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Modeling Credit Risk for Commercial Loans

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In the past few years, there have been several developments in the field of modeling the credit risk in banks' commercial loan portfolios. Credit risk is essentially the possibility that a bank's loan portfolio will lose value if its borrowers become unable to pay back their debts. Arguably, credit risk is the largest risk faced by commercial banks, since loans and other debt instruments constitute the bulk of their assets. In the U.S., loans made up over 60% of total banking assets at year-end 2000, and fixed-income securities made up an additional 14%.

These credit risk models are becoming widely accepted by banks for various purposes; in fact, bank supervisors, including the Federal Reserve, have recently proposed new risk-based capital requirements based partly on such models. This *Economic Letter* provides a brief survey of how these models are constructed and used for credit risk measurement and management.

General modeling procedure

Commercial banks have been using credit risk models for their mortgage and consumer lending for decades. These credit risk models, typically known as credit scoring models, were first developed for consumer lending because of the large number of borrowers and their detailed credit histories. In contrast, there are many fewer commercial borrowers, and it is only within the last few years that credit risk models for commercial loans have been successfully created, marketed, and integrated into banks' risk management procedures. Although a reasonable variety of such models exists, all of them are constructed generally on three standard procedural steps.

The first step is to choose the type of credit risk to be modeled. “Default” models simply estimate the probability that a borrower will default; that is, the borrower will not make any more payments under the original lending agreement. In contrast, “multi-state” (or “mark-to-market”) models estimate the probability that the borrower’s credit quality will change, including a change to default status. For example, a multi-state model forecasts the probabilities of whether a B-rated borrower will remain B-rated, will become an A-rated or a C-rated borrower, or will default. Obviously, default models are a special case of multi-state models and are being used less frequently by banks.

An important element of this choice is the horizon over which credit losses are measured. For example, a borrower’s credit quality may change several times before a default, and a default model would not be able to capture these changes. Many options are available to the user, but common practice has settled on a one-year horizon, which is shorter than the maturity of many commercial loans. This relatively short horizon is due partly to modeling convenience and partly to the increasing liquidity of the secondary loan market and the credit derivatives market. Both of these markets permit banks to hedge (i.e., decrease) their credit exposure to a particular borrower or class of borrowers.

The second step is to determine the probability of each credit state occurring and the value of a given loan in each of them. In default models, there are two credit states: the credit is simply paid off completely, or it is worth a recovery value in case of default. In multi-state models, the loan’s value in each possible credit state is frequently assessed by referencing credit spreads derived from the corporate bond market. The state probabilities can be calculated in several ways, such as from simple historical experience in the corporate bond market or from models using data from the public debt and equity markets. The combination of the estimated values of a loan in the different states and the estimated probabilities of the states determine the credit loss distribution for that loan.

A key element of these loss calculations is the credit rating initially assigned to a loan and its corresponding borrower. Corporate credit ratings for large borrowers that issue publicly traded debt are available from financial information vendors, such as Moody’s and Standard & Poor’s. For other borrowers, which, in fact, typically make up the bulk of banks’ commercial loan portfolios, banks must rely on their own internal ratings systems, based on both public information and their own credit experience; see Treacy and Carey (1998) for a survey of banks’ internal ratings systems.

The third step combines the credit loss distribution for each loan into an aggregate portfolio loss distribution. This aggregation depends directly on the default correlations between individual credits, that is, the degree to which potential changes in credit status and losses are interrelated. There are generally two ways to model these correlations. In reduced form (or “top down”) models, correlations are essentially a by-product of the model’s portfolio loss distribution. In structural (or “bottom up”) models, the default correlations are modeled as functions of several variables, such as a borrower’s industrial categorization and country of origin. In addition, macroeconomic factors can be incorporated into these correlations. Once specified, the correlations are used to combine individual credit losses in different states into a loss distribution for the entire portfolio based on the credit risk model’s underlying assumptions.

Credit risk models as a risk management tool

A portfolio’s credit loss distribution is a key analytical tool for credit risk management. Once determined, this loss distribution gives a banker a complete forecast of possible portfolio credit losses over the coming year. For example, the mean of the distribution is the expected value of potential credit losses and could be used directly to determine the level of loan loss provisions that should be held for the loan portfolio.

Furthermore, the higher percentiles of the portfolio loss distribution can be used to determine the economic capital necessary for the portfolio. Economic capital is the buffer of reserves banks hold to guard against unexpected loan losses. Economic capital is typically set high enough that unexpected credit losses are very unlikely to exhaust it. For example, a banker could determine the amount of capital necessary to insure the solvency of the portfolio with a 99.97% probability, which roughly corresponds to the annual 0.03% default probability of AA-rated corporate bonds. Furthermore, the loss distribution provides the banker with a diagnostic tool for examining the impact of changes in credit concentrations on the entire portfolio's potential losses.

This approach to credit risk management has now been explicitly incorporated into the risk-based capital requirements developed by the Basel Committee on Banking Supervision (2001), an international forum for commercial bank regulation. Under the Committee's recently proposed revisions to the 1988 Basel Capital Accord, national bank supervisors would permit banks that have met certain supervisory criteria to use their own internal models to determine certain inputs to their regulatory capital requirements. However, the new guidelines will not permit banks to set their capital requirements solely on the basis of their own credit risk models.

Looking ahead

The field of credit risk modeling for commercial loans is still developing, but its core principles have been readily accepted by banks and their supervisors. The next few years of industry practice will be crucial in developing key aspects of the estimation and calibration of the model parameters. (For a thorough survey of the issues, see Hirtle, et al. (2001).) Resolution of these issues is needed before supervisors and model users can be completely confident with the models' outcomes. However, as banks gain additional modeling experience and more observations on changes in corporate credit quality, credit risk models should become an integral element of all banks' risk measurement and management systems.

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