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Best practices for estimating credit economic capital

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Best practices for estimating credit economic capital

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Introduction

While the recession has shaken the banking industry to its core, one of the biggest shocks for banks has been the realization that current capital reserves are insufficient to protect them during a crisis. Bankers and their regulators are asking some hard questions: Are the models we use to estimate capital requirements faulty? Are the inputs to those models of inferior quality? Did our risk governance processes fail? Did management respond too slowly?

Over the past decade, the increased complexity of banking instruments and the heightened need for accuracy have made models an indispensable part of portfolio risk estimation. Value-at-risk (VaR) models have gained acceptance as a credible approach to estimating overall portfolio risk. In the current environment, however, the performance threshold for these models has risen – and banks are keen on making more informed choices on their modeling approach.

With this interest on the part of banks in mind, we recently interviewed the risk management teams from 11 of the world's leading banks to understand the landscape of credit economic capital modeling techniques. For most of these institutions, corporate assets make up more than 50 percent of their portfolio. In addition to the more recent risk-management interviews, we also conducted a survey in 2007 of 22 banks, half of which are focused on corporate customers, the other half on retail. The findings summarized in this report are based on both the interviews and our earlier survey. In both cases, the participating institutions represented a diverse geographic mix of banks based in North America, Europe, and Asia-Pacific.

Through our research, we sought to answer the key questions faced by banks that either run or are setting up a credit economic portfolio system:

- What characterizes an ideal credit portfolio model?
- What is the role of stress testing and the best practices for managing it?
- What lessons can be learned from the current economic crisis?

Our findings indicate that banks consider economic capital a valuable concept, but they have yet to nail down the ideal approach to estimating it. Our interviewees agree that a VaR model with a complementary stress-testing framework is necessary. Many banks are developing proprietary models because none of the existing third-party VaR models accurately measure the risk in portfolios constituted of both retail and corporate assets, with vanilla and exotic products.

We found from our discussions that the existing VaR models differ in three important ways:

- **Approach to correlation.** An asset-based correlation approach is suitable for a corporate-focused portfolio, whereas an approach based on default intensity is suitable for a retail-focused portfolio.

- **Simulation-based vs. analytical estimation of portfolio loss.** Simulation-driven models provide flexibility to incorporate fat-tail distributions of default probability and are more representative of underlying loss distributions than analytical models, which use normal approximations. They also allow easier extension of models to capture PD-LGD correlations and mark-to-model effects on portfolio losses.
- **Mark-to-model vs. default mode recognition of portfolio loss.** Corporate-focused banks recognize loss in value due to deterioration in credit quality (mark-to-model), whereas retail-focused banks consider losses only in the event of realized default (default mode).

The ideal VaR model would be a simulation-based model in mark-to-model mode. The corporate exposure correlation would be driven from an asset-based correlation model and retail exposure correlation from a default-intensity correlation. The correlation between corporate and retail, though still being researched, could be based on the historical observed correlation of asset returns and default rates.

Almost all our interviewees agreed that a VaR model estimate of economic capital does not afford sufficient protection in the event of a downturn and that a comprehensive stress-testing methodology is needed to complement the VaR approach. For stress testing to play this role, however, more work is needed to refine the stress-testing governance model, the scope of the stress tests to be conducted, and the approach to incorporating stress test results into decision making.

Though most of the banks we interviewed estimate economic capital, they choose to keep and allocate the more conservative of economic or regulatory capital (usually the latter) to their business units, using a mix of methodologies to do so. About half of the group allocates capital based on marginal contribution, while some use heuristics to drive business objectives and others use models to allocate excess capital over economic capital.

Detailed findings

1. Choosing a value-at-risk model

Banks may choose either to purchase third-party VaR models for estimating economic capital or to build their own proprietary model. Moody's KMV suite of portfolio products is clearly the most popular choice among the 22 banks we surveyed; no other products have such broad acceptance. The KMV products' high global penetration makes them the benchmark portfolio model; most risk management teams have chosen KMV products in order to be in line with this benchmark and because with KMV it is easier to defend both model choice and outputs to their leadership and colleagues.

Our survey also found that more than 60 percent of retail-focused banks rely on one model, while the majority of corporate-focused banks (45 percent) opt for two models. Of those banks running one model, 55 percent use KMV products.

Before selecting KMV, a handful of banks evaluated its performance along with that of other third-party models, including CreditRisk+, Credit Metrics™, products from Algorithmics, and CreditPortfolioView. The evaluating banks built prototype portfolio models and benchmarked the performance of third-party options against them. They chose KMV products for their ability to represent corporate portfolios accurately. This accuracy is made possible by KMV products' strong capability in modeling concentration risk in low-default portfolios.

Feedback on the performance of KMV's Riskfrontier™ with retail portfolios was mixed. Some banks were dissatisfied with the methodology, and some found that the results were not in line with intuition. They have moved away from KMV's products and developed a proprietary model based on default intensity for their retail and SME portfolios.

Banks find KMV products' capital allocation to business units/obligors in line with their intuitive rank ordering of risk in their portfolio. Several of our interviewees using KMV products commended their performance in identifying portfolio concentrations and allocating appropriate capital during the current crisis.

Banks felt that while CreditRisk+ accurately estimates the overall capital required, its marginal capital allocations are not in line with the individual risk contribution of obligors/industries.

Proprietary models are clearly gaining popularity across banks because they:

- Increase transparency in portfolio risk estimation (as preferred by regulators);
- Can model risk profiles of complex instruments;
- Can incorporate region-specific correlation structures;
- Can provide levers necessary to perform comprehensive stress testing.

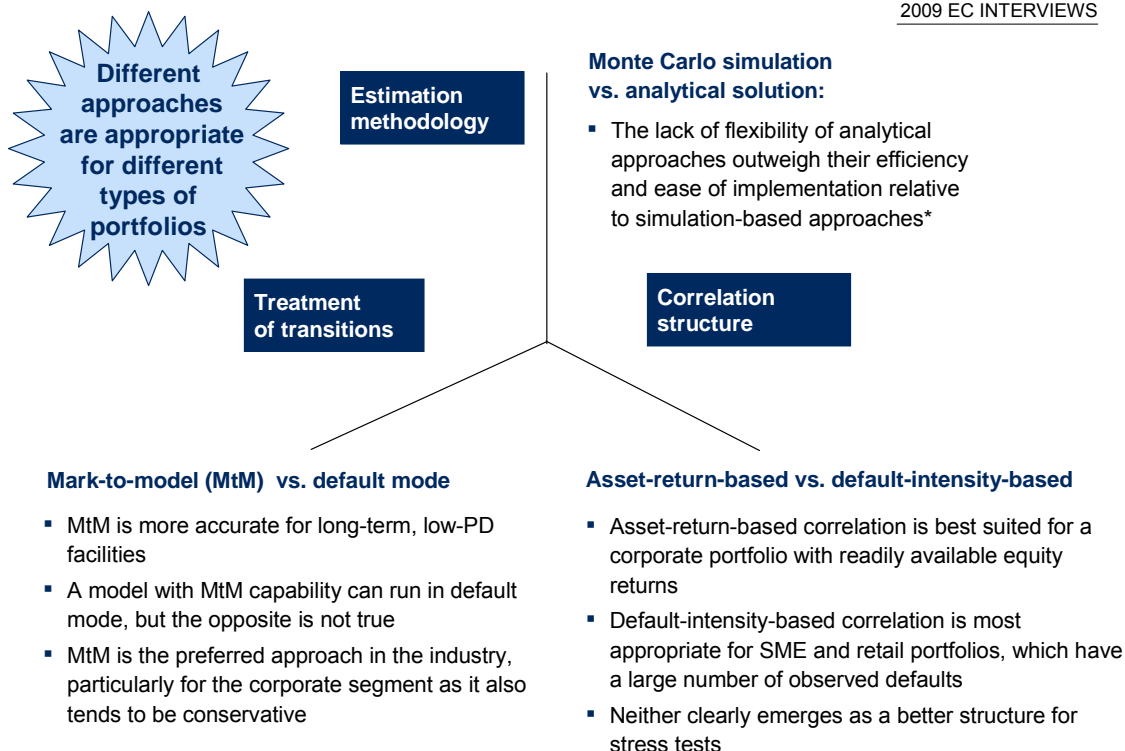
Developing a proprietary model is a fairly complex process. Exhibit 1 on the following page illustrates the three fundamental choices in designing a long-term model: the estimation methodology, the treatment of rating transitions, and the correlation structure.

Of the three design choices, the most difficult is the correlation structure. Most retail-focused banks have developed proprietary models based on default intensity, while corporate-focused banks have favored asset-return-based models. Next in importance is the treatment of rating migrations – specifically, deciding between mark-to-model (MtM) and default mode (DM). Most models (both third-party and proprietary) provide flexibility to recognize losses in both

Exhibit 1

Fundamental design considerations for the long-term model

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MtM and default modes. Corporate banks prefer to run their models in MtM because it captures the inherent risk profile of high-tenure low-default-probability corporate portfolios. Banks focused on retail performance, by contrast, prefer to estimate the economic capital for their retail portfolio independent of the corporate portfolio and in default mode (see Exhibit 2 on the following page). DM is simpler to implement and sufficiently captures the high expected losses of the retail portfolio. Running the retail and corporate portfolios independent of each other does not, however, capture the benefits of diversification; banks are now researching ways to capture this benefit outside both the models.

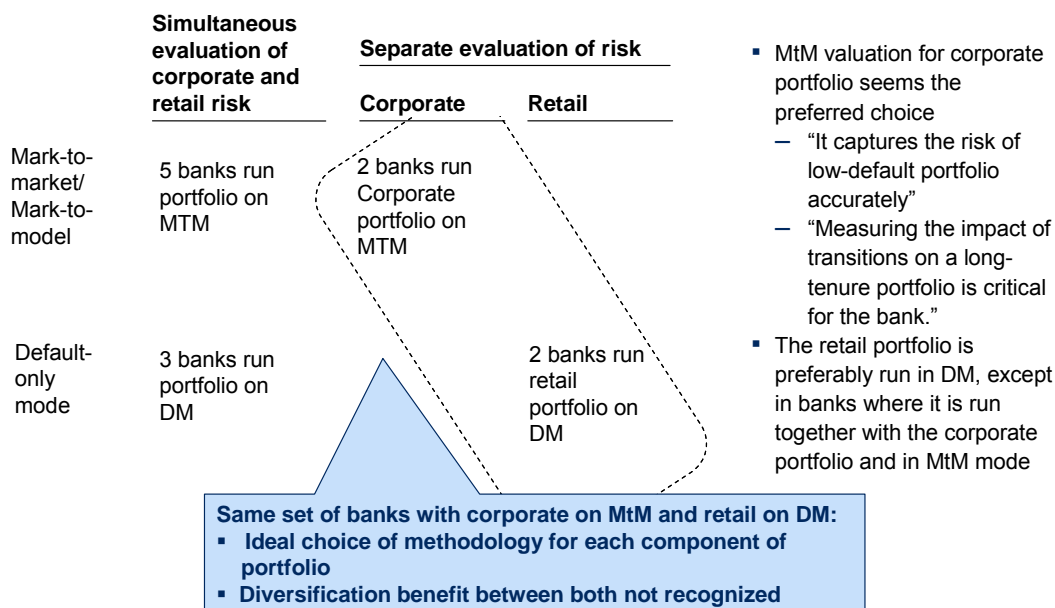
The Basel II regulations require banks to calculate capital in default mode. Some of the banks we interviewed estimate only regulatory capital and use that to drive business decisions like pricing and performance management.

The ideal VaR model would be a simulation-based model in MtM mode. Corporate exposure correlation would proceed from an asset-based correlation model and retail exposure correlation from a default-intensity correlation. The correlation between corporate and retail could be based on the observed historical correlation of asset returns and default rates.

Exhibit 2

Mark-to-model vs. default mode

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Mark-to-model vs. default mode for portfolio loss evaluation

Key modules in a proprietary model include the following:

- **Correlation module.** While it makes sense to seek a commercial application, such models do not exist for developing countries. Historical data across multiple business cycles are needed to calibrate a stable correlation model.
- **Complex instrument valuation module.** No consensus exists on the most accurate way to model complex instruments in portfolio models.
- **Efficient simulation module.** Development of an efficient simulation engine is particularly important for retail portfolios because of the large number of accounts. The banks we interviewed expressed dissatisfaction with the simulation engine underlying KMV products.

Developing and institutionalizing a proprietary model is a multi-year task – typically, it takes at least 1 year and often 2 or more. Several banks have tried to build a full model in one fell swoop, but failed. The lesson here is that it might be better to approach the task in stages, first laying out the specifications and building a prototype model in Excel, and then testing it with real-life data, in order to identify any bugs in the specifications, design and implementation. Rolling out a proprietary model will require buy-in across the organization, not only within the risk team but also from pricing and business development. Testing a prototype model against intuition in a staged approach can help build that support.

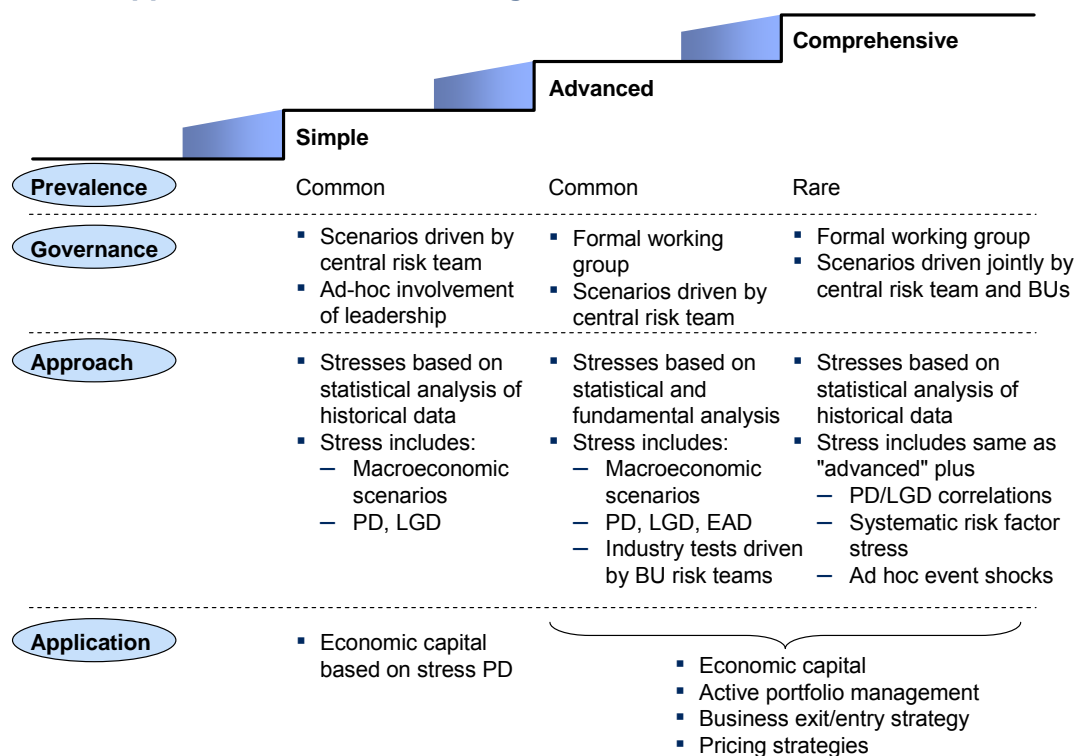
2. Approach to stress testing

As shown in Exhibit 3, most of the banks we interviewed currently have a simple stress-testing framework, but they recognize the need to move to a comprehensive approach. Typically, a central economic team develops scenarios for macro-economic stress; PD/LGD are stressed and used in economic capital decisions; and the stress-testing results have little to no impact on strategic decision making.

Exhibit 3

Current approaches to stress testing

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The Basel Committee on Banking Supervision recently released a new consultative paper recommending a comprehensive stress-testing methodology to complement existing VaR frameworks. Exhibit 4 on the following page summarizes these recommendations.

Incorporating best-practice stress testing will require banks to change their organizational structure and governance practices, conduct a broader range of tests, and incorporating stress-testing results into their decision making.

- Organization and governance.** Best-practice banks have a formal working group that defines and conducts stress tests, and individual business units play a significant role in identifying the key risks impacting their businesses and the relevant stresses across those risks. These banks also have an appropriate governance structure in place to oversee how the team functions.

Exhibit 4

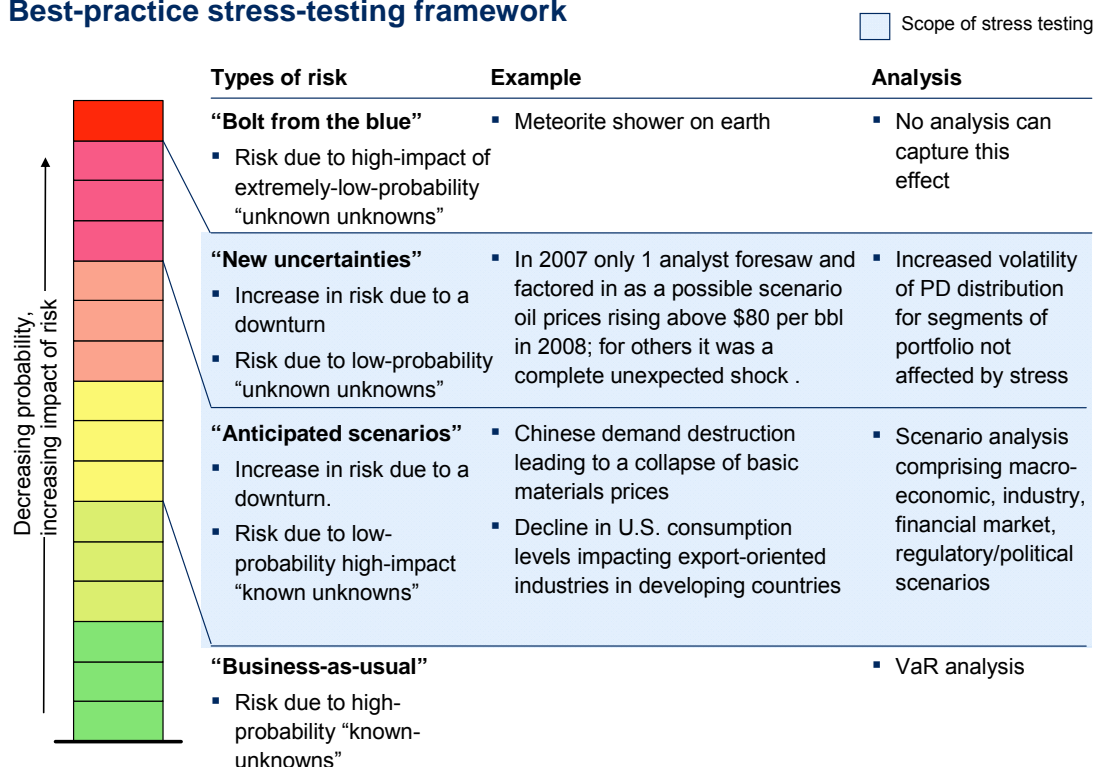
Basel II guidelines on stress testing**Basel II highlights**

Risk governance	<ul style="list-style-type: none"> ▪ Stress testing should be actionable, with clear link to decision making at the appropriate management level ▪ Function must challenge assumptions, especially historical assumptions ▪ The risk management function must involve business units in the stress tests ▪ Stress testing for the bank must be conducted centrally
Methodology	<ul style="list-style-type: none"> ▪ Identify comprehensive list of risks that affect the bank and aggregate common risks ▪ Identify system-wide interactions and feedback effects ▪ Sensitivity tests and scenario analysis are recommended <ul style="list-style-type: none"> – For sensitivity tests: Single parameter and simultaneous shocks – For scenario analysis: Hypothetical stress tests over historical scenarios
Changes in response to crisis	<ul style="list-style-type: none"> ▪ Review scenarios more frequently and look for new risks ▪ Identify correlations and aggregate risks across exposures, including operational, market, and credit risk ▪ Systematically challenge effectiveness of risk mitigation measures
Other recommendations	<ul style="list-style-type: none"> ▪ Explicitly consider risks to complex products like structured products, off-balance-sheet items ▪ Enhance stress testing to capture effects of reputational risk and illiquidity

- **Range of stress tests.** While VaR analysis identifies capital that protects the bank from business-as-usual risk, the role of stress testing is to protect the bank from low-probability “known unknowns” and “unknown unknowns” (see Exhibit 5 on the following page).
 - Scenario analysis helps identify macro-economic and industry scenarios that are based on known drivers of risk across the portfolio. These scenarios are then used to stress PD/LGD/EAD and correlations across the portfolio. This is an integrated and consistent approach to capturing simultaneous stress across various business drivers of portfolio risk.
 - Systemic uncertainty stress is needed to measure the impact of “unknown unknowns” on the portfolio. Every downturn is characterized by new, unanticipated uncertainties. While it is impossible to predict these, modeling the increased uncertainty during periods of crisis – e.g., by increasing volatility of parameters – helps to capture their impact.
- **Impact on decision making.** Best-practice banks use the results of stress testing to inform all types of strategic decisions, including business exit and entry and investment. Stress testing is an integral part of active credit portfolio management. The VaR-model-based economic capital estimation is complemented by stress scenario requirements of economic capital. Likewise, pricing decisions and RAROC thresholds are set based on stress-scenario results.

Exhibit 5

Best-practice stress-testing framework



3. Capital allocation

While most of the banks we interviewed estimate economic capital, they typically keep the more conservative of economic or regulatory capital (usually the latter) and allocate capital to the business units based on this higher amount. Banks that choose to keep economic capital do so only when it is very similar to regulatory capital.

However, banks use different approaches to capital allocation. Banks that do not use allocated capital for pricing tend to allocate regulatory capital based on marginal contribution to economic capital.

Banks that drive pricing decisions on allocated capital are very sensitive to the mechanism of allocation. While a few banks only allocate economic capital based on marginal contribution, others use heuristics to drive business objectives or use models to allocate excess capital over economic capital.

4. Lessons from the crisis

What lessons can portfolio risk managers learn from the current crisis? The banks we interviewed said that the models themselves were not to blame, but rather management’s failure to believe the model outputs and take action. Most of the risk management teams felt that their bank leadership ignored the early warning signals triggered by the models because they did not tally with intuition. As the signals became far more intense, leadership began to

believe the results, but then took too much time in making the critical decisions that, if made sooner, could have averted the crisis.

In response to the weaknesses exposed in their risk management systems, our interviewees say they are taking the following steps:

- **Adopting a comprehensive stress-testing approach.** In line with the best practices described above, banks are currently defining their governance structure for stress testing, creating a set of complementary and complete stress tests, and developing a process for incorporating results into decision making.
- **Refining model assumptions.** The crisis has illuminated new drivers of risk and linkages across drivers. Banks are therefore refining their models to capture these effects.
- **Limiting exposures to complex instruments.** The crisis also has revealed a lack of understanding about how complex instruments behave under stress. In the current environment, banks prefer to be risk-averse and limit their exposures to such instruments.

As some market participants have observed, the fact that many banks use the same models led to herding behavior: their models all rang an alarm at the same time, causing everyone to “run to the door.” This effect seems to imply that using an alternative approach – one that might trigger an earlier warning in some cases – could create significant value. It also suggests that regulators aiming to ensure functioning credit markets during times of distress should try to promote adoption of more diverse models.

* * *

The current economic crisis is one of the worst to hit the banking system since its inception. There is at the same time, comfort in knowing that credit portfolio risk models have, by and large, performed well during the crisis, and that the crisis in no way brought an end to VaR models.

Given the rapid evolution of the markets, banks need to take a much more systematic and vigilant approach to managing and updating their risk models – regularly identifying the risks underlying their portfolio, developing more sophisticated methods to estimate the portfolio impact of those risks, and designing contingency plans for plausible scenarios. Likewise, they need to refine the assumptions and methodologies in VaR models to suit complex portfolio exposures and evolving dependencies across business units. In addition, banks need to complement these models with stress-testing frameworks that work in data-poor environments of heightened uncertainty from new sources of risk. Last but not least, bank leaders should continuously challenge the effectiveness of contingency plans and risk management measures.

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