Economic Capital, Performance Evaluation, and Capital Adequacy at Bank of America

by John S. Walter

A case study of the economic capital system used by Bank of America reveals several basic principles shared by all economic capital frameworks and provides a practical illustration of how economic capital can work for any financial institution. This article begins with a discussion of the financial theory of allocating equity capital among different businesses for the purpose of evaluating business performance and capital adequacy. It then provides a detailed look at the measurement system itself, including each of the four different sources of risk—credit, country, market, and business—that together determine the amount of capital assigned to an activity.

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Institutions using economic capital methodology have coined the term to distinguish it from other measures of capital adequacy—in particular, regulatory and accounting concepts of capital. The term economic also encapsulates an ambition, like that of the dismal science, to describe and measure on a consistent basis the range of phenomena that drive a bank’s risk/return decisions. A consistent and comprehensive economic model accomplishes two goals:

1. It provides a common currency of risk that management can use to compare the risk-adjusted profitability and relative value of businesses with widely varying degrees and sources of risk.

2. It allows bank management and supervisors to evaluate overall capital adequacy in relation to the risk profile of the institution.

With increasing dialogue among practitioners, regulators, and academics, best practices have gradually emerged, setting standards for calculation in most aspects of economic capital. Advances continue, especially in the areas of operational risk and consumer credit risk, but the overall field has matured to the point where supervisors have begun, with the upcoming implementation of the New Basel Capital Accord, to adopt and codify the industry’s best practices in the regulatory capital framework.

Market Value Definition of Risk

Over the past decade, economic capital has steadily progressed toward market value models. Most commercial portfolio frameworks have by now discarded first-generation economic capital models based only on default risk, although these models persist in some cases for consumer portfolios. Given the goal of ensuring capital adequacy for a certain level of solvency, the volatility of market value is the best measure of a bank’s risk and therefore its capital requirement.

Ultimately, shareholders are interested in the total return on their investment in the bank’s stock and its risk in market value terms. They compare the return earned on their investment to a required return based on its risk. Bondholders also care about market values. The value of their fixed-income investment is a function of the credit spread of the bank, the level of interest rates, and the expected cash flows of the debt. Since both stockholders and bondholders evaluate their investments based on market value terms, management should evaluate its opportunities with the same market value discipline.

Defining risk in market value terms reinforces this discipline by aligning the interests of business managers with those of shareholders and bondholders.

The values of debt and equity are intimately related, as they are both derivative claims on the underlying assets of the company. According to the Merton model, the equity of a firm is equivalent to a call option on the firm’s value, with the debt being the strike price. The equity holders have the option to “buy” the firm’s assets and any other value of the franchise by repaying the debt. Equity holders will not exercise this option and will default on their obligation to the debt holders if the total asset and franchise value falls significantly short of the amount owed to creditors. The firm’s leverage in market value terms (i.e., the difference between the market value of assets and the book value of liabilities) and the volatility of its market value are therefore the primary determinants of a company’s default probability and required credit spread. The measure of risk that drives both the value of debt and equity, then, is the volatility of asset values.

The distinction between a market value-based measurement of risk and an accounting earnings-based measurement of risk is important. Given the need to maintain a low likelihood of default, a high credit rating, and the resulting ability to finance the firm’s activity, the most relevant measure of risk for determining capital adequacy is the volatility of a bank’s market value.

Just as a bank’s overall capital requirement is driven by the volatility of its market value, capital allocations to the bank’s individual activities should depend on
the contribution of each to the overall market value volatility. However, since most bank businesses do not mark their portfolios to market, risk managers cannot directly track the volatility of market values; rather, model-driven estimates of market value volatility or even the volatility of earnings must serve as surrogates.

Accounting for Diversification

For an economic capital model to apply for the entire bank as well as its individual activities, it must consider not only the volatility of market value for each activity, but also how that value changes with respect to that of all other activities. The logic for this diversification adjustment is straightforward: The less cyclical exposures generate diversification benefits for the bank as a whole that enable the bank to operate with less equity capital. A capital allocation based on risk contribution confers this benefit to business activities that enhance diversification, thereby encouraging their growth. Omitting this effect would clearly overstate the risk of the bank.

Finance theory tells us that investors’ required returns are a function of nondiversifiable risk. One of the primary goals of the economic capital framework is to measure and compare business performance across activities with widely varying degrees of risk. SVA (shareholder value added) is calculated by comparing each business’s return to the bank’s cost of equity. Because the bank’s cost of equity is based on systematic risk, the risk measure used for SVA calculation must be based on risk contribution rather than based on stand-alone risk. Otherwise, a second process would be required to determine differentiated costs of equity for each business.

Strictly speaking, the risk contribution approach outlined above measures the exposure to internally undiversified risk rather than truly systematic or undiversifiable risk. However, when this approach is used by large diversified financial institutions, any differences in the theoretical cost of equity after adjusting for risk contribution of individual businesses are likely to be well within the measurement error of the risk measures themselves.1

Capital Adequacy

For capital adequacy purposes, the overriding goal of allocating capital to individual businesses is to determine the bank’s optimal capital structure—the amount of equity that is required to maintain the bank’s internal standard of solvency (i.e., target credit rating) given the overall level of risk.

This process involves estimating how much the risk of each business contributes to the total risk of the bank, and hence to the bank’s overall capital requirement. Ultimately, the economic capital based on risk should be compared to the actual capital held by the bank. A sensible risk-based capital adequacy framework should match the measured risk with the financial resources available to cover that risk. The financial resources available to cover the total amount of losses over a given horizon include not only book capital, or common equity, but also loan loss reserves and income generated during the period.

Banks consider expected or average level of loss to be a cost of doing business. Margins on loan products, for example, are set at a level sufficient to cover operating costs as well as expected loss and to provide a favorable return on capital. As a result, expected loss is not included in the measurement of risk, but is thought of as a direct charge against current period earnings.

To determine capital adequacy, best practice institutions measure capital based on unexpected loss, or volatility around expected loss, and compare their estimate of required capital with financial resources available to cover unexpected loss—common equity and loan loss reserves. Since expected loss is covered by future margin income, expected loss is not included in the measurement of economic capital. Likewise, future margin income is excluded from the financial resources available to cover losses.
Performance Measurement

For performance evaluation purposes, risk-adjusted return on capital (RAROC) systems assign capital to businesses as part of a process to determine the risk-adjusted rate of return and, ultimately, the SVA of each business. The objective in this case is to measure a business’s contribution to shareholder value after fully adjusting for risk, and thus to provide a basis for strategic planning, ongoing performance monitoring, product pricing, and tactical portfolio management decisions.

The RAROC for each business is its net income divided by its required economic capital. Often, the calculation adjusts accounting net income to replace provisions with expected loss and to remove timing distortions inherent to the accounting process. If the RAROC is higher than the cost of equity—shareholders’ required rate of return—then the business is creating value for shareholders.

RAROC is a clear and consistent indicator of profitability. However, the exclusive use of RAROC or any rate of return to evaluate performance can discourage profitable investments. A rate of return does not measure how much value an activity creates or destroys; it only indicates its rate of profitability. To maximize shareholder wealth a bank must undertake any new project that, over its expected life, yields a RAROC that exceeds the cost of capital. Managers rewarded solely on RAROC are likely to reject value-increasing projects that will lower their average return.

To avoid this problem and create the right investment incentives, a bank should evaluate performance according to the SVA of a business. SVA is calculated by subtracting the cost of equity capital from the operating earnings of the business. Like RAROC, SVA uses economic capital as the “currency” for risk and therefore allows comparison of activities with varying risk characteristics. It overcomes the limits of RAROC by incorporating the size of the investment, not just its rate of return.

Rewards to managers should depend on the incremental improvement in shareholder value added rather than its absolute value. This levels the playing field, encourages turnarounds of poorly performing businesses, and avoids rewarding the inheritance of a highly profitable operation.

Economic Capital at Bank of America

Bank of America defines risk as volatility in the firm’s market value. The key elements of this definition are its comprehensiveness and its emphasis on market value rather than earnings. Bank of America calculates risk in four major categories—credit, country, market, and business—but the particular categorization is less important than its guiding principle:

There must be “a place for everything, with everything in its place.”

Capitalization and confidence levels. Two estimates describe a bank’s risk profile: expected loss and unexpected loss. As illustrated in Figure 1, expected loss is the average rate of loss expected from a portfolio. If losses equaled their expected levels, there would be no need for capital.

Unexpected loss is the volatility of losses around their expected levels. Unexpected loss determines the economic capital requirement.

To prevent insolvency, economic capital must cover unexpected losses to a high degree of confidence. Banks often link their choice of confidence level to a standard of solvency implied by a credit rating of A or AA for their senior debt. The historical one-year default rates for A firms and AA firms are approximately 10 and 3 basis points, respectively. These target ratings therefore require that the institution have sufficient equity to buffer losses over a one-year period with confidence levels of 99.90% and 99.97% (see Figure 2).

Bank of America’s reference points for the allocation of economic capital are a target rating of AA and the related 99.97% confidence level for solvency. This confidence level requires that economic capital be sufficient to cover all but the worst three of every 10,000 possible risk scenarios with a one-year horizon. To ensure consistent treatment and the unbiased evaluation of businesses, the bank applies this common standard to all businesses and risk categories.

Risk contribution. The theory underlying the economic capital framework requires each portfolio’s capital allocation to reflect its “contribution” to the volatility of the bank’s market value as opposed to its own stand-alone volatility. The calculation therefore includes both the stand-alone volatility of an exposure and its correlation with value changes for
the rest of the portfolio. As long as correlation is less than perfect, the capital allocation will be less than what would be necessary if the activity were a standalone business. This approach will not only capture the diversification benefit to the overall firm of holding a portfolio of risks, but it will also allocate that benefit to the individual activities that contribute to the diversification.

The calculation of risk contribution as opposed to stand-alone risk is also necessary for the aggregation of capital across businesses. A bottom-up approach, including the diversification effect, allows the aggregation of capital at several levels and in various dimensions without distorting the results. For example, a customer relationship manager may evaluate the capital required across all businesses and types of transaction for the customer.

Credit risk. All businesses with borrower or counterparty exposure receive capital for credit risk, or the risk of loss due to bor-

ower defaults or deteriorating credit quality. For commercial portfolios, credit risk capital is calculated for individual loans. For consumer portfolios, the large number of loans makes it cost-effective to calculate credit risk only down to the “risk segment” level. Risk segments are homogeneous groups of loans based on product, credit score, delinquency status, and other attributes.

Several factors determine the credit risk capital requirement. The most important are the exposure amount, the borrower’s default probability, the estimated loss given default, the remaining tenor, and the correlation to other exposures in the portfolio.

The Bank of America credit risk capital model measures the default risk using an analytic formula for correlated binomial events. The model calculates the volatility of loss for an exposure...
based on estimates of the expected value and volatility of three factors: exposure given default, loss given default, and the binomial default indicator (yes or no).

Like that of many other institutions, the system relies on a portfolio risk model. Portfolio effects, such as correlation and capital multipliers, are determined by applying the Moody’s KMV Portfolio Manager™ software to the total credit portfolio, including both consumer and commercial assets. This approach accounts for the specific portfolio composition, diversification, and concentrations of the institution. Implementation of the model across a wide range of applications requires the estimation, using the Portfolio Manager results, of marginal correlation factors based on product, location, market segment, industry, and credit quality. Capital multipliers, which scale the volatility contribution to the capital requirement, are determined in a similar fashion. The Bank of America model uses capital multipliers based on credit quality in order to capture the varying shape of the loss distribution for different segments and adapt to changes in portfolio composition between model updates.

The portfolio risk model also is used to set the capital requirement for migration risk. Migration risk is estimated by comparing the capital requirement based on market value changes with that based only on default risk. The migration risk component is a function of remaining term and credit quality.

Country risk. Country risk is the risk of loss—independent of the borrower’s financial condition—on foreign exposures due to government actions. Causes of these potential losses include foreign exchange controls, large-scale currency devaluation, and nationalization of capital investments. Country risk is attributed to all businesses with international exposures.

Country risk capital is driven by the sovereign default probability and the borrower’s conditional probability of default given a country event. Internal country risk ratings are used to determine the sovereign default probability. The conditional likelihood of default varies within three main categories: transfer exposures, local currency exposures, and trade exposures.

Country and credit risk are similar concepts, so the country risk approach closely parallels the method for default risk. The treatment of borrower concentration is different, however. The total amount of unexpected loss for the country, instead of for each borrower, drives the concentration effect.

Market risk. Market risk is the risk of loss due to changes in the market values of the bank’s assets and liabilities caused by changing interest rates, currency exchange rates, and security prices. It arises from outright positions in securities or derivative transactions, structural interest rate risk, and private equity investments. Bank of America estimates market value at risk (VAR) on a global level and for each of its trading desks using a historical simulation approach. The economic capital assignment is based on the contribution of each trading desk to the global VAR during the quarter. Before the allocation of capital, the daily VAR contribution is scaled to a one-year horizon and 99.97% confidence level to ensure consistency with other capital allocations.

A traditional variance/covariance VAR model, using the historical volatilities and correlations of venture capital and stock market indexes, is used to determine the capital requirement for the bank’s equity portfolio. For interest rate risk, a Monte Carlo model simulates interest rate scenarios, their effects on cash flows, and ultimately the market value of equity.

Business risk. Business risk is the risk of loss from nonportfolio activities. These activities include origination, servicing, distribution, trust, asset management, and the activities of any other fee-driven businesses. This category is one of the few where risk measurement is not yet market-value based. Business risk comprises two categories: operational risk and strategic risk.

Bank of America measures operational risk using a loss distribution approach (LDA), where operational risk is the risk of loss due to inadequate or failed internal processes, people, and systems or due to external events. The bank uses the Basel categorization, which divides operational risk into seven subcategories. The model’s foundation is a database containing our internal history of operational loss events and their financial consequences. Publicly disclosed industry data, scaled for relative differences in size and quality of controls, supplements the internal data where it is insufficient for statistical models. The
LDA model relies on estimates of frequency and severity distributions for each risk category and a Monte Carlo engine to combine them into an aggregate loss distribution, incorporating insurance deductibles and program limits.

Strategic risks and general economic risks, such as those relating to competition, operational leverage, product and technological obsolescence, and business strategy and execution, must also be covered in a comprehensive capital allocation framework. The bank uses a top-down approach for measuring strategic risk, which is based on the volatility of non-portfolio earnings for each business. Non-portfolio earnings are the net income for each business adjusted to remove the effects of credit risk, country risk, market risk, and operational risk.

Recognizing the historical nature of both of the above methods, Bank of America’s business risk model also includes a qualitative adjustment to reflect changes in the control environment and inherent risk of the business over time. A self-assessment process that evaluates exposure to reputation, execution, people, processing, technology, legal, regulatory, and external risks determines this qualitative adjustment.

Intangible assets. In addition to the capital assignment for operational and strategic risks, Bank of America also includes a capital assignment for goodwill and other intangible assets. The capital assignment for intangibles largely reflects the considerable regulatory capital penalty for these assets. As opposed to the other components of capital, the capital assignment for intangible assets is motivated by their regulatory burden.

Inter-risk diversification. Capital requirements are determined separately for each of the above risk categories. However, the worst possible losses due to credit risk, market risk, country risk, and business risk are not likely to occur simultaneously. Simple addition of the capital requirements implies perfect correlation across risk categories, which is an incorrect and extremely conservative assumption. Rather than lower the capital requirements within the individual models by using lower confidence levels or other parameter adjustments, Bank of America explicitly measures the inter-risk diversification effect.

A correlation matrix for losses in each risk category is the backbone of this approach. The model treats correlation estimates based on historical data conservatively. The application of the correlation matrix creates an offset to the capital requirements for the individual risk categories and reduces the bank’s overall economic capital requirement.

Summary

Over more than a decade, the methods employed by financial institutions to calculate economic capital have advanced to encompass nearly all areas of risk, including operational and strategic risks. They have expanded beyond accounting-based principles to consider the volatility of market values. Looking ahead, improved technology, increasing amounts of better-scrutinized data, and research by both professionals and academics will continue to drive advances in the field.

The New Basel Capital Accord has increased awareness and confirmed the importance of economic capital by adopting and codifying some of the practices of the industry. This convergence of regulatory capital to economic capital should not stifle further innovation and improvements. Economic capital will continue to evolve to suit the needs of the industry as a powerful tool for performance evaluation and capital adequacy.

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Notes

1 Less diversified (not always smaller) institutions would need to carefully evaluate the use of a single cost of equity in their SVA calculations. If they use a standalone risk measurement approach, a single cost of equity would not be correct from a financial perspective. If they use risk contribution, it may or may not work, depending on the specifics of their portfolio.