Crafting a Market Landscape
Quantitative vs. Judgmental Credit Risk-Rating Systems
by Ivo Antonov

C redit risk-ratings allow banks to estimate the risk of loss from a borrower's failure to pay as promised. The author believes that knowing the basic differences between quantitative and judgmental approaches to risk modeling will help lenders determine how best to select and apply these tools to underwriting, credit administration, risk management, and portfolio management. This article compares quantitative and judgmental risk-rating models—two fundamentally different approaches to credit risk-rating and portfolio management—and focuses on applying these models to middle-market commercial borrowers.

W ith an array of new and powerful risk-rating tools now available, banks and other financial institutions no longer view the risk-rating process as simply a means to satisfy regulators and manage credit risk exposure. A number of factors have converged to convince these institutions that risk-rating is now more important than ever in increasing competitiveness, improving profitability, and, ultimately, creating value for shareholders.

Increased competition in domestic markets. Sustained economic growth and the emergence of a new breed of nonbank lenders have intensified competition in the traditional market for bank commercial lending. This has made borrowers ever more demanding, pushing banks toward greater efficiency in decision-making and exerting pressure on lending spreads. Risk-adjusted pricing, an efficient framework for analyzing risk in a consistent manner, and the need for proper allocation of economic capital are necessary tools in this environment.

Unprecedented growth in new debt issues. High-risk, non-investment grade companies have entered the credit markets in

increasing numbers over the past few years. This has been the result of favorable economic conditions and a greater willingness by investors to invest in entrepreneurial firms at an earlier stage of development. The mix of business loan applicants now includes a greater number of firms that are smaller, have relatively short track records, and often are involved in risky businesses, making it more difficult for banks to control risk exposures.

Industry deregulation. Conventional boundaries between investment, commercial and retail banking are disappearing in North America while existing protectionism has been eased in Europe. Only those banks that have sound credit risk management, efficient decision support, and management tools will survive in an increasingly globalized banking market.

Securitization and loan trading. Most commercial banks have developed their own sophisticated credit-rating systems. However, these systems are very specific, confined to tradition and prevailing credit culture, and they inhibit the shared understanding of risk that is needed for securitization and loan trading. A common currency of risk-rating is needed but does not yet exist. Large publicly administered debt and equity markets are already served well by such rating agencies as Moody's and Standard & Poor's. However, the growth in securitization is expected to come from the middle market, where smaller private and public companies that are not rated by these agencies represent the largest credit exposure in most commercial bank portfolios.

Increased volatility in global markets. Rapid economic growth in different parts of the world has not come without significant economic turmoil. Increased volatility in global markets will most likely persist and any potential slowdown or turnaround in major financial and economic centers, such as the U.S., Japan, or Germany, will further increase this volatility. Accordingly, banks will be pressured to quantify more accurately their credit risk exposures as they optimize the mix of assets in their portfolios.

Regulator support of credit risk models. Regulators have long embraced market risk models. However, this has not been the case with credit risk models. A recent study by the Basel Committee on Bank Supervision has stirred considerable debate regarding the potential of applying credit risk models in supervisory oversight of banking organizations and the formal process of setting regulatory capital. Though the study concludes that it is too early to change the Capital Accord before credit risk models are proven valid and applicable across institutions and geographical markets, it sets the groundwork for banks to start working in this direction.

The Problem of the Middle Market

For the last 30 years, credit-rating agencies have been actively rating large publicly administered debt and equity. History in this area, however, can be traced back to the beginning of the century. Risk-rating agencies serve the top segment of the market well— large exposures and public issues. The problem many banks are facing today is the scarcity of risk-rating solutions

and default estimates that can be used effectively in middle-market commercial lending. In an interview that was published in the July/August 1999 issue of *The Journal of Lending & Credit Risk Management*, Brian Ranson of Bank of Montreal addressed this problem:

Credit scoring now extends to small business. At the large corporate end of the market, such entities as KMV provide the leading-edge thought and models that have changed the science. Between these points, the private, medium-sized companies still are evaluated using traditional methods. I don't know if the science will ever reach the point that we can dispense with traditional methods, because, for these companies, the ability to assess the client's business prospects and the quality of management remain critical. It takes well-trained people to understand the business, react at the appropriate time, structure a sound transaction, pick the right security structure, and create the appropriate covenants. I believe this is a human activity requiring sound judgment that will endure for quite some time.

Many, like Mr. Ranson, do not believe the middle market conforms to the quantitative science used in developing risk-rating solutions. The middle market is dominated by privately held companies, for which credit information and default experience is not available in the public domain. Some banks have tried to address this problem by using data from their own customers. Other efforts have pooled private company data from a group of banks. However, even when data of this nature is obtained, the sample sizes often have been too restrictive in terms of default occurrences and, therefore, not applicable to the

broader market universe.

Developers of quantitative risk-rating models have responded to the lack of middle-market company data by creating risk-rating models and default estimates using data from publicly traded corporations. In order to move these models down-market, however, adjustments are needed to account for the known differences in the size and behavior of private-versus-public companies.

Judgmental credit risk models may also be used to fill in this middle-market gap. These credit risk models capture important financial information as well as qualitative information about a company's management, its competitive position, and the risk inherent in its industry. Judgmental models emu-

late the time-tested rules of credit risk analysis to produce an overall rating of a borrower's creditworthiness. In the absence of data for statistical validation, judgmental models follow the reasoning of an experienced credit expert in determining the level of risk in a commercial loan transaction. While judgmental risk-rating models have been shown to be highly accurate in their results, they lack the empirical validation required by many banks, particularly for loan portfolio management and securitization.

Quantitative Risk-Rating Models

Quantitative risk-rating models are developed from large pools of data. For most of these models, the data consists of the financial history

and default experience taken from a sample of actual companies. Subjective information about a borrower carries little or no weight in these models. The simplest quantitative risk-rating models are developed according to the following pattern:

- A sample is identified of companies that have met some predetermined criterion of failure, such as bankruptcy or loan defaults.

- A second group of companies is identified, with similar mix and industry attributes to the sample above; however, these businesses all are in a healthy state.

- The differences between healthy and defaulted businesses are analyzed. Computer analysis

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The Jargon of Credit Risk-Rating Models

Default. All credit risk models agree that a borrower is in default when it cannot meet its obligations to pay principal and interest. Commonly accepted default characteristics include:
- A loan is placed in a status of non-accrual of interest.
- A borrower is 90 days or more past due in its principal or interest payments.
- A borrower has filed for bankruptcy protection.
- A loan is partially or fully written off.

Creditworthiness. From normal operating activity, a business is expected to generate cash flow sufficient to pay expenses, meet obligations to debt and equity holders (interest, long-term debt amortization, and dividends), and reinvest sufficient amounts in assets to support future sales. Creditworthiness is an informed opinion about the future likelihood of a business to meet these requirements.

Probability of default. This is one of the key outputs of many credit risk rating models. In a given probability distribution, it is a measurement of the likelihood that a borrower will default on its obligations to pay principal and interest.

Loss in the event of default. This is the percentage of face value of a debt instrument that is lost when default occurs. Recovery observations are important for proper estimate of loss given default for various debt instruments.

Expected loss. The expected loss for a borrower equals the default probability times the loss in the event of default. The average expected loss of a portfolio is the weighted average of expected loss of the debt instruments in the portfolio with weights being equal to the proportion of each individual expo-

sure in comparison to the size of the total portfolio.

Unexpected loss occurrences. Unexpected loss represents volatility and quantifies portfolio diversification. The unexpected loss of a portfolio is not as simple to calculate as the expected loss since portfolio diversification depends on the correlation between possible defaults of the individual assets in the portfolio. A loan portfolio's unexpected loss is a function of the unexpected loss of individual debt instruments, weights, and the correlation between the individual assets. Default correlation matrices are applied to estimate portfolio diversification.

Credit portfolio quality. By providing significant granularity and allowing aggregation of risk correlation between individual exposures, some credit risk models allow banks to quantify not only the overall riskiness of a portfolio at a point in time but also the deterioration or improvement in a portfolio over time.

Minimum reserve requirements. Banks set aside capital reserves against the expected loss of their portfolio. Reserve provisions and economic capital affect both profitability as well as financial stability of banks. Confidence in expected loss estimates of a debt portfolio can improve reserve allocation significantly.

Economic meaning of capital. Economic meaning of capital puts portfolio management theory to work in maximizing the return of a portfolio while keeping the risk within predefined tolerable limits.

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reveals which ratios are consistently and significantly different between the two groups.

- A risk-rating formula is developed containing the significant ratios. This usually takes the form of a score such that:

Score = (ratio1 x weight attached to ratio1) + (ratio2 x weight attached to ratio2)…etc.

The formula would reveal the extent to which the financial profile of a particular company matches the profile of either successful or defaulted businesses.

- New companies are evaluated with the model. This involves scoring their financial ratio profile against the model's profile. Eventually, the performance of these models can be compared with what actually happened—for example, did the company actually default—and these results can be used to recalibrate and strengthen the predictive power of the model.

More advanced quantitative credit risk models make use of artificial intelligence structures, such as neural networks and rule-based expert systems, to identify numerous correlations within the financial data. These advanced model structures also can capture the reasoning of credit experts, combining this with statistical optimization, to produce more robust ratings. Advanced quantitative models have better predictive and discriminating power compared to their simpler formulae predecessors.

A second generation of more sophisticated quantitative models has been developed. These models give limited weight to a company's financial information and determine a default probability from the mar-

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ket value and volatility of a company's assets. While these models have been shown to be very powerful in measuring credit risk for companies with publicly traded equity, the lack of market valuations on the equity of private companies limits the applicability of these models in the middle market, where companies are privately owned.

Judgmental Risk-Rating Models

Compared to quantitative models, judgmental credit risk-rating models deal with rules of thumb, different combinations of financial and qualitative information, inexact information, and missing information. The risk factors in a judgmental model usually include the borrower's financial condition, size, industry risk, position within the industry, the reliability of the borrower's financial statements, and the quality of its management and elements of transaction structure (for example, collateral). Then, as an experienced credit analyst would do, judgmental systems use artificial intelligence technology to examine these factors and produce key considerations and final assessments. Along with an overall credit rating that measures borrower creditworthiness, these systems present a rich set of informed evaluations about the various subjective aspects

of a company's business and the environment in which it operates.

Judgmental systems follow the reasoning pattern of an experienced analyst, which is why both internally developed as well as vendor-provided examples are welcomed in underwriting, credit administration, credit review, and risk-based pricing. These credit risk models provide consistency throughout the organization. They can be used as a tool to communicate and enforce a bank's credit policy. Because judgmental credit risk models can explicitly demonstrate reasoning, their users can benefit from the learning opportunity they provide. These systems also may be used improve relationships with customers, as some of the analysis and key decision factors can be shared with them in a constructive manner.

Characteristics to Consider

The choice of a credit risk-rating model depends on various objective and subjective criteria. While the quantitative and judgmental models have much in common, there are several areas where one would find the greatest differences between the two approaches.

Simplicity. Generally, quantitative risk rating models are based on a simpler delivery architecture. These rating tools are comprised of a set of rules contained in a formula.

Even the most sophisticated quantitative models based on expert systems or other artificial intelligence technology use a simple input vector of financial ratios calculated from historical financial statements. There is less input for quantitative risk models, making them easier to use than judgmental models, and they can quickly rate large numbers of transactions in a portfolio with little human intervention. The simplicity of these models makes them effective for Internet deployment, so it is likely that quantitative models will become widely available through the Web channel. Judgmental credit risk models require more information to derive an assessment and often involve the user in more time for exploring and responding to its results.

Accuracy. Many banks consider quantitative models to be only suggestive of an appropriate rating. For example, some of the most well known quantitative models are based on just a handful of financial ratios from a single period of performance. Concerns about their accuracy cause many banks to be reluctant to place singular and heavy reliance on quantitative models. These concerns stem from 1) the inconsistent and uncertain quality of borrower financial information, 2) the limited depth of the underlying data used in developing these models, and 3) applying one or a few risk-rating models across a diverse range of industries, geographic regions, and asset classifications. While many of these banks use quantitative risk rating models, they generally believe that a properly developed and implemented judgmental rating system can deliver more accurate estimates of risk

for middle-market private companies. The benefits of such accuracy may outweigh the higher costs of judgmental systems.

Transparency. Quantitative models are sometimes called a black box. The basis of the rating is often not displayed and can only be explained by examining the underlying data and predictive power of calculations, which often are non-intuitive. However, since most of their parameters are statistically optimized, apart from a broad listing of components, they are limited in their ability to show how specific ratings are derived. This limits their applicability for underwriting and credit administration, where it is important for the risk-rating tool to train and inform its users in the key credit and policy issues of a transaction.

Judgmental credit risk models, on the other hand, are based on an accepted body of expert knowledge. Since a key benefit of a judgmental model is its ability to educate a user, the developers of these models have typically gone to great lengths to expose their risk-rating methodology and make it easy for users to understand.

Value added. Both quantitative and judgmental credit risk-rating models add considerable value in the establishment of consistent and objective analytical framework. This framework can be used to develop a common understanding of the whole credit management process within the organization's ranks and, thus, reduce some of the burden of unpopular policy measures. Judgmental risk models go a step further because not only do they enforce consistency, they can be used to guide and direct users where decisions and actions are not

black and white and may require interpretation.

Customization. Quantitative rating models have limited ability to adapt to an organization's unique needs and preferences or the characteristics of different financial markets. Customization would compromise a model's basic concepts and negate its predictive power. While the risk-rating formulae can be tuned to a different environment, its integrity is entirely dependent on a source of underlying data. Accuracy is not so dependent on the availability of data for judgmental risk models, and adjusting these models to fit unique policies and rating styles does not compromise their performance. Some users of judgmental models claim that this is essential in capturing the unique credit culture that is fundamental to maintaining a competitive advantage in their market.

While the openness of judgmental rating systems provides the flexibility that some banks desire, it also limits their applicability to areas where a common currency of risk rating is needed. For example, securitization and loan trading activities require a universal rating language and methodology before participants in these markets can share information.

Probability of default. One of the biggest advantages of quantitative rating models is that their results are based on specific experiential data and, therefore, can be supported by an objective body of empirical research. Since this data includes default events, there is an inherent default probability in each of the calculated ratings. This provides another advantage of quantitative models, since default estimates are critical in the active management of loan port-

folios.

A drawback of judgmental credit-rating models is that, by themselves, they do not provide a default probability and, therefore, cannot be used to determine other important elements of the transaction, such as unexpected loss. So they are less useful to risk managers who need this information for portfolio optimization and capital allocation. One way some users of judgmental systems have addressed this lack of an inherent default probability is by validating their results against external ratings from such rating agencies as Moody's or Standard & Poor's. This provides a linkage to a default estimate because these rating agencies have determined the default probabilities associated with their respective rating categories. Another path is to create a representative database that provides insight into default probability, by pooling the data from multiple banks.

Who Uses Different Credit-Rating Models?

As shown in Figure 1, credit risk-rating models are used by underwriters, credit administrators, loan review groups, and portfolio managers. Different models are better suited to serve the needs of these diverse user groups. Banks can use more than one credit risk model that assesses the different aspects of cred-

it risk applicable to underwriting and portfolio management. The opinion outlined below, though not supported by a formal study into the matter, summarizes the findings of numerous discussions with practitioners from different banking institutions.

Portfolio and risk managers have traditionally been the primary users of credit risk models. Portfolio managers favor the quantitative rating approach over judgmental rating models. They want a rating that can be plugged into an active portfolio management system and has linkages to default and validation. The objectivity of a rating is more important than its intuitiveness and transparency.

Recent volatility in financial markets has prompted a need to complement statistics with judgmental knowledge. Risk managers believe that properly managed judgmental rating systems deliver more accurate and informed estimates of risk. For large exposures, the benefits of such accuracy may outweigh the higher costs of judgmental systems.

Credit administrators are also active users of credit risk-rating tools. They look for more than a rating formula based on a few predictive inputs. Their interest in a rating solution is driven by the need for an analysis framework that is consistent, accurate, and transparent.
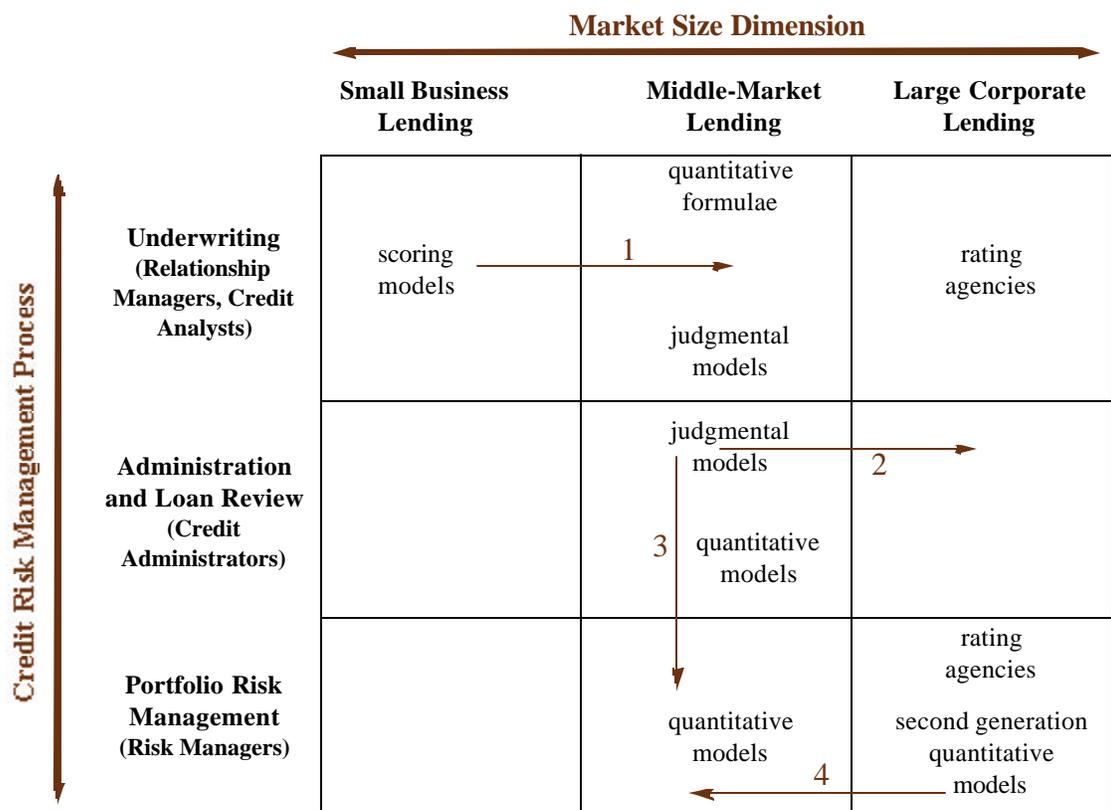
Conclusion

No single credit risk rating system is best for all possible uses. Quantitative rating models are simpler and often less costly; however, they may fall short of the need for accuracy, flexibility, and transparency. While judgmental credit-rating systems may be more costly, when properly designed and implemented, they deliver a higher degree of accuracy in their ratings, are more flexible in adapting to different environments, and can be understood by users.

Quantitative models are more widely accepted by portfolio risk managers while judgmental models, whether internally developed or provided by external vendors, have more application in middle-market underwriting and credit administration. Considering the drive for diversification and globalization among many banks, the most effective strategy is one that integrates two or more credit risk models. This enables a bank to substantiate the final ratings it assigns to borrowers with second or third opinions. It also recognizes the varying needs among the different groups involved in the risk management process. ❐

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Figure 1

Market Size Dimension

	Small Business Lending	Middle-Market Lending	Large Corporate Lending
Underwriting (Relationship Managers, Credit Analysts)	scoring models	quantitative formulae — 1 → ; judgmental models	rating agencies
Administration and Loan Review (Credit Administrators)		judgmental models → 2 ; 3 quantitative models	
Portfolio Risk Management (Risk Managers)		quantitative models ← 4	rating agencies; second generation quantitative models

Credit Risk Management Process

Dynamic Drivers

1 Raising credit ceilings due to increased confidence in scoring techniques and prevailing favorable economic conditions.

2 Enabling profitability analysis, risk pricing, and monitoring movements in credit quality.

3 Assessing more elements of credit risk by mapping to public credit risk databases or creating large private company databases from pooling of data from multiple banks.

4 Developing private company quantitative models based on comparable industry templates developed from public company data.

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