A BRIEF HISTORY OF ACTIVE CREDIT PORTFOLIO MANAGEMENT

MODELING**METHODOLOGY**

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ABSTRACT

The first commercial EDF™ (Expected Default Frequency) credit measure model was released by KMV in 1990, although its foundations in extending the Merton model date from the early 1980s. In those early days, KMV found that it was not easy to convince credit officers that there was a better way to assess the credit risk of publicly-listed firms compared to their traditional credit analyses.

The EDF model is now in use at hundreds of institutions worldwide, and Moody's KMV EDF credit measures are produced daily on more than 30,500 listed firms in 58 countries.

This paper addresses the following questions: What are the origins of active credit portfolio management? How did the practice start, how has it evolved, and what can we see on the horizon?

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The first commercial EDF™ (Expected Default Frequency) credit measure model was released by KMV in 1990, although its foundations in extending the Merton model date from the early 1980s. In those early days, KMV found that it was not easy to convince credit officers that there was a better way to assess the credit risk of publicly-listed firms compared to their traditional credit analyses. The first application of EDF credit measures, and still perhaps its most popular use, was to produce early warnings of credit deterioration of firms, usually long before internal or agency ratings showed deterioration.

This early warning ability produced many success stories of clients being able to avoid severe losses on defaults. One bank client used the model to sell several deteriorated loans to a major investment bank. When these loans later defaulted, the investment bank asked the bank how it had come by such foresight. Upon learning that the bank used EDF credit measures, the investment bank became a client of KMV. During an EDF sales presentation at a bank a few years later, one member of the audience left the room early when current examples of weak EDF companies were being shown. During a meeting after the bank had become an EDF client, one member of the bank asked the KMV staff whether they were aware how the bank paid for its EDF license. Puzzled, the KMV staff said, "no." The banker then explained that when that individual had left the room during the sales presentation, he had sold the loan of the company that was being shown. It later defaulted, and the bank estimated that it had saved enough by avoiding that one loss to pay for an EDF license for several decades!

With such success stories from early adopters of EDF credit measures, word soon spread throughout major banks. The EDF model is now in use at hundreds of institutions worldwide, and Moody's KMV EDF credit measures are produced daily on more than 30,500 listed firms in 58 countries.

2 CREDIT CORRELATIONS

One of the EDF model drivers is the asset value of the firm. As a result of calculating EDF credit measures, KMV was therefore able to measure asset values on thousands of firms on a regular basis. KMV realized that this could be used to measure correlation among firm risks, a key prerequisite for credit portfolio modeling. The first version of the KMV Global Correlation Model™ (GCorr) was soon born.

This solved the problem of trying to measure credit correlation by estimating historical debt value correlations, which are inherently unstable because of changing composition and credit quality of firms. Historical debt value correlations are therefore problematic for credit portfolio modeling, because of historical debt value correlations may not be relevant for the future. The insight at KMV was to decompose the problem of default and debt value correlations into a relatively more stable component, asset return correlations derived from a multi-factor model of global economic, country/region and industry/sector factors, and a relatively more dynamic component, forward-looking EDF credit measures. By regularly updating firms' industry and country compositions, systematic risk estimates, and factor correlations, and by frequently updating EDF credit measures, KMV produced useful, dynamic, forward-looking measures of default and debt value correlations for the first time.

3 CREDIT PORTFOLIO MODELING

Having solved the problem of creating useful dynamic measures of default and debt value correlations, KMV was now able to create the first truly useful credit portfolio model. The first release of Portfolio Manager™ came in 1993. After the EDF model, Portfolio Manager became the second path-breaking product released by KMV. It introduced terms to the financial industry (e.g. unexpected loss, the standard deviation of the portfolio's loss distribution) that would ultimately become standard terminology among credit risk managers, and would lead to a revolution in the way financial institutions measure their risks and manage their institutions. Credit economic capital required to support the portfolio's credit risk to the institution's desired degree of safety could now be calculated, leading to many uses that go far beyond the original purpose of measuring economic capital adequacy. We will discuss a number of these uses later in this article.

4 RAROC MODELS

Active credit portfolio management, as we know it today, was still several years away, but banks recognized that they could use credit economic capital requirements to begin to develop better ways of managing what was entering their loan portfolios through their underwriting activities. This involved making sure that loan pricing covered the true costs of the loan, including direct costs of origination, costs of funding, taxes, and overhead, plus a profit margin. Loans that did not exceed a hurdle rate of return would, in theory, be rejected or restructured in a way that the hurdle would be exceeded.

A key aspect of the funding costs included the cost of the incremental economic capital required by the loan, which in turn reflected the degree of portfolio concentration or diversification from the new deal. Commonly referred to as RAROC (risk-adjusted return on capital) modeling, this could not be measured properly before the advent of good credit portfolio models. Previous attempts using regulatory capital or other accounting concepts of capital, or applying a standard *capital multiplier* to a standalone calculation of loan risk, did not reflect the true economics of capital and profitability for the loan.

Unfortunately, while the RAROC concept was good, practical application of the concept often did not work well in practice. Partly this was because banks included other than marginal costs (e.g., average cost of funds or allocations of fixed costs) in the cost calculation, and partly this was because of conflicts with the relationship managers. Such problems continue today, and as a result, many leading banks are phasing out their RAROC models in favor of superior loan transfer pricing approaches.

5 REGULATORY CAPITAL ARBITRAGE AND BASEL II

The 1990s also saw the development of the collateralized loan obligation (CLO) market. While some CLOs were created to transfer risk, many of them were performed for a different reason: regulatory capital *arbitrage*. After banks were able to measure economic capital required for their loan portfolios, it became increasingly clear that the 8% capital rule under Basel I was far more than the economic capital requirement for better quality credits. This led to a growing number of CLOs designed to achieve regulatory capital relief.

Regulatory capital arbitrage became one of the primary justifications for Basel II. Regulators seem to be continually trying to compensate for past regulations that the market proves to be uneconomic. Leading institutions are very good at finding ways to exploit the economic irrationality of regulations.

While banks initially focused attention on Pillar 1 of Basel II, and Moody's KMV has certainly assisted many banks in achieving Pillar 1 compliance, attention has turned to Pillar 2 in many countries. More than 90% of major banks in a recent survey commissioned by the International Financial Risk Institute intend to use their credit economic capital models for Pillar 2 compliance. RiskFrontier™, the Moody's KMV next-generation credit portfolio model, has been designed not only for calculating economic capital requirements and relative return/risk measures that facilitate active credit portfolio management; RiskFrontier's stress testing features also assist banks with Pillar 2 compliance.

6 ACTIVE CREDIT PORTFOLIO MANAGEMENT

What we think of as modern active credit portfolio management began among a few leading edge institutions in the late 1990s, mainly to: (1) reduce concentrations and credit portfolio volatility (unexpected losses), (2) increase capital velocity—use economic capital more efficiently and create the capacity to do more business, and (3) improve returns on risk and capital.

Active credit portfolio management involves three key principles. First, hold credit only when the institution is being paid well for the marginal portfolio risk—the extra portfolio risk associated with a small increase in exposure size. Second, reduce concentration and hence credit portfolio correlation caused both by excessive origination in single names, countries and/or industries and by deterioration in credit quality. When credit quality deteriorates on an obligor, correlation of that obligor's exposures with the credit portfolio increases. Those exposures are no longer being as well diversified by the portfolio. As a result of the increased standalone credit risk and increased credit correlation, credit portfolio risk and required economic capital accelerate for those exposures. Even if the institution was being paid well for the marginal portfolio credit risk at origination, it is not likely to be compensated adequately if marginal portfolio risk is accelerating.

The third principle of active credit portfolio management is to reward liquid and penalize illiquid exposures in the portfolio through an illiquidity premium when measuring marginal portfolio credit risk and return. Because a credit portfolio manager cannot forecast a priori which exposures will deteriorate in credit quality, and therefore need to be reduced, liquidity is very important for active credit portfolio management and should be rewarded.

There are two basic organizational models that institutions use for their active credit portfolio management functions. The first is a risk function overlay, for which the credit portfolio management unit is part of the risk management function, and typically has the goal of reducing portfolio risk. Alternatively, some institutions make their credit portfolio management unit a profit center. At these institutions, the credit portfolio management unit usually owns the credit portfolio P&L, and originations that are not sold immediately are *sold* to the credit portfolio management unit at some transfer price.

7 LOAN TRANSFER PRICING

Most early loan transfer price systems were based on measures of the marginal portfolio risk from the new deal, calculated after considering how much of the deal's risk was diversified by the rest of the portfolio. This, of course, could not be done properly without a good credit portfolio model. Although more recently some loan transfer pricing systems have been based on fair market values of the loans, ignoring portfolio-referent transfer prices may lead to concentrations that may not be sold or hedged because of limited liquidity or poor portfolio management. Loan transfer pricing should ideally consider both portfolio-referent and market value approaches. This ensures that loans are originated at transfer prices that reflect portfolio concentration/diversification and enable the loans to be sold or hedged immediately without loss.

8 USES OF ECONOMIC CAPITAL MEASURES

As mentioned previously, over time leading financial institutions developed many uses for credit economic capital modeling that went far beyond the original purpose of measuring capital adequacy. The new economic capital measures became the language of risk at leading institutions, and began to be used for the following:

- Internal risk reporting for business lines, obligors/counterparties, and individual exposures
- External risk and capital adequacy reporting to regulators, rating agencies, and investors
- Strategic planning, including medium-term strategic scenario analysis, business line growth and performance targets, and acquisition and divestiture analysis
- Economic capital budgeting among business lines
- Performance measurement among business lines, where return on economic capital is measured and/or the cost of economic capital used offsets the business lines' profitability, thus affecting their managers' incentive compensation
- Limit setting, where dynamic, economic-capital-based guidance limits supplement hard notional counterparty limits, helping to ensure that exposure reduction occurs if credit quality deteriorates
- Risk-based pricing of individual exposures
- Customer profitability analysis, for which the cost of economic capital required for the customer's exposures is an offset to the profitability of that customer relationship

9 RAPID GROWTH OF CREDIT MARKETS

In the past decade, credit markets have grown rapidly. Credit derivatives have emerged as one of the largest financial markets. As of mid-2007, the notional amount of credit derivatives outstanding was an astounding $45.46 trillion, according to International Swaps and Derivatives Association, Inc. (ISDA). Its growth has slowed recently, however, down to a mere 75% per year. Loans are now traded in a number of countries in secondary markets. Despite the 2007 credit and liquidity crisis, which has affected CDO issuance in the second half of 2007, CDOs will remain another source of credit market liquidity. This rapid growth and liquidity of the credit markets has enabled credit portfolio managers to hedge using single and basket CDS and indexes. In some banks, half of large corporate exposures is being hedged or securitized.

10 CREDIT VALUATION

While these markets were rapidly evolving, KMV was expanding its research to use the increased volume of credit market data. By the turn of the millennium, the focus on research at KMV shifted to credit valuation. This brought up the questions of what was the relationship between EDF values and credit spreads, and what were the important non-credit components of credit spreads?

Through extensive research, KMV determined that its former model of credit migration, based on simply an asset process, did not characterize longer-term credit risk, as was necessary for accurate credit valuation and risk assessment. The problem was one that KMV knew was an issue all along, but for which there was poor theoretical guidance—firms modify their liabilities in response to their business values. In other words, in addition to an asset process, there is also a liabilities process.

Rather than try to explain the liabilities process and its correlation with the asset process mathematically, in true KMV tradition, KMV solved the problem empirically, once again leveraging the vast amount of asset and liability data generated from EDF modeling over the past decade. KMV called the resulting empirical correlation of assets and liabilities *Distance-to-Default Dynamics*, and it had a profoundly positive influence on the ability for KMV to explain especially longer-term credit risk and pricing. Distance-to-Default Dynamics was released in Portfolio Manager 2.0 in 2001, and was incorporated into both RiskFrontier and the modeling of the term structure of EDF values in 2007. However, prior to its commercial release, KMV allowed the Federal Reserve and the Basel Committee to use Distance-to-Default Dynamics in fitting the model used in Basel II regulatory capital calculations, based on the regulators' recognition that agency rating transitions may significantly underestimate credit migration risk in banks' credit portfolios.

Armed with Distance-to-Default Dynamics, KMV, now Moody's KMV, could turn its attention to one of the key components of credit spreads for much of traded credit—optionality. Corporate bonds and loans often have one or more important embedded options, and a generalized model that could relate the values of a wide variety of such options to credit quality (EDF or Distance-to-Default) was needed. In 2004, Moody's KMV produced its first lattice valuation model, with lattice probabilities based on Distance-to-Default Dynamics. This lattice model was incorporated initially into CreditMark™, later into CDO Analyzer™, and now into RiskFrontier.

The Moody's KMV lattice valuation model was produced because our clients had been telling us that they wanted to be able to mark their loan and other credit portfolios to market/model for a variety of purposes, including credit pricing/decisioning at origination, loan transfer pricing, fair value accounting under International Financial Reporting Standards (IFRS), and understanding value when taking active credit portfolio management actions, including loan sales, hedging, and securitizations. While only a few institutions are marking their loan portfolios to market today, the number is growing. Though they may resist it publicly, many banks think mandatory fair value accounting of loans is inevitable.

11 CREDIT AS AN ASSET CLASS

Historically, many believed that credit risk occurred only in leveraged loans and impaired debt. Virtually all public debt was once rated investment grade at issuance. Thanks to Michael Milken and others, the junk bond market offered investors an expanded opportunity to invest in credit-risky debt, and less creditworthy companies to access the debt markets directly. However, junk bonds commingle credit and interest rate risk, so pure credit investments were generally not available to institutional or retail asset managers. The few loans that were traded were primarily inter-bank trades. The recent growth in CDOs, credit derivatives, and secondary trading of loans has allowed asset managers to invest in virtually pure credit risk. Credit has finally emerged as a distinct asset class.

If banks are net hedgers of credit risk, who is ultimately taking the other side? The answer appears to be insurance companies, hedge funds, and other asset managers. Recognition of credit as an asset class has facilitated this process. Some ascribe the low bank failure rate in the last recession, despite large numbers of corporate defaults as an indication of how efficiently the credit markets have been able to distribute credit risk from originators to other institutional investors in credit.

12 USE OF CREDIT PORTFOLIO MODELS BY INSURANCE COMPANIES

In addition to leading banks, some of the early adopters of economic capital modeling and active credit portfolio management were leading insurance companies. Davide Crippa, Head of Credit Solutions Portfolio Management and Analytics from Swiss Re, said, "Companies like ours, with a strong focus on economic capital, started, like banks, to look at credit portfolio management in the late 1990s as a way to identify and measure risk from an economic point of view, instead of from a regulatory or a rating agency point of view." Leading insurance companies that have adopted economic capital modeling have been calling for a strong economic capital focus in the proposed Solvency II regulations, the insurance world's analogue of banking's Basel II. A true portfolio credit view, with explicit modeling of credit correlation, is rapidly spreading among insurance companies, but has yet to be widely adopted by traditional asset managers or hedge funds, though that inevitably will change.

13 RECOGNITION OF VALUE ADDED BY CREDIT PORTFOLIO MANAGEMENT

Though leading institutions believe that active credit portfolio management adds value to their businesses, solid evidence that this was perceived and being rewarded by investors has been slow in coming. On the other hand, there are a number of examples of financial institutions being punished by shareholders based on perceptions of poor credit risk and portfolio management. For example, during the Russian crisis and the Parmalat case, several financial institutions' market caps dropped a multiple of their actual reported losses. Tamar Joulia, Head of Portfolio Management for ING, said at the Fall 2007 IACPM meeting that her rule of thumb was that surprise losses affect shareholder value tenfold (i.e., a $1 billion loss would cause a $10 billion decline in market capitalization).

In the May to November 2007 period, 13 large U.S.-based financial institutions collectively reported about $50 billion of losses related to the 2007 crisis. Their collective market capitalizations fell by some $300 billion, a 6:1 ratio. However, individual institutions' ratio of market capitalization drops to reported losses ranged from 1 to 70. Why was there such a difference among institutions? The answer is unclear, but is probably related to a combination of (1) mismeasurement of losses, (2) relative opaqueness among institutions (e.g., investment banks tended to have lower ratios, possibly reflecting greater transparency through mark-to-market accounting), (3) future prospects related to remaining exposure, and (4) the market rewarding superior positions taken by some institutions (e.g., Goldman Sachs) in the summer of 2007.

On the positive side, a few equity analysts have recently begun to reward institutions having better risk and portfolio management functions with higher expected earnings multiples. For example, Stuart Graham and Neil McDonald, Research Analysts at Merrill Lynch, upgraded their valuation of Deutsche Bank in a report on March 1, 2006. They wrote, "EUR 3 per share of the upgrade reflects cuts to our medium term provisioning assumptions at Deutsche…. These reductions reflect our belief that Deutsche has significantly reduced its structural provisioning needs through its Loan Exposure Management Group (LEMG). This unit has actively managed the credit risk in Deutsche's international loan book since mid-2003 (excluding the levered finance portfolio). Its expertise is now being rolled out into the German SME portfolio. We believe that Deutsche has been able to shed the bulk of the economic risk in its portfolio through a combination of CLO programmes and buying CDS protection." This additional EUR 3 per share translated into an incremental valuation of EUR 1.5 billion for Deutsche Bank, a significant recognition of the value of active credit portfolio management.

14 WHAT'S ON THE HORIZON

We have all heard the warning, "Those who ignore history are condemned to repeat it." This certainly seems true in banking. Despite the fact that the world has not eliminated economic cycles, we saw many banks leading up to the 2007 crisis continuing to pursue revenue growth in the face of competition through looser lending standards at what had been a relatively benign part of the cycle. A year ago we wrote that some of today's marginal deals would become tomorrow's problem loans. This was not a brilliant forecast, but merely a recognition that many banks continue to fail at learning from past mistakes.

A few leading banks have recognized this pattern, and have taken a number of steps to mitigate potential future problems. First among these steps is putting in place good credit risk measurement, both at the standalone level and at the portfolio level. Second is establishing management incentives that are truly aligned with shareholder value creation as opposed to revenue production irrespective of risk. The key third step is active management of the credit portfolio following the principles mentioned previously. Fourth is communicating externally why this strategy adds shareholder value. Over time, more financial institutions will realize that the past decade has seen a shift in the paradigm of investing

in credit. Credit portfolios must be managed actively to produce good returns per risk and economic capital. Credit trading will continue to grow, creating more liquidity which is so important for active credit portfolio management.

Given the history of innovation at Moody's KMV, clients expect Moody's KMV to continue to provide high-quality data, leading-edge analytics, and superior insight derived from an empirical understanding of credit. Moody's KMV is committed to advancing the state of the art of credit portfolio management in partnership with its clients.