**
*19 Participating Bank Holding Companies*

*These projections represent hypothetical estimates that involve an economic outcome that is more adverse than expected. These estimates are not forecasts of expected losses, revenues, net income before taxes or capital ratios. The two minimum capital ratios presented below are for the period Q4 2011 through Q4 2013 and do not necessarily occur in the same quarter.*

The Federal Reserve made changes to this table on March 16, 2012, to correct computation errors for some loss rates and levels. The corrections do not impact other figures, including capital ratios.

**Projected Capital Ratios through Q4 2013**
**Under the Hypothetical Supervisory Stress Scenario**

| | Actual | Stressed ratios with all proposed capital actions through Q4 2013 | | Stressed ratios assuming no capital actions after Q1 2012 (1) |
|---|---|---|---|---|
| | Q3 2011 | Q4 2013 | Minimum | Minimum |
| Tier 1 Common Capital Ratio (%) | 10.1 | 6.3 | 6.2 | 6.8 |
| Tier 1 Capital Ratio (%) | 12.3 | 7.8 | 7.6 | 8.4 |
| Total Risk-Based Capital Ratio (%) | 15.5 | 11.2 | 11.0 | 11.7 |
| Tier 1 Leverage Ratio (%) | 7.4 | 4.7 | 4.6 | 5.1 |
| Tier 1 Common Capital ($B) | 741 | 438 | | |
| Tier 1 Capital ($B) | 907 | 540 | | |
| Total Risk-Based Capital ($B) | 1,139 | 770 | | |
| Risk-Weighted Assets ($B) | 7,356 | 6,904 | | |
| Average Total Assets ($B) | 12,188 | 11,482 | | |

**Projected Losses, Revenue and Net Income before Taxes for Q4 2011 through Q4 2013**
**Under the Hypothetical Supervisory Stress Scenario**

| | Billions of Dollars | Percent of Average Assets |
|---|---|---|
| Pre-Provision Net Revenue (2) | 294 | 2.5 |
| Other Revenue (3) | 2 | |
| *less* | | |
| Provisions | 324 | |
| Realized Losses/Gains on Securities (AFS/HTM) | 31 | |
| Trading and Counterparty Losses (4) | 116 | |
| Other Losses/Gains (5) | 45 | |
| *equals* | | |
| Net Income before Taxes | -222 | -1.9 |

**Projected Loan Losses by Type of Loans for Q4 2011 through Q4 2013**
**Under the Hypothetical Supervisory Stress Scenario**

| | Billions of Dollars | Portfolio Loss Rates (%) |
|---|---|---|
| Loan Losses (6) | 341 | 8.1 |
| First Lien Mortgages, Domestic | 61 | 7.3 |
| Junior Liens and HELOCs, Domestic | 56 | 13.2 |
| Commercial and Industrial | 67 | 8.2 |
| Commercial Real Estate, Domestic | 24 | 5.2 |
| Credit Cards | 92 | 17.2 |
| Other Consumer | 26 | 5.9 |
| Other Loans | 16 | 2.3 |

(1) Assumes planned capital actions through Q1 2012, but assuming no material capital issuances from March 16 through March 31, 2012.
(2) Pre-Provision Net Revenue includes losses from operational risk events, mortgage put-back expenses, and OREO costs.
(3) Other Revenue includes one time income and (expense) items not included in Pre-Provision Net Revenue.
(4) Trading and Counterparty includes mark-to-market losses, changes in credit valuation adjustments (CVA) and incremental default
(5) Other Losses/Gains includes projected change in fair value of loans held for sale and loans held for investment measured under the fair value option, and goodwill impairment charges.
(6) Commercial and industrial loans include small and medium enterprise loans and corporate cards. Other loans include international real estate loans. Average loan balances used to calculate portfolio loss rates exclude loans held for sale and loans held for investment under the fair value option.

Notes: The two minimum capital ratios presented here are for the period Q4 2011 through Q4 2013 and do not necessarily occur in the same quarter. Capital actions include common dividends, common share repurchases, and common share issuance. Average balances used for profitablity ratios and portfolio loss rates are averages over the nine-quarter period. Estimates may not sum precisely due to rounding. Aggregate ratios are weighted averages.

Source: Federal Reserve estimates in the Supervisory Stress scenario.


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**Comprehensive Capital Analysis and Review 2012**

**Table 2: Projected Capital Ratios for 19 Participating Bank Holding Companies in the Supervisory Stress Scenario**

*These projections represent hypothetical estimates that involve an economic outcome that is more adverse than expected. These estimates are not forecasts of expected losses, revenues, net income before taxes or capital ratios. The two minimum capital ratios presented below are for the period Q4 2011 through Q4 2013 and do not necessarily occur in the same quarter.*

| | Ally Financial Inc. | American Express Company | Bank of America Corporation | The Bank of New York Mellon Corporation | BB&T Corporation | Capital One Financial Corporation | Citigroup Inc. | Fifth Third Bancorp | The Goldman Sachs Group, Inc. | JPMorgan Chase & Co. | Keycorp | MetLife, Inc. | Morgan Stanley | The PNC Financial Services Group, Inc. | Regions Financial Corporation | State Street Corporation | SunTrust Banks, Inc. | U.S. Bancorp | Wells Fargo & Company | 19 Participating Bank Holding Companies |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Actual Q3 2011** | | | | | | | | | | | | | | | | | | | | |
| Tier 1 Common Capital Ratio (%) | 8.0 | 12.3 | 8.7 | 12.5 | 9.8 | 10.0 | 11.7 | 9.3 | 12.1 | 9.9 | 11.3 | 9.3 | 12.0 | 10.5 | 8.2 | 16.0 | 9.3 | 8.5 | 9.3 | 10.1 |
| Tier 1 Capital Ratio (%) | 14.3 | 12.3 | 11.5 | 14.0 | 12.6 | 12.4 | 13.4 | 12.0 | 13.8 | 12.1 | 13.5 | 9.9 | 15.2 | 13.1 | 12.8 | 17.9 | 11.1 | 10.8 | 11.3 | 12.3 |
| Total Risk-Based Capital Ratio (%) | 15.5 | 14.3 | 15.9 | 16.1 | 16.1 | 15.4 | 16.9 | 16.2 | 16.9 | 15.3 | 17.0 | 10.2 | 16.4 | 16.5 | 16.5 | 19.5 | 13.9 | 13.5 | 14.9 | 15.5 |
| Tier 1 Leverage Ratio (%) | 11.6 | 9.8 | 7.1 | 5.1 | 9.2 | 9.9 | 7.0 | 11.1 | 6.7 | 6.8 | 11.9 | 5.4 | 6.4 | 11.4 | 9.7 | 7.8 | 8.9 | 9.0 | 9.0 | 7.4 |
| **Q4 2013 Under the Hypothetical Supervisory Stress Scenario - Stressed ratios with all proposed capital actions through Q4 2013** | | | | | | | | | | | | | | | | | | | | |
| Tier 1 Common Capital Ratio (%) | 4.4 | 10.8 | 6.2 | 13.1 | 6.4 | 8.8 | 4.9 | 6.3 | 7.2 | 5.9 | 5.3 | 6.3 | 7.6 | 5.9 | 6.8 | 12.5 | 4.8 | 5.4 | 6.3 | 6.3 |
| Tier 1 Capital Ratio (%) | 6.4 | 10.8 | 8.6 | 14.3 | 6.4 | 9.4 | 6.0 | 7.3 | 8.9 | 7.1 | 5.9 | 6.9 | 10.4 | 7.1 | 8.1 | 14.4 | 5.7 | 7.4 | 7.9 | 7.8 |
| Total Risk-Based Capital Ratio (%) | 7.1 | 13.0 | 13.8 | 16.1 | 9.9 | 12.0 | 9.9 | 11.0 | 12.1 | 10.4 | 9.1 | 7.2 | 11.9 | 10.5 | 12.1 | 16.1 | 8.5 | 10.2 | 11.5 | 11.2 |
| Tier 1 Leverage Ratio (%) | 5.2 | 9.2 | 5.3 | 5.1 | 4.7 | 6.9 | 2.9 | 6.8 | 4.5 | 4.0 | 5.8 | 4.1 | 4.5 | 5.9 | 6.4 | 6.3 | 4.5 | 5.6 | 6.0 | 4.7 |
| **Minimum Capital Ratios Under the Hypothetical Supervisory Stress Scenario - Stressed ratios with all proposed capital actions through Q4 2013** | | | | | | | | | | | | | | | | | | | | |
| Tier 1 Common Capital Ratio (%) | 2.5 | 10.8 | 5.9 | 13.0 | 6.4 | 7.8 | 4.9 | 6.3 | 5.7 | 5.4 | 5.3 | 5.1 | 5.4 | 5.9 | 6.6 | 12.5 | 4.8 | 5.4 | 6.0 | 6.2 |
| Tier 1 Capital Ratio (%) | 6.4 | 10.8 | 8.2 | 14.3 | 6.4 | 9.0 | 6.0 | 7.3 | 7.5 | 6.6 | 5.9 | 5.7 | 8.0 | 7.1 | 7.4 | 14.4 | 5.7 | 7.4 | 7.6 | 7.6 |
| Total Risk-Based Capital Ratio (%) | 7.1 | 13.0 | 13.3 | 16.1 | 9.9 | 11.5 | 9.9 | 11.0 | 10.9 | 9.8 | 9.1 | 6.0 | 9.2 | 10.5 | 11.4 | 16.1 | 8.5 | 10.2 | 11.2 | 11.0 |
| Tier 1 Leverage Ratio (%) | 5.2 | 9.0 | 5.1 | 5.1 | 4.7 | 6.7 | 2.9 | 6.8 | 3.8 | 3.8 | 5.8 | 3.4 | 3.4 | 5.9 | 5.7 | 6.3 | 4.5 | 5.6 | 5.7 | 4.6 |
| **Minimum Capital Ratios Under the Hypothetical Supervisory Stress Scenario - Stressed ratios assuming no capital actions after Q1 2012 (1)** | | | | | | | | | | | | | | | | | | | | |
| Tier 1 Common Capital Ratio (%) | 2.5 | 12.4 | 5.7 | 13.3 | 7.3 | 7.2 | 5.9 | 7.7 | 5.8 | 6.3 | 6.3 | 5.4 | 5.4 | 6.6 | 5.7 | 15.1 | 5.5 | 7.7 | 6.6 | 6.8 |
| Tier 1 Capital Ratio (%) | 6.4 | 12.4 | 8.0 | 14.9 | 7.3 | 8.2 | 6.8 | 8.7 | 7.8 | 7.8 | 6.9 | 6.0 | 8.0 | 7.9 | 6.4 | 17.0 | 6.5 | 9.8 | 8.3 | 8.4 |
| Total Risk-Based Capital Ratio (%) | 7.1 | 14.4 | 13.2 | 17.1 | 10.9 | 10.7 | 10.8 | 12.7 | 11.0 | 10.9 | 10.1 | 6.3 | 9.2 | 11.3 | 10.4 | 18.6 | 9.3 | 12.5 | 11.9 | 11.7 |
| Tier 1 Leverage Ratio (%) | 5.2 | 10.1 | 5.0 | 5.2 | 5.3 | 6.2 | 3.2 | 8.1 | 3.8 | 4.5 | 6.7 | 3.6 | 3.4 | 6.5 | 4.9 | 7.1 | 5.0 | 7.4 | 6.3 | 5.1 |

(1) Assumes planned capital actions through Q1 2012, but assuming no material capital issuances from March 16 through March 31, 2012.

Notes: The two minimum capital ratios presented here are for the period Q4 2011 through Q4 2013 and do not necessarily occur in the same quarter. Capital actions include common dividends, common share repurchases, and common share issuance. Estimates may not sum precisely due to rounding.

Source: Federal Reserve estimates in the Supervisory Stress scenario.

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**Comprehensive Capital Analysis and Review 2012**
**Table 3: Estimates of Minimum Tier 1 Common Ratios, Q4 2011 through Q4 2013**

The minimum stressed ratios (%) are the lowest quarterly ratios from Q4 2011 to Q4 2013 in the Supervisory Stress scenario. The left column shows minimum ratios assuming no capital actions after Q1 2012. The right column shows minimum ratios with all proposed capital actions through Q4 2013. Minimum ratios may occur in different quarters across the BHCs, and in different quarters for each BHC across the two columns.

| Bank Holding Company | Minimum stressed ratios assuming no capital actions after Q1 2012 (1) | Minimum stressed ratios with all proposed capital actions through Q4 2013 |
|---|---|---|
| Ally Financial Inc. | 2.5 | 2.5 |
| American Express Company | 12.4 | 10.8 |
| Bank of America Corporation | 5.7 | 5.9 |
| The Bank of New York Mellon Corporation | 13.3 | 13.0 |
| BB&T Corporation | 7.3 | 6.4 |
| Capital One Financial Corporation | 7.2 | 7.8 |
| Citigroup Inc. | 5.9 | 4.9 |
| Fifth Third Bancorp | 7.7 | 6.3 |
| The Goldman Sachs Group, Inc. | 5.8 | 5.7 |
| JPMorgan Chase & Co. | 6.3 | 5.4 |
| Keycorp | 6.3 | 5.3 |
| MetLife, Inc. | 5.4 | 5.1 |
| Morgan Stanley | 5.4 | 5.4 |
| The PNC Financial Services Group, Inc. | 6.6 | 5.9 |
| Regions Financial Corporation | 5.7 | 6.6 |
| State Street Corporation | 15.1 | 12.5 |
| SunTrust Banks, Inc. | 5.5 | 4.8 |
| U.S. Bancorp | 7.7 | 5.4 |
| Wells Fargo & Company | 6.6 | 6.0 |

(1) Assumes planned capital actions through Q1 2012, but no material capital issuances from March 16 through March 31, 2012.

Notes: Capital actions include common dividends, common share repurchases, and common share issuance.

Source: Federal Reserve estimates in the Supervisory Stress scenario.


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**Comprehensive Capital Analysis and Review 2012**
**Table 4: Projections for 19 Participating Bank Holding Companies**
**Billions of Dollars**

*These projections represent hypothetical estimates that involve an economic outcome that is more adverse than expected. These estimates are not forecasts of expected losses, revenues, net income before taxes or capital ratios.*

The Federal Reserve made changes to this table on March 16, 2012, to correct computation errors for some loss rates and levels. The corrections do not impact other figures, including capital ratios.

| | Ally Financial Inc. | American Express Company | Bank of America Corporation | The Bank of New York Mellon Corporation | BB&T Corporation | Capital One Financial Corporation | Citigroup Inc. | Fifth Third Bancorp | The Goldman Sachs Group, Inc. | JPMorgan Chase & Co. | Keycorp | MetLife, Inc. | Morgan Stanley | The PNC Financial Services Group, Inc. | Regions Financial Corporation | State Street Corporation | SunTrust Banks, Inc. | U.S. Bancorp | Wells Fargo & Company | 19 Participating Bank Holding Companies |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Projected Losses, Revenue and Net Income before Taxes for Q4 2011 through Q4 2013 Under the Hypothetical Supervisory Stress Scenario** | | | | | | | | | | | | | | | | | | | | |
| Pre-Provision Net Revenue (1) | -5.1 | 16.0 | 40.1 | 6.5 | 5.4 | 18.6 | 41.2 | 4.1 | 14.2 | 59.3 | 1.7 | 9.6 | 1.0 | 4.2 | 3.7 | 2.4 | 2.7 | 14.7 | 53.3 | 293.5 |
| Other Revenue (2) | 0.2 | 0.0 | 4.0 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | -1.8 | -0.4 | -0.3 | 0.0 | 0.0 | 0.3 | -0.1 | 1.9 |
| *less* | | | | | | | | | | | | | | | | | | | | |
| Provisions | 3.1 | 9.6 | 59.7 | 1.1 | 6.0 | 22.3 | 61.6 | 4.8 | 0.5 | 48.9 | 4.0 | 1.0 | 0.9 | 11.1 | 5.6 | 0.4 | 8.5 | 15.2 | 60.2 | 324.4 |
| Realized Losses/Gains on Securities (AFS/HTM) | 0.9 | 0.0 | 1.2 | 0.3 | 0.2 | 0.3 | 6.1 | 0.1 | 0.2 | 3.8 | 0.0 | 11.5 | 0.0 | 1.2 | 0.0 | 0.4 | 0.0 | 0.7 | 3.9 | 31.0 |
| Trading and Counterparty Losses (3) | 0.0 | 0.0 | 21.1 | 0.0 | 0.0 | 0.0 | 20.9 | 0.0 | 27.1 | 27.7 | 0.0 | 0.0 | 12.8 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 6.9 | 116.5 |
| Other Losses/Gains (4) | 0.9 | 0.0 | 13.4 | 0.0 | 0.0 | 0.0 | 2.9 | 0.0 | 8.0 | 1.7 | 0.6 | 7.9 | 8.1 | 0.3 | 0.1 | 0.0 | -0.1 | 0.0 | 1.7 | 45.5 |
| *equals* | | | | | | | | | | | | | | | | | | | | |
| Net Income before Taxes | -9.8 | 6.3 | -51.3 | 5.1 | -0.9 | -4.0 | -50.3 | -0.9 | -21.5 | -22.9 | -2.9 | -10.8 | -22.5 | -8.9 | -2.4 | 1.5 | -5.7 | -0.9 | -19.6 | -222.0 |
| **Projected Loan Losses by Type of Loans for Q4 2011 through Q4 2013 Under the Hypothetical Supervisory Stress Scenario** | | | | | | | | | | | | | | | | | | | | |
| Loan Losses (5) | 3.6 | 8.1 | 70.1 | 1.2 | 6.0 | 19.0 | 67.0 | 6.4 | 0.3 | 55.8 | 3.9 | 0.9 | 0.7 | 11.1 | 6.0 | 0.3 | 8.0 | 14.6 | 58.3 | 341.3 |
| First Lien Mortgages, Domestic | 0.4 | 0.0 | 17.7 | 0.4 | 1.6 | 1.3 | 8.9 | 0.9 | 0.0 | 7.0 | 0.2 | 0.0 | 0.1 | 1.6 | 1.3 | 0.0 | 1.8 | 2.0 | 15.9 | 61.1 |
| Junior Liens and HELOCs, Domestic | 0.7 | 0.0 | 16.0 | 0.0 | 0.6 | 0.2 | 5.9 | 1.1 | 0.0 | 9.1 | 0.7 | 0.0 | 0.0 | 3.0 | 1.3 | 0.0 | 2.2 | 1.7 | 13.7 | 56.3 |
| Commercial and Industrial | 0.5 | 2.4 | 12.3 | 0.2 | 0.9 | 1.3 | 11.8 | 2.2 | 0.0 | 11.4 | 1.6 | 0.0 | 0.3 | 3.4 | 1.0 | 0.0 | 2.3 | 4.2 | 11.0 | 66.7 |
| Commercial Real Estate, Domestic | 0.1 | 0.0 | 3.9 | 0.1 | 1.8 | 0.4 | 0.5 | 1.4 | 0.0 | 1.8 | 0.4 | 0.4 | 0.0 | 1.5 | 1.9 | 0.1 | 0.8 | 1.8 | 6.7 | 23.6 |
| Credit Cards | 0.0 | 5.4 | 14.5 | 0.0 | 0.3 | 13.9 | 27.0 | 0.4 | 0.0 | 21.3 | 0.1 | 0.0 | 0.0 | 0.6 | 0.1 | 0.0 | 0.1 | 3.2 | 5.0 | 92.1 |
| Other Consumer | 2.0 | 0.2 | 4.0 | 0.0 | 0.7 | 1.6 | 8.1 | 0.2 | 0.0 | 2.1 | 0.3 | 0.0 | 0.1 | 0.6 | 0.2 | 0.0 | 0.5 | 0.9 | 4.2 | 25.7 |
| Other Loans | 0.0 | 0.0 | 1.8 | 0.5 | 0.2 | 0.2 | 4.8 | 0.2 | 0.3 | 3.0 | 0.5 | 0.5 | 0.1 | 0.5 | 0.3 | 0.2 | 0.3 | 0.8 | 1.7 | 15.7 |
| **Portfolio Loss Rates by Type of Loans for Q4 2011 through Q4 2013 Under the Hypothetical Supervisory Stress Scenario (% of Average Balances)** | | | | | | | | | | | | | | | | | | | | |
| Loan Losses (5) | 3.3 | 9.3 | 8.3 | 2.6 | 5.7 | 11.4 | 11.3 | 8.0 | 0.9 | 8.1 | 6.9 | 1.4 | 1.6 | 7.1 | 8.1 | 2.0 | 6.8 | 7.4 | 8.2 | 8.1 |
| First Lien Mortgages, Domestic | 6.0 | 0.0 | 6.7 | 7.7 | 5.4 | 3.7 | 9.3 | 7.7 | 0.0 | 6.3 | 7.5 | 0.0 | 0.7 | 9.0 | 8.8 | 0.0 | 7.4 | 4.7 | 9.5 | 7.3 |
| Junior Liens and HELOCs, Domestic | 21.1 | 0.0 | 15.0 | 12.6 | 8.5 | 11.1 | 18.2 | 12.1 | 12.1 | 10.5 | 7.8 | 0.0 | 12.5 | 11.5 | 11.4 | 0.0 | 12.6 | 9.9 | 13.8 | 13.2 |
| Commercial and Industrial | 1.6 | 8.0 | 7.7 | 6.5 | 5.9 | 8.2 | 10.9 | 8.2 | 0.0 | 9.0 | 8.7 | 0.0 | 3.5 | 6.7 | 6.2 | 0.0 | 7.0 | 10.8 | 8.1 | 8.2 |
| Commercial Real Estate, Domestic | 2.3 | 0.0 | 6.4 | 9.8 | 5.6 | 2.1 | 5.9 | 11.3 | 4.1 | 3.0 | 4.1 | 1.3 | 4.0 | 6.0 | 9.2 | 20.1 | 6.9 | 5.0 | 5.5 | 5.2 |
| Credit Cards | 0.0 | 10.0 | 15.5 | 0.0 | 18.9 | 19.4 | 18.5 | 22.3 | 0.0 | 18.0 | 20.0 | 0.0 | 0.0 | 15.0 | 14.1 | 0.0 | 18.9 | 16.9 | 22.4 | 17.2 |
| Other Consumer | 3.0 | 10.1 | 5.6 | 1.2 | 5.6 | 9.8 | 23.4 | 1.8 | 3.7 | 3.6 | 7.3 | 0.0 | 1.2 | 3.4 | 5.3 | 0.0 | 2.4 | 3.3 | 5.1 | 5.9 |
| Other Loans | 2.5 | 0.0 | 1.9 | 1.3 | 2.0 | 3.5 | 2.8 | 2.9 | 0.9 | 2.4 | 4.7 | 1.6 | 0.9 | 3.0 | 3.2 | 1.2 | 3.1 | 4.7 | 2.1 | 2.3 |
| **Profitability Rates for Q4 2011 through Q4 2013 Under the Hypothetical Supervisory Stress Scenario (% of Average Assets)** | | | | | | | | | | | | | | | | | | | | |
| PPNR | -2.7 | 12.2 | 2.0 | 2.0 | 3.1 | 7.5 | 2.3 | 3.6 | 1.7 | 2.7 | 1.9 | 1.4 | 0.1 | 1.5 | 3.1 | 1.2 | 1.5 | 4.6 | 4.1 | 2.5 |
| Net Income before Taxes | -5.2 | 4.8 | -2.6 | 1.6 | -0.5 | -1.6 | -2.8 | -0.7 | -2.5 | -1.0 | -3.3 | -1.5 | -3.2 | -3.2 | -2.0 | 0.8 | -3.3 | -0.3 | -1.5 | -1.9 |

(1) Pre-Provision Net Revenue includes losses from operational risk events, mortgage put-back expenses, and OREO costs.
(2) Other Revenue includes one time income and (expense) items not included in Pre-Provision Net Revenue.
(3) Trading and Counterparty includes mark-to-market losses, changes in credit valuation adjustments (CVA) and incremental default losses.
(4) Other Losses/Gains includes projected change in fair value of loans held for sale and loans held for investment measured under the fair value option, and goodwill impairment charges.
(5) Commercial and industrial loans include small and medium enterprise loans and corporate cards. Other loans include international real estate loans. Average loan balances used to calculate portfolio loss rates exclude loans held for sale and loans held for investment under the fair value option.

Notes: Average balances used for profitability ratios and portfolio loss rates are averages over the nine-quarter period. Estimates may not sum precisely due to rounding.

Source: Federal Reserve estimates in the Supervisory Stress scenario.