

# Stress Testing in Action: Lessons from the Financial Crisis

By Emil Matsakh, Yigit Altintas and Will Callender

*Undertaking a robust stress test and communicating results in a credible manner will enable banks to increase investor confidence.*

The ongoing economic downturn in the United States triggered by the housing market collapse has led to the deterioration of banks' capital positions, as banks have faced large market-to-market losses in their securities portfolios and higher-than-expected credit losses on their loan portfolios. Since 3Q 2007, U.S. banks have written down a combined \$627 billion, while raising just \$508 billion of capital to plug the hole. Due to the severity and duration of the financial crisis, stress testing (and the role it should play in the broader capital management process) has been identified as a critical area in which the banking industry must make vast and enduring improvements going forward.

## FMCG's View of Industrywide Capital Adequacy

Our own industry stress-test model provides a barbell view of the capital adequacy of the banking industry.<sup>1</sup> As shown in Exhibit 1, there is wide diversity among banks in the degree to which they can weather a stressed economic downturn.<sup>2</sup> Twenty percent of banks appear to reach critical sustainability levels by year-end 2010, while 40 percent of banks show an improved or flat capital/reserve position in 2010 versus current levels.

Moreover, there are significant differences in the quality of tangible common equity (TCE) across banks depending on the portion of TCE made up of tax credits. For 40 percent of banks that are in the strongest capital state, less than three percent of

stressed TCE is in tax credits. Among the 20 percent of banks that are in a troubled capital state, however, the accumulated tax credit portion of stressed TCE at year-end 2010 is almost 70 percent—and this seems to be more common among larger banks.

In addition to forecasting capital strength under a stressed environment through 2010, we projected the ratio of TCE to total assets (TA) in 2011 and 2012 under an improving economy. Our analysis indicates that the disparity among the surviving banks will continue post-2010, with the top 40 percent of banks reaching precrisis capital levels of seven percent to eight percent and the rest of the banks remaining below the long-term target six percent TCE/TA position (Exhibit 2). This has significant strategic implications across the industry and suggests that, while acquisitions will be a viable option for some, many surviving institutions will need to focus on capital management, carefully rationing capital to businesses based on attractive risk-adjusted returns to capital (RAROCs).

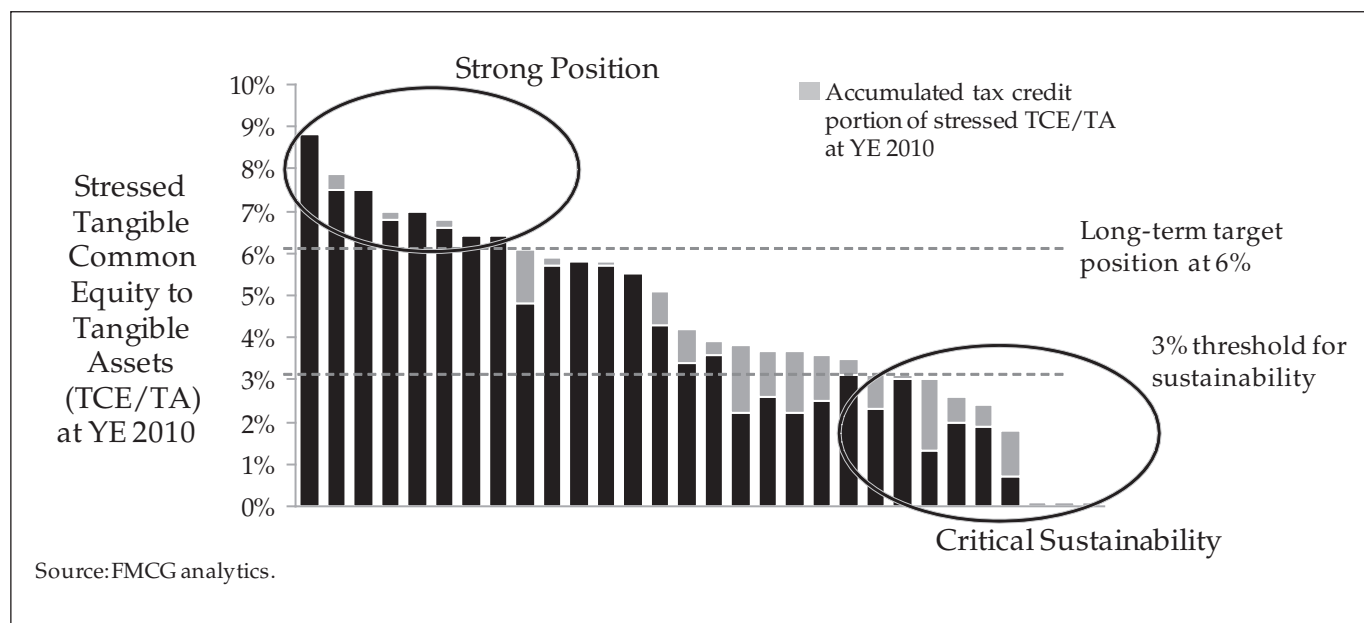
## Stress Testing as a Top Agenda Item

In the first half of 2009, the capital adequacy of financial institutions and, in particular, the role of

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Exhibit 1. Predicted Levels of Capital Adequacy by Year-End 2010



stress testing in the capital management process, became the top agenda item of bank regulators and policy makers. The U.S. Treasury launched a stress test of the top 19 U.S. banks. Other G-20 nations began working to take similar actions to assess the soundness of their banking systems in addition to the existing Basel II Internal Capital Adequacy Assessment Process (ICAAP) requirements. In May 2009, the Basel Committee on Banking Supervision published guidance from an industrywide examination on “Principles for Sound Stress Testing Practices and Supervision.”

Shareholders and debt investors have also come to expect and place a premium on improved transparency of capital adequacy (through robust stress testing) under the current strained market environment, as witnessed by the market’s reaction to the Treasury’s stress test of the top U.S. banks.

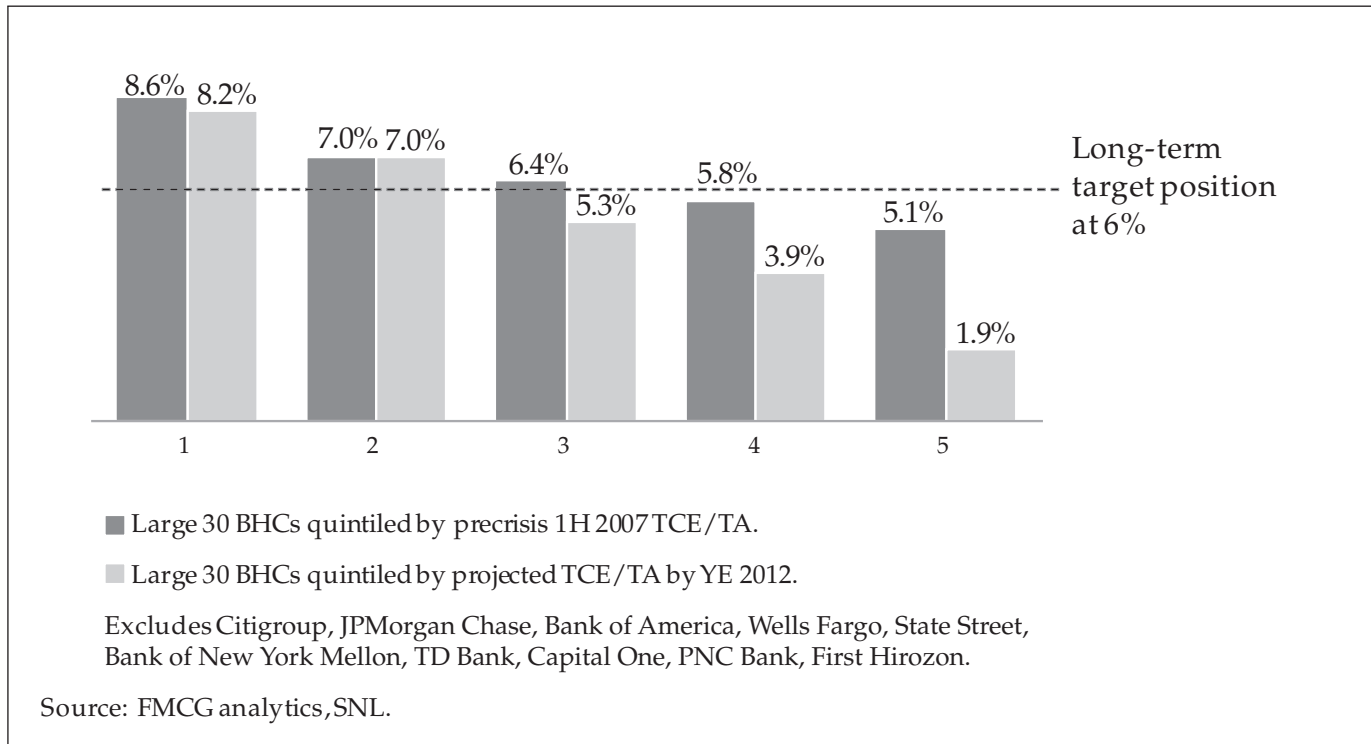
As part of the government’s Financial Stability Plan, 19 of the largest U.S. banks in March and April 2009 underwent “large” macroeconomic stress tests conducted by the Treasury, referred to as the Supervisory Capital Assessment Program (SCAP). The stated objective was to assess whether these systemically important institutions had enough capital to continue business-as-usual lending activities while absorbing elevated losses in the event that the economic decline becomes more severe than expected. The stress-test out-

comes, which required that 10 of the banks raise a combined \$75 billion in additional capital, have provided some stability to the market—witness the \$56 billion of equity raised through public offerings in 2Q 09 versus just \$4 billion in 1Q 09 (Exhibit 3).

While the banking industry as a whole has seen stock valuations rebound by 90 percent since its pre-SCAP low in early March 2009, the market has not been equally favorable to all banks. Since the March trough, banks who underwent the Treasury’s stress test have experienced a 181-percent increase in their stock prices compared to just 17 percent for those banks that did not (Exhibit 4). This disparity in market performance demonstrates the significance that the market has begun to place on stress testing and improved transparency. For many smaller and midsize banks that did not go through the Treasury’s stress test but need additional capital to replenish their capital base or repay TARP (Troubled Asset Relief Program), catching investors’ interest at reasonable prices is tougher without a credible stress test. This is particularly so because many capital sources consider smaller bank loan portfolios to be riskier, and there is less confidence that additional government assistance will be forthcoming.

Some investors are conducting their own stress tests of candidate banks using publicly available

Exhibit 2. Top 40 Percent of Banks Predicted to Reach Precrisis Capital Levels by 2010



information or conservatively extrapolating results from the Treasury’s stress-test guidelines. However, developing a granular and tailored stress test using a bank’s internal loss data and loan-level or segment-level portfolio characteristics can significantly affect stressed loss estimates (for example, by 15 percent to 30 percent). Therefore, undertaking a robust test and communicating results in a credible manner will enable banks to increase investor confidence and potentially lower dilution of the existing shareholders. For example, stress-testing results were the cornerstone of an investor presentation by one of our recent clients that was able to raise capital from public and private sources (including some of the most sophisticated private equity investors in financial services) exceeding its preraise market capitalization.

### Limitations of the Treasury’s SCAP

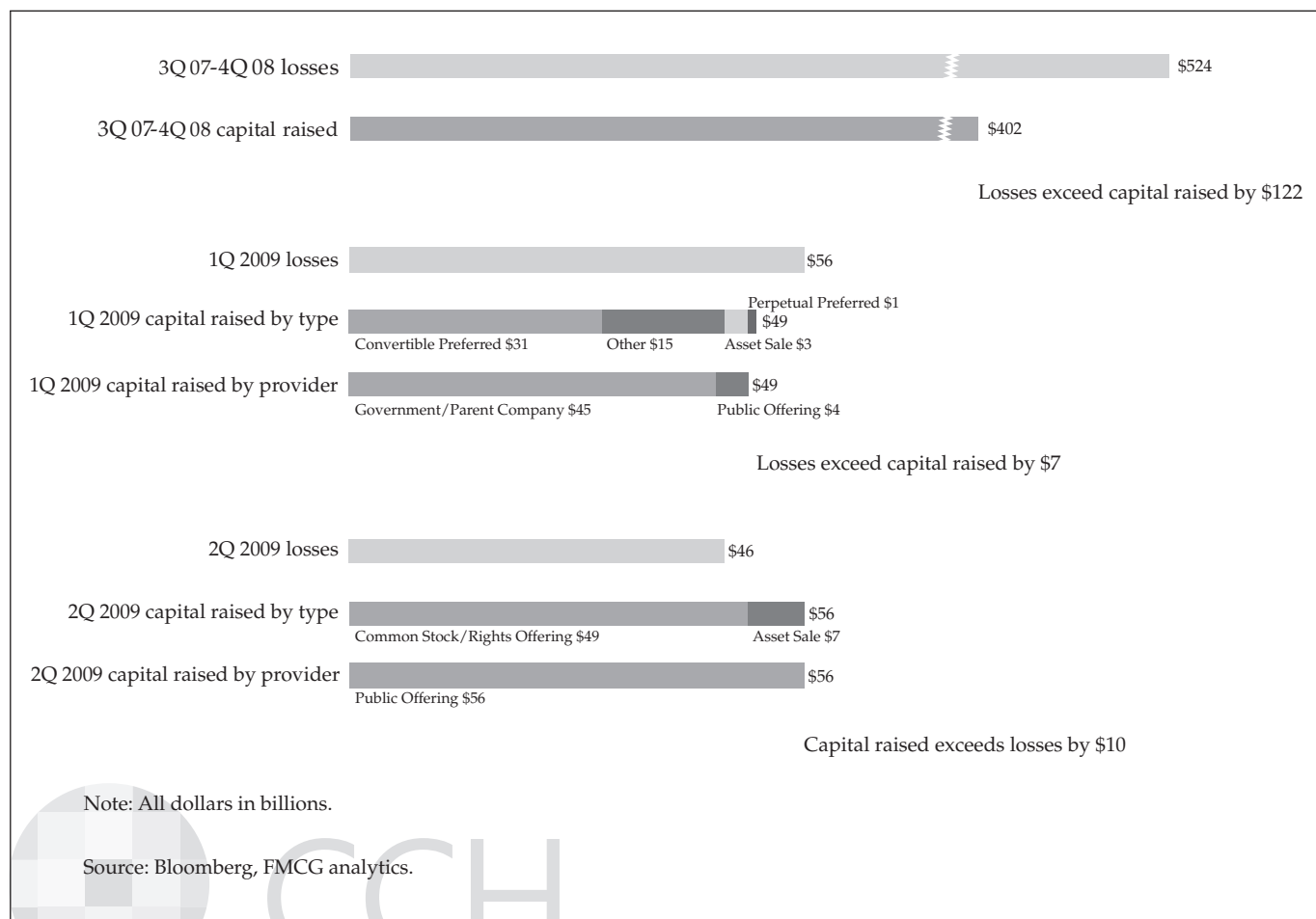
Many of these superregional, regional and community banks have recently begun to develop or

improve their in-house stress tests. As our recent conversations and projects with clients have revealed, however, the tendency has been to model their stress tests after the Treasury’s SCAP. While this may have been perceived to be necessary in the short run to compete with SCAP banks in attracting capital by applying a market-standard stress test, the Treasury’s SCAP should not be viewed as a best-practice framework for stress testing in the long run for several reasons.

First, SCAP is not comprehensive in its coverage of risk types, as it focuses *exclusively* on credit risk. Second, SCAP does not consider a variety of shock scenarios that vary in severity but, rather, defines only one “more adverse” downturn scenario. Third, SCAP provides a more limited and prescriptive set of rules than an internal stress test should due to the fact that it had to be implemented in a short period of time and, for the sake of regulators, needed to be directly comparable across institutions.

In short, SCAP was meant to operate as an ad hoc stress test, rather than as an integrated component of a more comprehensive and ongoing capital management process.

Exhibit 3. \$56 Billion of Equity Raised Through Public Offerings in 2Q 09



## The Capital Management Process

Capital management is the process by which banks determine the appropriate amount of capital to hold on balance sheet given the competing constraints of solvency and profitability. Holding too little capital may result in insufficient coverage of the level and nature of risks assumed by the bank, while holding too much capital may create a drag on a bank's profitability. The capital management process should consider both the quantum and the quality/mix of required capital components and enable the bank to reconcile varying capital demand versus sources of capital. As such, the capital management process should be dynamic and forward looking to support strategic decision making.

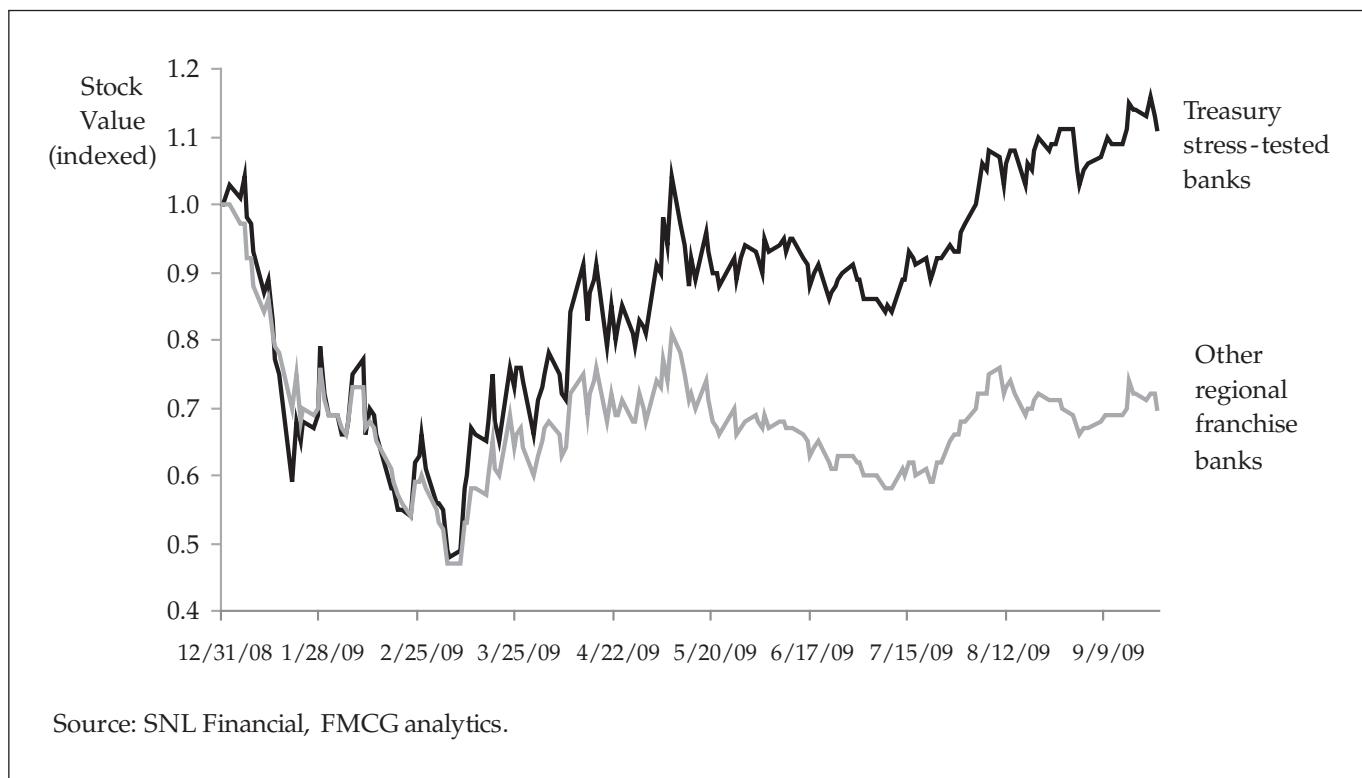
In its comprehensive form, the capital management process should allow banks to answer the following strategic questions:

- Do we have too much or too little capital for our desired risk level?
- Are we directing capital to its best/highest use?
- Do we have a mix of business that achieves a good risk-adjusted return?
- Do we need to grow/add risk-diversifying businesses?
- Should we seek a different credit rating?

## Four Perspectives of Capital Adequacy

The capital management process requires banks to carefully balance and reconcile internal and external perspectives of capital adequacy that differ in their determination of why banks need capital, what constitutes capital, the computation of capital and the review audience, among others.

Exhibit 4. Stress-Test Banks Stock Prices up 181 Percent Since March 2009; Others up 17 Percent



External perspectives include regulatory and rating agency views. Economic capital assessment is an internal, bottom-up perspective. Stress testing can have both external and internal viewpoints. The key differences among these perspectives are highlighted in Exhibit 5.

In summary, the following relationships between different forms of capital requirements are important to consider within the capital management process:

- Minimum requirements must be satisfied from regulatory and rating agency perspectives, including both quantum and mix considerations.
- Economic capital provides an internal view of required capitalization, including capital required for risks not considered within regulatory and rating agency frameworks.
- Economic capital is more closely related to Tier 1 common or tangible common needs.
- Stress-test requirements are more closely related to regulatory capital needs.

While each of these perspectives is critical to the capital management process, the remainder of the article focuses on stress testing, as it is the perspec-

tive that had been most underemphasized at banks during the pre-crisis period and has become highly prized by the market of late.

### Developing a Best-Practice Internal Stress-Testing Framework

Stress testing is an important risk-management and capital planning tool used by banks to identify plausible but adverse business and market conditions and assess their potential impact on the bank's capital position. Stress tests allow banks to address risk types that are not adequately captured in the regulatory capital frameworks (for example, liquidity risk) and provide input into assessment of capital adequacy. Stress tests also assist the board and management in determining a bank's risk appetite and help them plan for appropriate business management strategies, investor relations/regulatory communications and capital actions under adverse scenarios (contingency planning).

Exhibit 5. Four Perspectives on Capital Adequacy

	Regulatory (Basel I)	Stress Test	Rating Agency	Economic Capital
<b>Need for capital</b>	Ensure safety and soundness of the system and protect depositors	Capital, net of existing resources, required to withstand a defined adverse scenario and ensure regulatory capital sufficiency	Protect unsecured debt investors against losses arising from issuer default	Capital needed to insulate against unexpected losses to a defined solvency level
<b>Capitalized risk types</b>	Credit, market	Credit only (in SCAP context) Multiple risk types (in ICAAP context)	Credit, market, operational (ALM considered on a qualitative basis)	Credit, market, structural interest rate (ALM), operational, business, fixed assets/other
<b>Minimum requirement</b>	Total capital = Tier 1 (core) capital + Tier 2 (complementary) capital, subject to various limits and restrictions, minus certain deductions  Total capital $\geq 10\%$ Risk Weighted Assets[RWA], Tier 1 $\geq 6\%$ RWA, leverage ratio $\geq 5\%$  Tier 1 must be greater than or equal to 50% of total capital. Noncommon equity up to a limit for Tier 1.	Multiple requirements (in ICAAP context)  Tier 1 common $\geq 4\%$ RWA at YE2010 (in SCAP context)  Tier 1 $\geq 6\%$ RWA at YE2010 (in SCAP context)	Varies by rating agency  Rating agencies incorporate capital adequacy as a component to bank holding company ratings. Often acceptable ranges are expressed in TCE/TA terms.	Protection against unexpected losses to a confidence level consistent with target debt rating (e.g., "A")
<b>Implied rating</b>	Undefined	Undefined	Actual unsecured debt rating (capital adequacy is one of the rating decision factors)	Target senior unsecured debt rating

## Common Shortcomings in Banks' Stress-Testing Practices

The financial and economic crisis in the United States has revealed several common shortcomings in banks' stress-testing practices.

The first is inadequate granularity: Though many banks had sufficient internal data, they often failed to stress their portfolios at the most granular level. Instead of stressing loan growth and credit-loss expectations at the granular credit-segment level (that is, by loan-to-value ratio [LTV] and FICO credit score), many banks limited their lens to the portfolio-level assessments.

A second weakness in typical stress-testing approaches is inadequate coverage of risks. Several risk types presented by relatively new products

have not been adequately addressed by many banks. For example, many bank stress-test models did not adequately capture contingent risks that arose either from legally binding credit and liquidity lines or from reputational concerns related to off-balance-sheet vehicles. In addition, banks underestimated the pipeline risk related to issuing new structured products due to the assumption that securitization markets would remain liquid.

Third, focus on individual risk silos rather than on an integrated view of risk is a common shortcoming of many institutions. Stress tests ran by individual business lines (for example, corporate, retail or treasury services) or by risk functions focusing on specific risk types (for example, credit, market) and missed cross-risk interactions or knock-on effects (for example, liquidity shocks after a credit crisis).

Exhibit 6. Six Steps to a Comprehensive Stress Test

1) Define framework and identify adverse scenarios	<p>Scenario framework reflecting:</p> <ul style="list-style-type: none"> <li>• Characteristics (e.g., macroeconomic vs. idiosyncratic risk, historically based vs. hypothetical)</li> <li>• Consistency and interaction of scenarios of various risk types (e.g., feedback effects)</li> <li>• Severity spectrum (e.g., magnitude and duration)</li> </ul> <p>Scenarios reflecting adverse but plausible business and market conditions, e.g.:</p> <ul style="list-style-type: none"> <li>• Economic recession</li> <li>• Severe disruption of financial markets resulting in government interruption</li> <li>• Home price depreciation</li> <li>• Liquidity and funding market stress</li> <li>• FX devaluation</li> </ul>
2) Assign parameters to risk measurement models	<p>Credit risk: for macrolevel scenarios, estimation of econometric relationships between macrofactors and risk measurement models</p> <p>Market risk:</p> <ul style="list-style-type: none"> <li>• Trading</li> <li>• Banking book (ALM), including yield curve, parallel, twist and basis movements</li> <li>• Residual</li> </ul> <p>Operational risk Business risk Insurance risk Pension risk Other risks not captured through regulatory and economic capital framework (e.g., liquidity)</p>
3) Estimate uses of capital under stress scenarios	<p>Quantitative risk measurement system-based loss estimates Qualitative assessment based on expert opinion</p>
4) Identify capital sources	<p>Capital base Loan loss reserves (LLR) Future earnings power</p>
5) Incorporate management levers and contingent capital sources	<p>Dividend cuts Limitations on growth Asset sales and securitization Divestitures Capital or hybrid issuance <i>Etc.</i> <i>Note that these levers should be scenario specific as their availability may be limited under certain scenarios.</i></p>
6) Assess capital adequacy	<p>Analysis of sources and uses of capital under each stress scenario</p>

Fourth, overreliance on historical relationships is a common limitation. The ongoing global financial crisis has shown that historical relationships break down under stressed conditions (for example, spreads, correlations); therefore, stressed correlations between risk factors must be used in constructing the test.

Fifth, unanticipated changes in customer behavioral characteristics posed significant challenges for many. These include customers' tendency to delay defaulting on credit cards versus other consumer (nonresidential) loans because of additional utility provided by credit cards.

Sixth, rosy stress scenarios were a common limitation of typical stress tests. The scenarios modeled by

many U.S. banks were not severe enough in terms of both magnitude and duration, often because it was difficult to obtain management buy-in of more severe scenarios. As a result, potential risks were underestimated, particularly after the long benign economic period (that is, steady home price appreciation over 20 years followed by 2.5 years (so far) of home price depreciation).

### Best-Practice Road Map for Stress Testing

Based on this recent client work as well as experiences with regulators and rating agencies, FMCG

has developed a best-practice road map for a rigorous and comprehensive stress test that avoids these common pitfalls (Exhibit 6).

From this work, we gathered 10 critical observations about which levers tend to have the most meaningful impact on results (particularly in SCAP-like stress-test context):

1. **Granularity matters.** Loan-level versus portfolio-level analysis can change results significantly, especially for construction/land and investor commercial real estate (CRE) loans, where the most critical default driver is whether the underlying project is underwater. This depends on collateral-specific characteristics such as original LTV, underlying property type, origination vintage and location. For example, in our analyses, stressed loss rates for construction and land loans in the southeastern United States have ranged between 10 percent and 80 percent from one loan to another.
2. **Location, location, location.** The housing bubble burst has affected not only metropolitan statistical areas (MSAs) differently but counties, zip codes and zip codes + 4 within the same MSA. When property-level appraisals are not available, consideration of home price depreciation estimates (for both realized losses and go-forward deterioration) at micromarket levels can drastically change results. For example, cumulative home price depreciation within the same MSA can differ by close to 20 percent, thereby affecting loss projections.
3. **Customer relationship is an often overlooked, but important, variable.** The Treasury stress test and most banks use three common loss drivers—LTV/combined LTV, FICO and vintage—to assess residential mortgages and second liens/home equity lines of credit (HELOCs). While these variables are predictive of defaults, another key variable is often overlooked: the customer relationship. A mortgage borrower with a significant deposit relationship at the same bank compared to one with no relationship is 1.5 to 2.0 times less likely to default on a loan, assuming all other drivers are the same.
4. **Statistical relationships from benign risk periods break down.** Modeling approaches must explicitly account for the fact that macroeconomic relationships established during more benign periods may break down under stress and must be adjusted. For example, the traditional macrofactor model of credit card defaults shows a linear relationship between changes in unemployment and increases in defaults (in fact, the relationship is less than one-to-one because the newly unemployed can dip into their savings first). This relationship becomes nonlinear under stress scenarios (as evidenced by the current crisis) due to contagion effects. Also, geography (because of its linkage to home price evolution) becomes an important driver of credit card losses unlike that evidenced in prior recessions
5. **Dynamic modeling of credit migration reflects decline in home prices.** The traditional approach of stressing historical default assumptions for a risk segment (for example, loans within a specific “original” LTV band) is no longer accurate for mortgages due to the unprecedented decline in home prices. For example, the default rate of an over 95 percent “current” LTV loan is as much as five times higher than that of an 80 percent “current” LTV loan, even though they both began as 75 percent LTV loans. Therefore, it is critical for appropriate stress-test modeling to analyze the dynamic migration of loans to higher default-rate segments based on loan-level migration across the “current” LTV spectrum under a continuing home price decline scenario.
6. **Nonperforming assets (NPAs)/other real estate owned (OREO) growth affects income projections in multiple ways.** Projections of outstanding NPAs and OREO significantly affect preprovision income offsets. First, the rapidly growing NPAs/OREO under the stress scenario need to be funded until disposition at a negative carry. Second, the functional costs of collection efforts (including litigation in foreclosure) cannot be readily mitigated through reductions-in-force and other cost-saving efforts. Third, the property taxes, insurance fees and maintenance expenses for OREO properties may exceed recoveries for smaller-size loans. Accordingly, overconservative or overgenerous assumptions around the disposition time frames that drive the outstanding NPAs/OREO can affect earnings estimates significantly. Annual taxes and legal fees may approach four percent of OREO assets and may be based on tax assessments that have not been

updated recently. Annual property maintenance costs may run up to 10 percent of OREO assets unless the bank is able to renegotiate agreements with local maintenance companies. As a counterbalance, once write-offs are taken, some asset categories can be restructured to mitigate the growth in NPAs.

7. **Growth and pricing dynamics should be balanced.** Volume and pricing assumptions need to reflect the competitive dynamics in the bank's footprint under stressed conditions. While many banks find themselves flush with deposits today, others are finding it difficult to originate assets at appropriate risk-adjusted spreads to put funding productively to work. Thus, in a number of cases, we would expect balance sheets to shrink under stress. Consequently, in assessing loan portfolio runoff, the knock-on effects of nonrenewals on credit should be thought out. If a bank considers cutting exposure to CRE by not rolling construction loans into permanent financing, credit-modeling assumptions need to reflect heightened defaults among those customers whose current LTVs are, say, above 70 percent and who will not be able to refinance with other lenders. Projecting growing or flat deposit balances while significantly decreasing customer rates may be possible if banks return to a more rational deposit pricing approach similar to that evident after the last recession. However, banks must also consider the implications of having institution-specific increases in liquidity requirements, causing deposit yields to remain elevated for prolonged periods.
8. **Changes in fee revenue may be counterintuitive.** Fee projections need to reflect customer behavior patterns that are institution specific under recessionary conditions. For example, while some would expect service charges on deposit accounts (SCDA) to rise during the recession given income declines, many banks are finding a drop in SCDA fees (five percent to 10 percent) because customers are becoming more fiscally conservative and taking additional steps to avoid overdrafts.
9. **Effects of possible management actions should be considered separately from base case.** One of the key purposes of stress testing is to help management develop contingency

plans. Management levers—including asset disposition and loan-loss mitigation strategies, cost rationalization and business transformation approaches focused on net-interest margin (NIM) or fee income growth—and their timing should be considered in a stress-testing context as an overlay to the base case. Incorporating the effects of management actions directly into the stress test muddies the picture because it commingles the outcomes of the current business decisions and those that would be made only if the economic conditions were to become more adverse.

10. **Data quality is key.** Though data quality considerations may be overlooked in a rush to meet deadlines, starting a stress test with a quick and focused effort to verify the integrity of key data items is critical. Often, property appraisal and current LTV data turn out to be the weakest links in the analyses. Problems range from omission of a digit in appraisal value data (due to errors in the data entry or system extraction processes) to using completed rather than as-is collateral values for construction loans. All of these issues can drastically change the stress-testing results, particularly if they are systemic or affect concentrated positions.

### Steps to Quickly Develop Internal Stress-Test Analyses and Communicate Results

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The global financial crisis has highlighted the scarcity of capital as a key resource for financial institutions and the need to effectively communicate the bank's leverage position to the market. If a bank seeks to quickly develop/refine stress-test analyses for discussions with the board, potential investors and regulators/rating agencies, we believe the following steps are warranted:

- **Define objectives and timing requirements for your stress test.** For instance, this may entail management agreement to proactively communicate to potential investors in six weeks' time the bank's capital position (now, at the end of the stress period, and emerging out of

the stress period) so as to increase confidence and attract capital.

- **Develop a governance structure and assign responsibilities to the internal team.** Identify executive committee members accountable to the board for the effort. Create an interdisciplinary team of risk, finance, strategy, information technology (IT) and business-line experts to ensure that internal analyses have a solid, factual, honest basis and can withstand intense board, regulatory and investor scrutiny.
- **Create a war room to house data and the internal team undertaking the analyses.** The purpose of having a war room structure is threefold: Ensure uninterrupted focus of the internal team on the task, maintain utmost confidentiality of efforts and encourage direct and unfettered communication of sharp-pencil analytics to the executive committee to enable difficult management decisions.
- **Develop a credible communication strategy.** First, results need to be communicated to the

board to enable it to quickly make necessary decisions. Then, management needs time to craft credible communications. Appropriate messages will need to be conceived, evaluated and supported for investors, regulators and other constituents.

### Endnotes

- <sup>1</sup> Using publicly available information only, we developed an industry stress-test model that calculated stressed capital projections for using product-level loss estimates adjusted for institution-specific credit quality and business-mix characteristics. The data shown in this article are for the “Top 30” banks (excluding money centers and specialists) as of year-end 2010 and are, therefore, aligned with the time frame of the U.S. Treasuries’ Supervisory Capital Asset Program (SCAP) stress test “more adverse” scenario.
- <sup>2</sup> Economic downturn as specified by the U.S. Treasuries’ SCAP stress test “more adverse” scenario (*i.e.*, -3.3-percent and 0.5-percent gross domestic product [GDP] growth, 22-percent and seven-percent home price decline, 8.9-percent and 10.3-percent unemployment rate in 2009 and 2010, respectively).

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