MANAGING CREDIT RISK: A CHALLENGE FOR THE NEW MILLENNIUM

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Managing Credit Risk: A Challenge for the New Millennium

Edward I. Altman

Concern with credit risk management is escalating even beyond the levels of four years ago when we were first motivated to write about this challenging and important topic.[1] One reason is that lending institutions are increasingly comfortable with transacting their assets in counterparty arrangements whereby credit-risk exposure is shifted. This motivation has helped to stimulate the congruence of several important ingredients for the sophisticated treatment of corporate credit evaluation and management, including stand-alone valuation techniques, structured credit asset products, portfolio-management approaches, comprehensive and reliable relevant databases, and the growth in credit-derivative and other types of credit-insurance and hedging structures.

In addition to these evolutionary developments, at the start of this new century there are powerful stimuli coming from record levels of defaults and default losses in the United States in the corporate bond and leveraged loan markets and the imminent changes in bank capital allocation for credit assets promoted by the new Basel (BIS) guidelines, scheduled to be ratified in late 2002 and implemented by 2005. Indeed, recent BIS reports (1999, 2000 and 2001) have dazzled the credit world and lifted the debate on managing credit assets to new levels of sophistication, specificity and interest.[2] Several books and articles, in addition to our own, have

[1] See E. Altman, J. Caouette and P. Narayanan, "Credit Risk Measurement and Management: The Ironic Challenge in the Next Decade," **Financial Analysts Journal**, January/February 1998 and **Managing Credit Risk**, John Wiley & Sons, 1998 (same authors).

[2] See especially, "A Proposal for the New Basel Capital Accord," January 2001, from the Secretariat of the Basel Committee on Banking Supervision," Basel, Switzerland and recent updates (2001).

been written to comment on these developments[3] and we can expect many more in the coming years.

The U.S. economy had been strong for more than seven years, 1992-1999, and most of the world's stock markets were booming for a substantial amount of time during this period, reflecting high corporate profits and growth and relatively low interest rates. As a result, credit markets in most of the world, with some conspicuous exceptions (Mexico and Latin America in 1995, Southeast Asia in 1997 and Japan for almost a decade), enjoyed the so-called "benign credit cycle," whereby credit products and the size of credit assets grew dramatically. Non-performing loans and high yield bond default rates were under two percent per year and default losses were under one percent respectively in every year for the 1994-1998 period. High yield bond new issuance in the U.S. exceeded $100 billion for many years and leveraged loans (with yield spreads of at least 150 b.p. over risk-free Treasuries) averaged over $200 billion per year. What's more, Europe "discovered" credit assets as the Euro was being introduced and governments were mandated to reduce their deficits and their dependency for growth on government securities. This gave birth to the Euro high yield bond market and other credit risky financing structures as the old millennium was ending.

The End of the Benign Credit Period

This benign credit cycle began to crumble in the aftermath of the Russian crisis of August 1998 and the escalation of defaults and default rates in the United States. These were first perceived in the high yield "junk" bond market where the default rate jumped from 1.6% in 1998, far below the historical annual average of 3.4%) to 4.15% in 1999, 5.07% in 2000 and is likely to be close to 10.0% in 2001 (see Figure 1). And, recovery rates on defaulted bonds simultaneously

[3] Books such as A. Saunders (1999), Saunders and Allen (2002), and M. Crouhy, et.al. (2001) have explained and advocated the various new portfolio approaches proposed to deal with the credit asset capital allocation issue.

dropped to below 30¢ on the dollar in 1999-2001, resulting in much higher than average default losses. A recent study shows a significant negative correlation between default and recovery rates (see Altman and Brady, 2001). But, most observers were not too concerned and treated this escalation in credit risk as unique to the U.S. "junk" bond market, even as this author was citing more fundamental causes of the escalation in credit risk and comparing the 2000-2001 credit situation to a decade earlier (Altman, 2000). Nobody could ignore, however, the dramatic continued rise in default levels and rates by the end of 2001, when the total of defaulting dollars in the high yield bond market will top $50 billion for the first time. Default rates in 2001 approached the record levels of 1990-1991 and recovery rates dropped again. The so-called "bad cohort" of 1997 and 1998 of new loan facilities and bond issuance began to show up with increasing and disturbing frequency in the non-performing categories. We even speculated that perhaps, for the first time, credit defaults and default recovery levels could be a leading indicator of an economic downturn, instead of its traditional coincident relationship – see Figure 2 for a picture of this relationship during the four previous economic recessions and the surge in defaults prior to the current downturn in the U.S.

The BIS Story

For more than a decade, the so-called Basel I Accord of 1988 set the standard for bank capital allocation worldwide. It was clear that these standards, set before we had comprehensive data for assessing credit risk across the entire credit rating spectrum, was sadly antiquated, e.g., the 8% capital rule on corporate credit assets regardless of the risk rating of the asset. Then in June 1999, the BIS "New Capital Adequacy" Report (1999) shocked the markets with its three-pillar approach and the precise recommendation for change in capital allocated across the credit assessment spectrum. Equally important was its recognition of external, and possibly

FIGURE 1

Historical Default Rates

Straight Bonds Only Excluding Defaulted Issues From Par Value Outstanding, 1971 – November 23, 2001 *(US$ millions)*

Year	Par Value Outstanding[a]	Par Value Defaults	Default Rates *(%)*
11/23/01	**$649,000**	**$48,880**	**7.532**
2000	$597,200	$30,295	5.073
1999	$567,400	$23,532	4.147
1998	$465,500	$7,464	1.603
1997	$335,400	$4,200	1.252
1996	$271,000	$3,336	1.231
1995	$240,000	$4,551	1.896
1994	$235,000	$3,418	1.454
1993	$206,907	$2,287	1.105
1992	$163,000	$5,545	3.402
1991	$183,600	$18,862	10.273
1990	$181,000	$18,354	10.140
1989	$189,258	$8,110	4.285
1988	$148,187	$3,944	2.662
1987	$129,557	$7,486	5.778
1986	$90,243	$3,156	3.497
1985	$58,088	$992	1.708
1984	$40,939	$344	0.840
1983	$27,492	$301	1.095
1982	$18,109	$577	3.186
1981	$17,115	$27	0.158
1980	$14,935	$224	1.500

Year	Par Value Outstanding[a]	Par Value Defaults	Default Rates *(%)*
1980	$14,935	$224	1.500
1979	$10,356	$20	0.193
1978	$8,946	$119	1.330
1977	$8,157	$381	4.671
1976	$7,735	$30	0.388
1975	$7,471	$204	2.731
1974	$10,894	$123	1.129
1973	$7,824	$49	0.626
1972	$6,928	$193	2.786
1971	$6,602	$82	1.242

		Standard Deviation *(%)*
Arithmetic Average Default Rate		
1971 to 2000	2.713	2.484
1978 to 2000	2.948	2.683
1985 to 2000	3.719	2.829
Weighted Average Default Rate[b]		
1971 to 2000	3.482	2.558
1978 to 2000	3.503	2.563
1985 to 2000	3.582	2.565
Median Annual Default Rate		
1971 to 2000	1.656	

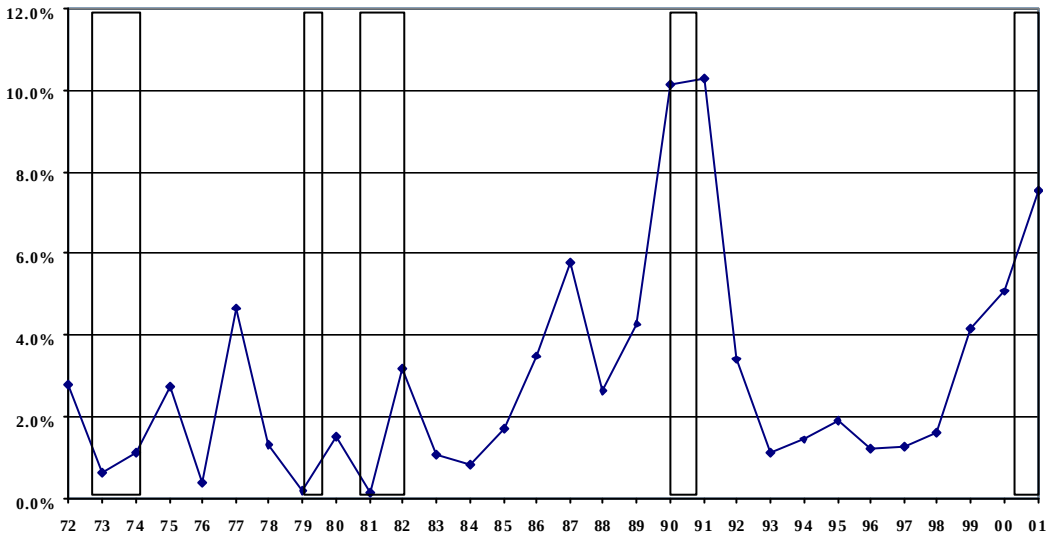
[a] As of mid-year
[b] Weighted by par value of amount outstanding for each year.

Source: Author' s compilation and Salomon Smith Barney

FIGURE 2

Historical Default Rates and Recession Periods in the U.S.

High Yield Bond Market
1972 - 2001 YTD



Periods of Recession: 11/73 - 3/75, 1/80 - 7/80, 7/81 - 11/82, 7/90 - 3/9, 4/01 - ?
Source: Figure 1 & Nat'l Bureau of Economic Research Data

internal, rating systems to determine risk weights and capital benchmarks. After an active commentary period, the BIS again surprised many observers with an even finer breakdown of capital standards across the spectrum of credit risk and a more precise recognition of internal rate based systems (IRB) for setting default (P_D) probabilities (Foundation Approach) and loss given default (LGD) parameters (Advanced Approach). Although the BIS did not go as far as to authorize the application of sophisticated portfolio credit risk models by individual banks, they clearly raised the bar for the level of sophistication of credit risk models. This has motivated the development or enhancement of internal credit rating systems and other credit risk capital considerations, such as operations risk, and their impact on economic capital and the pricing of credit assets. The importance of portfolio diversification has been introduced in the new capital standards by specifying a certain degree of correlation of default risk across credit assets (e.g., 0.20 or 0.10 depending upon the rating quality of the results). While some observers, including this author,[4] believe that the currently proposed new Basel II guidelines do not go as far as they could and will not squelch the problematic "regulatory capital arbitrage" (substituting high risk for low risk assets) trend, the new guidelines are clearly a step in the right direction and the Basel task force is continuing to modify guidelines (e.g., see Basel update, 2001). Since these new guidelines are expected to be sanctioned in late 2002 but will not be implemented until 2005, one wonders when will other important additional changes, like portfolio models, become sanctioned, rather than just encouraged to be constructed and tested?

For all of the above reasons, we observed a dramatic increase in interest from market practitioners, consultants, and scholars in developing credit risk management tools and integrated

[4] See E. Altman and A. Saunders, "Credit Ratings and the BIS Reform Agenda," NYU Salomon Center Working Paper #S-01-5, February 2001, presented at the Bank of England's "Conference on Systemic Bank Risk," London, May, 23-25, 2001 and submitted to the BIS. This article will appear in the **Journal of Banking & Finance**, vol. 26, 2002, along with the other papers presented at the Bank of England conference.

techniques to assess both the stand-alone and portfolio aspects of corporate credit. We now believe that lending institutions, primarily commercial banks, have reached a certain maturation stage whereby they no longer make loans, or purchase securities, and hold them either to maturity or to charge-off. Moreover, if the loans/bonds default, par investors like banks and non-bank institutions, no longer are content to wait-out the restructuring process. They may very well value the securities in default and decide to sell them to distressed debt investors in the secondary, so-called "vulture" investment market. Stimulated by pressures from regulators, creative securities firms, dynamic trading markets and internal return on equity objectives, banks are increasingly willing to consider transacting their assets in counterparty arrangements whereby the credit-risk exposure is shifted with the reduction in total risk of the original lender. Because the markets in which credit assets are hedged or sold are quite young, still fairly illiquid, and probably inefficient, banks and their counterparties are struggling to amass the information and analytical foundation for valuing the underlying assets in some form of meaningful risk-return framework.

This motivation has helped to stimulate the congruent coming of age of four important ingredients for the sophisticated treatment of corporate credit evaluation and management:

- stand-alone valuation techniques,
- comprehensive and relevant databases,
- attempts to resolve the portfolio credit-risk problem,
- the advent and impressive growth in the structuring and trading of credit-risk derivatives and various types of credit insurance and guarantees.

By being more sophisticated in the assessment and laying off of credit-risk, financial institutions can be more aggressive in the creation and trading of new products (e.g., structured instruments). Before addressing these points, one should examine the economic environment that both predates and now surrounds the current surge of interest and activity in credit-risk issues.

Credit-Risk Management and the Economic Environment

The assertion that market practitioners in the late 1990s and now at the end of 2001, are placing strong emphasis on credit-risk management does not imply that interest was nonexistent or even low in the past. Indeed, this matter received significant attention throughout most of the world with the structural increase in defaults in the late 1980s and early 1990s. The United States "led" the way with record bank loan and public corporate bond defaults caused by many ill-fated, highly leveraged restructurings of the mid- and late 1980s, an economic recession, and the inability of marginal firms to refinance their obligations. The junk bond default rate jumped to more than 10 percent in 1990 and 1991 (Figure 1) and many skeptics argued that high-credit-risk markets, such as leveraged bank lending and junk bond financing, were likely to disappear. This surmise proved to be far from the reality, as new issuance in both of these lending markets reached record levels in the period 1996-1998.[5]

Although these events, prior to 1997, heightened concern about established credit-management techniques and the lack of a meaningful credit culture within the world's largest and most sophisticated financial institutions, we did not as yet witness a pervasive interest in the creation and evaluation of new valuation techniques. What we observed was the occasional stand-alone valuation model, continued refinement of some relevant default databases (first

[5] Unfortunately, this over exuberance has been a leading cause of the acceleration in default rates, starting in 1999 and lasting at least three years.

established in the mid-1980s), and surveys by regulators and consultants of existing techniques. The surveys invariably reached the conclusion that credit cultures of financial institutions and their lending strategies needed to be rethought and possibly redesigned (see, e.g., Wuffli and Hunt 1993).

These calls for reassessment came at a time of increased competition in lending markets as more-varied types of firms were intermediating credit. Corporations no longer needed to negotiate with different types of institutions for their complex borrowing needs. Banks were underwriting credits of all maturities, and securities firms were making loans, as well as underwriting bonds. The concept of a "one-stop financial conglomerate" arrived, and with it the reduction of profit margins on traditional lending as the markets became more competitive.

On the demand side, some investors in credit instruments tried to enhance their yields by switching to nontraditional markets, such as emerging market debt and asset-backed vehicles, as well as moving down the credit-quality spectrum. In addition to the greater risk that investors were willing to take, the low interest rate environment created greater vulnerability to market risk and, combined with credit-risk migration concerns (i.e., the risk that a firm's credit rating will drift downward), led to concern about mark-to-market losses, even if default incidence continued to be low.

Stand-Alone Asset Risk Procedures

The foundation for any comprehensive treatment of a credit portfolio of loans and/or bonds is the initial assessment of the risk of each asset in the portfolio on a stand-alone basis. If the analysis is faulty or incomplete as to the default and credit migration risk of the underlying entity, then no matter how sophisticated the portfolio algorithm, the end result will be of little use. Stand-alone credit-risk measurement involves a growing array of analytical techniques. These

approaches have included multivariate regression, discriminant and logit statistical models, models based on contingent claims and market price proxies for asset value coverage of debt obligations, and finally, artificial intelligence procedures to either predict default or replicate the bond-rating results of established bond-rating agencies (see Altman and Saunders, 1997 for a 20-year retrospective). The latter objective is critical because it is directly related to one of the caveats of any credit-evaluation system - - regardless of the credit-scoring system used, the results should be linked to capital market indicators and experience. We suggest that the appropriate capital market indicators are bond ratings, not because we believe that the rating agencies have the best models and the most accurate results with respect to default likelihoods, but because the relevant databases on default and migration risk patterns are primarily based on the bond rating of the underlying credit. Hence, if the data that we use are based on ratings, then the scoring system should also be tied to ratings.

We have mentioned the notion of credit-risk migration. In essence, the ultimate negative migration is from some initial state to a default (i.e., from a performing asset to one that either has missed a periodic interest payment or for which a distressed restructuring is accomplished whereby the creditor receives a lower interest payment, an extension of the time period for repayment, and/or a more risky claim on the asset than the initial contract specified). In addition, credit risk involves the possibility that the inherent risk of the asset migrates to a lower quality level, thereby resulting in lower security values in a mark-to-market pricing environment (see Altman and Kao [1991], Carty and Fons [1993] and specifically found in CreditMetrics®[J. P. Morgan, 1997]).

Recovery Rates

The final ingredient of the credit-risk assessment of individual loans/bonds is the loss to the creditor if the asset's quality deteriorates or if it actually defaults. This step mainly involves assessing the impact of the recovery level given a default. The recovery rate concept is extremely important, but it was given small, if any, consideration in traditional bond-rating systems. While it is true that rating agencies adjust for expected recoveries by reducing the senior unsecured bond-rating equivalent for bonds of lower seniority levels and attempt to explicitly consider recovery levels in their bank loan rating programs, I am not convinced that there is a great deal of precision in these rating adjustments to the fundamental default probability assessment. On the other hand, financial institutions of all types, the rating agencies themselves and the new Basel II guidelines now stipulate explicitly that the recovery on defaulted assets plays an important role in assessing credit-risk loss. We can expect increased research and resources to be spent on the empirical investigation of historical recovery experience, particularly of nonpublicly traded private debt.[6] We are currently investigating the degree of correlation between default rates and recovery rates (Altman & Brady, 2001). The negative correlation that we find imply greater losses during credit stressful periods and have implications for all credit risk models, whether stand-alone or portfolio-based. It also has potential implications for the so-called "procyclicality" phenomenon whereby default losses and rating downgrades occur just when the requisite bank capital amounts increase, thereby possibly exacerbating economic downturns.

[6] Many studies have documented recovery experience on bonds, see Altman and Eberhart (1994), Asarnow and Edwards (1995), Altman and Kishore (1996), Moody's (1996 and 2000), S&P (1997), Fitch (1997), Van der Castle and Keisman (1999), and Frye (2000). A study by Altman and Suggitt (2000) measures the default and mortality rate experience on syndicated bank loans and PMD/S&P now report on default and recoveries of institutional bank loans on a regular basis, e.g., see their quarterly report (2001), "Bank Loan Defaults Surge in 2001." And, Altman and Brady (2001), have documented the important negative correlation between default and recovery rates based on a supply and demand comparative, time series analysis.

To summarize, the stand-alone, individual asset ingredient in credit-risk management systems involves credit-scoring procedures, assessments of negative-event probabilities, and the consequent losses given these negative migration or default events. Although for many years we have been emphasizing the important link between credit-scoring procedures and capital market experience, an institution that ties its scoring system to its own portfolio's historical experience is certainly justified in using its own files to assess risk and losses. The experience of the bank, however, or several banks that agree to pool their data, must be rich enough in terms of statistical quantity and data reliability to provide meaningful future estimates.

Portfolio Models

The return distribution on risky debt assets is not nearly as normal as it is on equities. Whereas the debt investor is usually limited to the promised yield or slightly higher returns (given positive credit migration or falling interest rates), the potential downside is total. The expected return distribution is, therefore, skewed toward lower-than-promised returns with a fairly large (fat) tail at default levels. Hence, traditional mean return-variance of return models are not appropriate, although they may be robust enough to use over short (e.g., one month or one quarter) measurement periods.

The search for alternative portfolio schemes seems to be heading either in the direction of Monte Carlo simulation results of possible returns on a credit portfolio or in the direction of the use of a proxy measure of risk, other than the variance of return, in a return-risk trade-off measure. One proxy that has received increased attention of late is the *unexpected loss* on individual loans, or portfolios of loans, based on some estimated distribution around the expected loss or some confidence level consistent with the bank's own desired credit rating. In this approach, the expected loss estimate can be used in adjusting the promised yield to obtain the

expected return and the unexpected loss is used as a measure of the risk of the portfolio. The unexpected loss is a by-product of this analysis and is an outcome that requires capital reserves. In all portfolio models, however, the illusive ingredient is to properly and reliably estimate risk-event correlations between assets. Little agreement exists as to how this estimate should be achieved, although meaningful attempts are being made by analyzing the time-series correlations of rating series, equity prices, or variables that explain equity prices and/or defaults[7] and also to integrate both market and credit risk measures.

Databases

In both the stand-alone and portfolio treatment of fixed-income assets, the solutions are dependent on the methodology used and the data inputs to the models. Among the most important data inputs are the expected default rates and migration (drift) patterns from the asset's initial credit rating. Fairly comprehensive databases exist on these inputs, the criteria usually being the bond rating from Moody's Investors Service or Standard & Poor's Corporation, either from original issuance or based on a basket of bonds at some point in time and then observed for subsequent years. Databases are available covering default and migration experience back to at least 1970.[8]

Although financial institutions may choose to use their own databases rather than rely on public bond market data and there are attempts to maintain loan default databases,[9] the reality is that few institutions have extensive historical data that are based on the credit-scoring system

[7] Analytical models have been commercially promoted by KMV (see McQuown, 1994), J. P. Morgan's "CreditMetrics," (1997), McKinsey's "Credit Portfolio View," (1997), Credit Suisse Financial Product's "Credit Risk +," (1997) and Kamakura Corp's. market/credit risk models, (2000), as well as the Altman & Saunders approach, (1997).

[8] See Altman & Kao (1991), Carty and Fons (1993) and S&P (Credit Pro™) and Moody's (annually) and the NYU Salomon Center's Default Database. Caouette, Altman & Narayanan (1998) compare and contrast these databases.

[9] For example, the PMD/S&P database.

currently in place. Hence, reliance on public data is likely to be the route that most consultants and decision makers will take, at least in the near future.

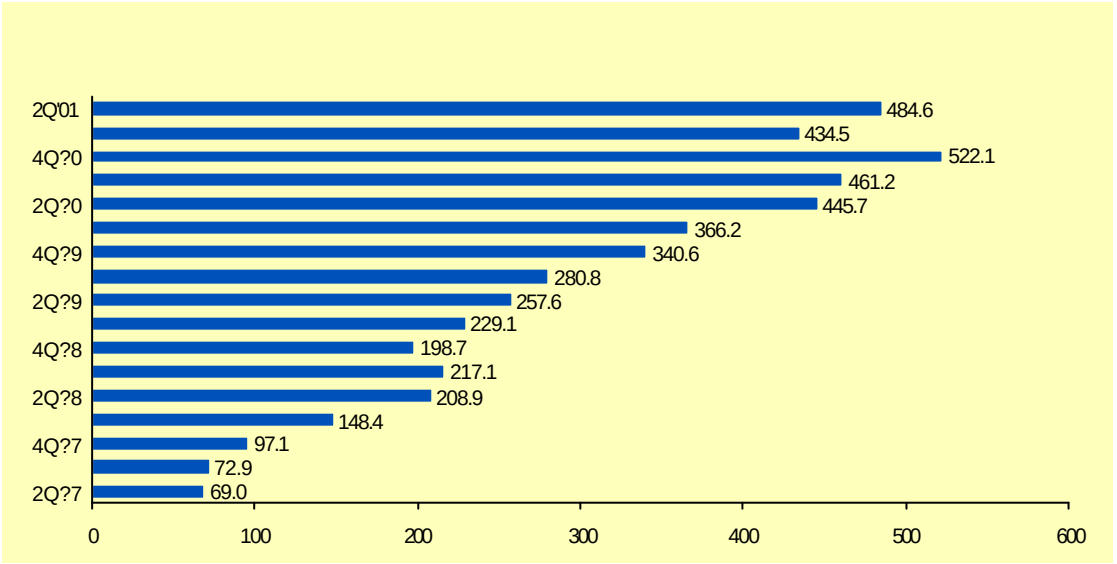
Credit-Risk Derivatives and Credit-Enhancement Mechanisms

The final factor related to the increased motivation for creating sophisticated credit evaluation and management techniques is the advent and impressive growth in the credit-risk derivative and the corporate credit-enhancement/financial guarantee markets. Selling a credit asset outright is no longer necessary if, for some reason, the original lender no longer wants to assume the credit risk. Relatively simple and also more-complex financial instruments are being devised to set up a type of insurance mechanism for transferring the risk of default and also the risk of migration in the case of total-return derivatives. These instruments have created new and dynamic counterparty exposures.

The credit-derivative market is growing as banks, securities firms, corporations, and other institutions seek to hedge their credit exposures or realign their lending portfolios. In the past seven years, this market has grown considerably, with many of the major securities firms providing liquidity by immediately finding willing counterparties or taking on the insurance risk themselves, confident that a counterparty will soon be found (see Parsley 1996, McDermott 1977 and the **Economist** 2001). Estimates are that the notional amounts of debt that has been "insured," via the credit derivative market increased from $70 billion in 1997 to as much as $500 billion in 2001 and possibly to over $1 trillion by 2002 (see Figure 3). The derivative seller provides insurance against an event (e.g., default) that changes the value of the underlying asset. In all of these cases, the relationship between the original borrower or lender is preserved except in the outright sale of the credit asset in the secondary market.

FIGURE 3

U.S. Credit Derivatives Market
Notional Amount (US$Bn)



Source: Bank Call Reports (OCC), insured commercial banks and foreign branches in the U.S.

- **British Bankers Association estimates 12/00 outstanding of $900 bn & $1.6 tn by 2002**

Financial guarantees provide, in some cases, a leaner, less ambiguous form of a credit derivative because no question arises of a change in ownership of the asset if some credit event occurs. The guarantor simply pays off the original lender based on some predetermined formula. This arrangement is particularly useful in the case of a nontransferable loan. In all cases, however, an important technical issue is a precise and universally agreed upon definition of the credit event that is being hedged (e.g., exact definition of a default).

The seller-counterparties in credit-risk derivative transactions, or the more traditional credit insurance providers, are increasingly mindful of managing and trading their own credit portfolios. Hence, these institutions are particularly interested in techniques that combine the stand-alone and portfolio aspects of their revenue-based assets. The credit-risk derivative and credit-enhancement markets have been improving, and will continue to improve the credit market's liquidity, and vice versa. This development, in turn, will require more accountability and transparency of asset values and will also motivate attempts to price the products more profitably. And, credit risk mitigation (CRM) techniques are being re-evaluated within the new Basel Accord's guidelines. A CRM framework has just been proposed (see Basel, September 2001) in order to improve incentives for banks to manage credit risk and to encourage prudent CRM techniques which relate the resulting capital treatment of the economic effects of different CRM techniques in both the trading and lending books of banks.

Conclusion

We are witnessing an impressive escalation in analytical resources devoted to more-effective management of credit risk. This development comes at a time when credit-related losses in the United States, Japan, and perhaps other countries in the near future, are escalating to record levels. The primary technical motivating factors include refinements of traditional

techniques to evaluate the default likelihood of individual assets, new analytical solutions to credit portfolio management, larger and improved databases to translate risk ratings into expected losses, and the dynamics of market mechanisms of risk mitigation techniques. The new millennium is getting off to a fast paced start to further new developments and techniques for the analytical treatment of credit risk management.

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