

# Stress-Testing a C&I Loan Portfolio

## A Top-Down Approach to Assessing Downside Economic Risks

*Stress testing is becoming an increasingly vital diagnostic tool for risk mitigation, and financial regulators are encouraging its use in banking institutions of all asset sizes. Basel II modeling requirements and the recent subprime crisis increase the need for such tools as a serious, pervasive economic downturn looms and obvious financial risks abound.*

BY RICK BUCZYNSKI

IN THE APRIL 2008 issue of *The RMA Journal*, Robert Hudson provided an excellent article on stress testing, which sometimes is called *scenario analysis* or *sensitivity analysis*. Hudson correctly and succinctly stated, “Basel II rules have added to the complexity of capital planning, making a forward-looking assessment of potential needs even more variable.” He also wrote, “Stress testing is moderately well established in the field of market risk, but its use for credit or operational risk is rudimentary.”

In recent federal agency releases on Basel II final rules and supervisory guidance, stress testing has been center stage. In particular, “A bank should consider ... the credit risk effects of extreme outcomes, stress events, and shocks to assumptions about portfolio and exposure behavior.”<sup>1</sup>

Outside of the obvious need to comply with regulator scrutiny, many banks are finding that stress testing can be an important tactical tool, not only for defensive posturing during difficult times but also for identifying strategic opportunities that competitors may overlook.

In practice, some banks stress test commercial and industrial (C&I) loan portfolios by lowering all obligor risk ratings by a fixed number of grade bands. For example, borrowers with an A+ equivalent credit rating are degraded

to A-, obligors rated as BBB are lowered to BB+, and so on. The net effect is increased default probabilities across the entire portfolio.

Although such an approach has merits, it fails to adequately address the uneven impacts an economic shock has on different industries. When economic conditions deteriorate, some sectors are threatened, others suffer immensely, and others actually benefit, as determined by the sectors' relative sensitivity to economic factors.

Another shortcoming of an across-the-board downgrade of risk ratings is that it does not necessarily help identify the interrelationships among industries. As a consequence, correlations between industries and a portfolio's inherent risk concentrations are not taken into account.

Borrowing from an industry risk-rating methodology developed by IBISWorld and RMA,<sup>2</sup> this article provides a framework to analyze a bank's C&I lending portfolio under conditions of economic stress. It also helps identify industries that will be hit hardest if a recessionary climate is the state of play and the lending opportunities reside in a downside scenario. This article does not profess to provide all the answers, just a solid starting point from a top-down portfolio-selection perspective.

## The Basic Methodology

In the May 2002 *RMA Journal*, Marc Intrater provided a basic conceptual framework for stress tests in the credit area:

The most common type of stress test examines industries or sectors. It would, for example, test what would happen if there were a downturn in the transportation industry. ... Second-order effects should be examined as well. If the transportation sector would be affected, what would that do to the hospitality sector? What would that do to the energy sector? Would there be lower-magnitude impacts on other sectors?

Within the context of stress testing using macroeconomic factors, Intrater noted:

Another direction for doing stress testing, involving somewhat more complex tools, would be to have them based on macroeconomic factors, such as interest rates, energy, or unemployment. If you have models that link macroeconomic factors to the health of different industries, you can perform such a stress test ... [by determining] the macroeconomic stress and its impact on the financial health of different industries. ... The macroeconomic stress test is similar to the first, sector-based stress test. But unlike the first test, in which the stress is very concentrated in one industry, it will probably be diffuse across a number of different industries affected by the macroeconomic factor.

These concepts provide the foundation of our methodology. The precise theoretical underpinning is a marriage of

Michael Porter's "Five Forces"<sup>3</sup> and a traditional macroeconomic-style top-down approach.

Porter's Five Forces are summarized as:

- Threat of new entrants or barriers to entering an industry.
- Bargaining power of customers.
- Bargaining power of suppliers.
- Threat of substitute products or services.
- Rivalry among existing firms.

These factors help explain the performance of a firm within a particular industry and can be assigned the moniker *internal structural forces*. (Porter's research suggests that industry conditions directly account for 19% of aggregate variation in business-specific profits and 36% of explained variation.<sup>4</sup>)

The top-down macroeconomic approach takes into account how economic factors such as personal disposable income, commodity prices, foreign exchange rates, investment patterns, and interest rates impact a particular industry. These elements can be called *industry sensitivities* or *external environmental forces*.

Finally, supply-chain linkages, related to Porter's bargaining power of buyers and suppliers, are critical to understanding and analyzing an industry's position (and therefore a company within that industry's posture) in an integrated economic world.

Figure 1 represents a simple schematic of the industry-oriented C&I stress-testing framework, wiring Porter's forces, macroeconomic factors, and supply-chain linkages together into one cohesive system.

Figure 1

### Factors Determining the Health of an Obligor's Industry: It All Starts Here...

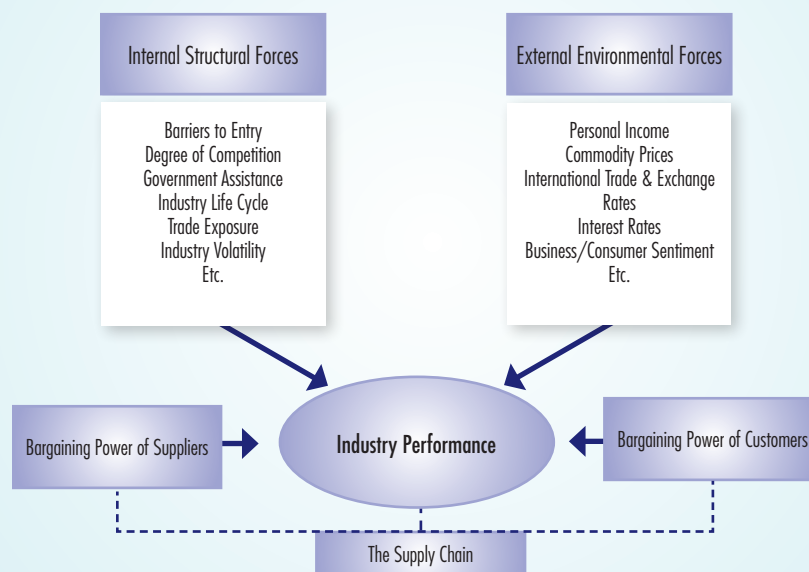
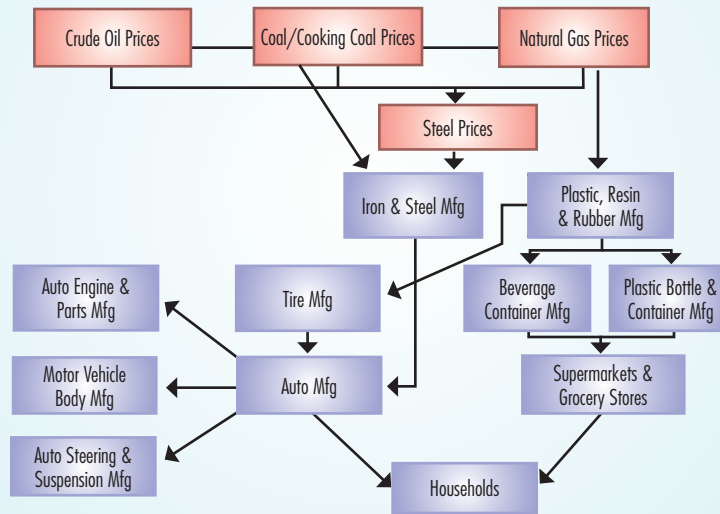


Figure 2

### The Intricate Web a Supply Chain Weaves: Ripple Effects in the Industry Stress-testing Model



#### Micro-modeling an Industry

Micro-modeling refers to identifying a significant statistical relationship between an industry’s historical revenue performance and potential explanatory drivers, including economic variables and an industry’s downstream demand. For this purpose, we will define industries at the five-digit level of the North American Industry Classification System (NAICS). In this exercise, structural variables are a given and not modified during the stress test, but they do help determine the starting point of an industry’s health as a benchmark. So, in its simplest form, we have:

$$R_i = f(E_i, D_i) \quad i=1, n$$

Where

$n$  = the number of industries analyzed.

$R_i$  = the historical revenue of industry  $i$ .

$E_i$  = a vector of explanatory economic variables for industry  $i$ .

$D_i$  = a vector of explanatory downstream demand industries for industry  $i$ .

*In other words, the revenue of a specific industry is a function of (determined by) a set of economic factors and downstream demand industries that purchase its products and services. Parameters that are estimated and/or back-tested help establish the relative significance (or weights) of all causal variables.*

The added twist to the multi-industry model is that downstream demand for an industry’s output in a business-to-business setting often involves several end-markets. For example, corn farmers sell to flour millers, ethanol producers, cooking oil processors, and cattle farmers. The revenue performance of these downstream markets obviously is driven by their own specific set of economic

variables as well as their end-markets—cattle farmers sell to meat-processing plants, and so on.

Figure 2 provides an example of how an energy shock can resonate through the industry stress-testing model. *The linkages illustrated in the figure by no means depict all the upstream and downstream relationships engineered in the framework.* They do suffice to show that an energy shock affects multiple energy prices and, in this example, steel prices as well. The stress ripples downstream in several potentially damaging waves. As Intrater put it, “... macroeconomic stress ... will probably be diffuse across a number of different industries affected by the macroeconomic factor.” It’s not just about purely statistical correlations; it’s about understanding the supply chain and endeavoring to model it.

#### Data Used in Building the Stress-testing System and the Industry Risk Scoring Index

At the macro level, a wide variety of data sources are used, including the Census Bureau, County Business Patterns, the Bureau of Economic Analysis, and the Bureau of Labor Statistics. Since the number of five-digit NAICS industries exceeds 700, specific factors that affect a discrete number of sectors are often augmented with other sources (for example, trade journals).

As a numeric proxy for “industry performance,” RMA and IBISWorld have created an industry risk-scoring index that is a real number between 1 (low risk) and 9 (high risk). Industry scores are cardinal functions of structural and external factors delineated in Figure 1. With the help of several banks that served on the IBISWorld steering

Table 1  
**Summary Assumptions Behind the Industry Stress Test Year 2009**

Economic Factor	Baseline Assumption: Weak Economy	Recession Scenario
Real GDP (Annual Growth)	1.3 %	0%
Real Per Capita Disposable Income (Annual Growth)	-0.5%	-1.5%
Housing Starts (Annual Average)	870,000	828,000
Industrial Production (Average Annual Growth)	0.9%	-2.0%
Unemployment Rate (Annual Average)	5.5%	6.5%
Consumer Sentiment (Annual Average, % change)	3.0%	-10.0%
Dow Jones Industrials (Annual Average, % change)	1.0%	-10.0%
World Real GDP Annual Growth	3.5%	2.0%

committee, we have mapped risk scores to conventional buckets from low to medium to high.

Preliminary validation tests<sup>5</sup> strongly suggest that this methodology has significant explanatory power. Nonetheless, the proof of the pudding is in the eating, and banks are clearly entrusted with the responsibility of validation-testing their own data.

### The Stress Test

Harry Glenos offered this advice in a May 2002 RMA *Journal* article:

Decide how the down-cycle periods in your external history relate to the stress scenario you want to test. There may be particular down cycles in that history that aren't applicable to what concerns you now. The recession in the early 1970s, for example, may have been driven by a sharp run-up in oil prices. That may not be the driver for the scenario you want to test. You need to examine an appropriate down cycle.

This provides us with a smart starting point. The assumptions presented in Table 1 assume that the baseline forecast of macroeconomic factors is weak, but without hyperstress in oil and commodity markets. For a test, we stress the system to a zero-growth scenario—a technical recession on a quarterly basis. In the process, we analyze stress on the financial health of 700 NAICS industries.

The scenario's results, on a two-digit level of NAICS industries, are summarized in Table 2. Although no industry is recession-proof, two sectors, agriculture and health care, are clearly the safest bets. In general, both sectors have benefited from strong pricing. Plus, these two industry groups typically supply goods and services that are staples, in sharp contrast to luxury goods that are notably vulnerable to weakening incomes and fading consumer and business sentiment.

On the other end of the spectrum, sectors such as arts, entertainment and recreation, and accommodation and food services are red-flagged. Industries driven by discretionary spending are extremely susceptible to economic down-

Table 2  
**Industry Risk Rating Scores: Baseline vs. Recession Scenario for Two-Digit Selected NAICS Industries**

Industry Group Two-Digit	Baseline Risk Level	Recession Risk Level
Agriculture, Forestry, Fishing & Hunting	Low	Low
Mining	Medium	Medium - High
Utilities	Medium	Medium - High
Construction	Medium	Medium - High
Manufacturing	Medium-High	High
Trade (Wholesale/Retail)	High	High
Transportation & Warehousing	Medium	Medium - High
Information	Medium - High	High
Finance & Insurance	Medium - High	High
Real Estate & Rental/Leasing	Medium - High	Medium - High
Professional, Scientific & Technical Services	Medium	Medium - High
Administrative/Support & Waste Management/Remediation	Medium - High	High
Educational Services	Medium - High	Medium - High
Health Care & Social Assistance	Medium	Medium
Arts, Entertainment & Recreation	High	High
Accommodation & Food Services	High	Very High

turns. Trade, particularly retail, falls into this category.

Although a two-digit summary offers some revealing insights, it obscures what is occurring at the more granular five-digit level. For example, agricultural markets look very solid, but tobacco farming is laden with risks. In the seemingly resilient health care industry, home care providers are a clear exception, prone as they are to the downside risks associated with recessionary pressures.

All lenders know that certain sectors succumb quickly to weakening economic conditions: hotels, restaurants, clothing stores, florists, pet stores, new housing construction, and the like. A comprehensive stress test will expose less obvious at-risk industries. Table 3 presents a partial list of industries that fall into this category by comparing the risk-grading scores in the baseline versus the recessionary scenarios.

Some industries, especially those that sell discount goods or services for which demand rises as incomes fall, offer a good lending hedge against a recession, although such opportunities could be limited in number. They are listed in Table 4.

### Where This Fits for Practitioners

This top-down “portfolio selection” approach to stress testing offers a first step in a complex, ongoing process. At an OCC workshop, within the similar context of “validation” under Basel II, Mark Levonian stated, “Methods span a spectrum from explicit, statistically based quantitative

Table 3

## Industries Vulnerable to Recessionary Pressures—The Less Obvious

Industry (Five-Digit NAICS)	Baseline Risk Level	Recession Risk Level
Management Consulting	Medium	Very High
Sand & Gravel Mining	Medium	Very High
Stock Exchange	Medium	High
Municipal Support Services	Very High	Very High
Extermination, Insect & Pest Control Services	Medium	Very High
Heavy Infrastructure Construction	Medium	Very High
Public Relations Firms	Medium	Very High
Communication & Energy Wire and Cable Manufacturing	Medium	Very High
Waste Collection Services	High	Very High
Pension Funds	Medium	Very High
Electrical Equipment Manufacturing	Medium	High
Travel Agencies	Very High	Very High
Chemical Wholesaling	Medium	Very High
Waste Treatment & Disposal Services	High	Very High
Industrial Supplies Wholesaling	Medium	High
Claims, Funds Administration & Other Insurance Services	High	Very High
Precast Concrete Product Manufacturing	Medium	High
Securities Brokering	Medium	Very High
Industrial, Medical & Other Rental and Leasing	Medium	High
Scientific, Technical & Economic Consulting	Medium	High
Software Publishing	Medium	High
Direct Mail Advertising	High	Very High
Measuring, Testing & Navigational Instrument Manufacturing	Medium	Very High
Electrical Apparatus & Other Component Manufacturing	Medium	High
Inorganic Chemical Manufacturing	Medium	Very High
Market Research	Medium	High
Custody, Asset & Securities Services	Medium	High
Investment Banking & Securities Dealing	High	Very High
Carpentry Contractors	Medium	High
Metal Wholesaling	High	Very High

scores to judgmental approaches. ... Creative thinking, new tools, and better data likely are needed.”<sup>6</sup>

It is hoped that the framework presented here provides a relevant hybrid between the quantitative and the judgmental, as well as a new tool or methodology. We must emphasize, however, that this is a first step in the process of a meaningful stress test. Jeffrey Morrison, in the September 2003 issue of *The RMA Journal*, suggested some practical, holistic guidelines for stress testing, which he describes as “... a range of techniques used to assess the vulnerability of a portfolio to major changes in the economic environment or to exceptional but plausible events.”

Although economic conditions establish a sound back-

Table 4

## Industries Best Positioned for Recessionary Pressures

Industry (Five-Digit NAICS)	Relative Ranking (Best = 100)	Recession Risk Level
Community Food Services	100.0	Very Low
Community Housing Services	78.9	Very Low
Youth Programs & Miscellaneous Care Facilities	70.9	Very Low
Vocational Rehabilitation Services	70.9	Very Low
Debt Collection Agencies	42.2	Medium
Technical & Trade Schools	35.4	Low
Used Goods Stores	17.4	Very Low
Home Appliance & Other Repair Services	17.4	Medium
Apartment Rental	8.0	Medium

drop to a meaningful stress-testing exercise, other factors must be taken into account. Many of these are highlighted by Morrison, who added, “... some of these questions may be unanswerable except by judgment and intuition.” The questions include the following:

- What are the timing effects of a recession on a bank’s portfolio?
- Are there significant variations in the health and resilience of local economies within a bank’s footprint?
- How do economic stress factors affect individual companies within an industry? For example, are there differences among small business, middle-market, and large corporate clients?
- How are probabilities of default and loss given default affected?
- What are the account-specific attributes such as company financials, lending history, and collateral quality? If only the world were a simple place.

Stress testing, what Robert Hudson called an “undeveloped art,” is by necessity developing at a rapid pace. Emerging methodologies, novel data-capturing systems, and more appropriate statistical methods will all be part of this evolution. ❖



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## Notes

The author wishes to thank Glen Siniawski of PNC Bank for his comments on an earlier version of this article.

1 See <http://www.occ.gov/ftp/release/2008-81a.pdf>.

2 A white paper is available from the author upon request.

3 Michael Porter, *Competitive Strategy*, New York: The Free Press, 1998.

4 Anita McGahan and Michael Porter, “How Much Does Industry Matter, Really?” *Strategic Management Journal*, vol. 18, pp. 15-30, 1997.

5 A validation paper is available from the author upon request.

6 Validation of Credit Rating and Scoring Models, OCC Workshop, February 2006, Washington, D.C.