About Corporate Default Rates

In the new Basel II framework, and for managing credit risk in general, perhaps the most important element to specify and analyze is the probability of default (Pd) of a credit-counterparty. Whether debt instruments are considered on a stand-alone basis, or within a portfolio context, default probabilities, and adjustments for recoveries (next chapter), play a critical role in risk assessment and valuation. Indeed, the two main requirements for a financial institution's acceptance as a Basel II "Advanced Bank" is its implementation of an "internal-rate-based (IRB) approach," involving a specification of Pd and RR (recovery rate) for each counterparty in all asset classes in order to specify the expected and unexpected loss-given-default (LGD).

The most comprehensive and almost universally referred to corporate default statistics available today are stratified by company or facility bond ratings and by some aging period from a base point in time. These data are updated annually by the leading ratings agencies and the latest data through 2006 can be found in Fitch (2007), Moody's (2007) and Standard & Poor's (2007). In addition, Altman (e.g., 2007) reports updated defaults measured both in a "traditional" and "cumulative-mortality" format. We will present and discuss each of these statistical methodologies and results carefully as it is very important for the user to understand the subtleties, as well as the magnitudes, of these risk measures when applying them to their own portfolios as well as when determining risk-capital requirements under Basel II. In addition, the Pd of a corporate counterparty is fundamental to the pricing and evaluation of a credit default swap (CDS) or a CDO on a bundle of CDSs.

In this chapter we focus on corporate bonds and corporate loans in the United States, with some reference to other areas and asset classes. In particular, we concentrate on corporate high-

yield (or "junk" bonds) and their loan counterpart, "leveraged-loans." The reason is that these asset classes are almost always the risk class designation of a corporate credit asset just prior to a default.

High-Yield Bond Default Rates

As noted above, a relevant metric for assessing default risk in the corporate sector is the high-yield, or "junk" bond, market default rate over various periods of time. This market has grown from a basically all "fallen-angel" market (investment grade, usually when first-issued, but like many of us, we get "uglier" as we age and the issue is eventually downgraded to non-investment grade or "junk" status) in 1998 of about $7 billion to about $1 trillion in 2006 (see Figure 15.1). In a sense, these high-yield, high risk bonds are the "raw material" for possible defaults.

Defaults are defined as bond issues that have missed a payment of interest and this delinquency is not cured within the "grace-period" (usually 30 days), or the firm has filed for bankruptcy under reorganization (Chapter 11) or liquidation (Chapter 7), or there is an announcement of a distressed-restructuring. The latter typically involves a tender for an equity for debt swap, where the creditors accept a lower-priority security in-lieu of the bond (usually common equity), or a lower coupon rate payment or an extension to repay the bond is proposed.

Default rates can either be calculated in dollar-denominations (e.g., by Altman and FITCH Ratings) or issuer-denominated rates (e.g., by Moody's and S&P). Moody's also now reports default rates denominated in dollars. The dollar-denominated rate vs. issuer-denominated rate has a very high correlation over time but can be quite different at a particular point in time. For example, Moody's speculative grade issuer-denominated rate in 2006 was 1.57% and its dollar-denominated rate was 1.07%. In 2002, when default rates were very high, the dollar rate was significantly greater than the issuer rate. In general, dollar-denominated rates are more

volatile than issuer-denominated rates. As to which rates are more relevant to investors, the correct answer is that both are relevant, depending on the investment strategy followed. For example, most institutional investors in high-yield bonds or leverage-loans do not invest an equal dollar amount in each issue. So, for them a dollar-weighted rate would seem to be most relevant. For "equal-weighted" investors, like CDOs (collateralized debt obligations), the issuer-rate makes more sense since the collateral in the "pool" is usually equally-weighted as to the amount purchased.

Table 15.1, from Altman and Ramayanam (2007), shows the high-yield, dollar-denominated rate for corporate bonds in the U.S. and Canada, from 1971-2006. Since relatively few managers invest in the total spectrum of bond rating classes (from AAA to CCC), the high-yield, speculative-grade rate of default is relevant for analysts and investors in this asset class. We will see, however, that default rates can be broken down by the full spectrum of ratings and are also reported by Altman, the rating agencies and some investment banks. The weighted-average (by dollar amount outstanding) annual default rate for the 36-year period 1971-2006 is 4.24% per year and the arithmetic-average is 3.17% per year, with a standard deviation of 3.07%. We can observe that the annual default rate has varied from as low as 0.158% in 1981 to as high as 12.80% in 2002. The median rate is 1.80% per year and the difference between the averages and median rate can be explained by the truncated distribution of zero (0) as the minimum but, in some years, like 1990, 1991, and 2002, the rate can exceed 10.0%. Indeed, we can observe that the rate has been about 10% or more (including 2001's 9.8%) in four out of the 36 years (11%) that we have calculated this rate. Since 10% or greater is about two-standard-deviations above the mean, four observations with this amount is more than what one might expect in a 36-year time period if we assumed a normal distribution (i.e., 2 ½% of the 36 years, or about one observation).

In 2006, the default rate was a miniscule 0.76%, the lowest rate in 25 years (since 1981 when the high-yield bond market was only $17 billion). The Moody's issuer-denominated rate was somewhat higher at about 1.57%, but it too was at a very low rate compared to its historical average of close to 5% per year. Both of these rates are consistent with an extremely benign credit environment. Indeed, from Figure 15.2, we can observe a very low quarterly and annual default rate from 2003-2006, with the exception of an upward blip in late 2005 when several very large defaults took place (e.g., Delta and Northwest Airlines, Delphi Corp., Calpine Corp.). Much has been written and discussed, of late (e.g., see Altman, 2006), about the unusually low default rate period and whether conditions will revert back to the average rate or whether the extreme, massive liquidity picture will remain with us for a long time to come. We do observe another benign period from 1993 to 1998, so while it is possible that the current period will persist, we are of the opinion that there will be a reversion to the mean and, indeed, this is perhaps overdue.

Mortality and Cumulative Default Rates

While the traditional approach to measuring default rates is appropriate for gauging average annual rates for a broad cross-section of high-yield bonds, or any asset class that is relevant to the investor/analyst, it is not adequate for a number of reference benchmarks. For one thing, it does not reference specific bond ratings within the high-yield space (e.g., BB, B, or CCC) and, indeed, it does not address, at all, the investment grade classes. In addition, it does not address the timing of the default from some reference date. In order to be more precise about expected default rates for a given credit rating, Altman (1989), Moody's (1990) and S&P (1991-92), all identified the relevant cohort group for measurement as the bond rating at some point in time. As will be shown, however, Altman's mortality measure examines bonds with a certain *original* rating for a period of up to ten years after issuance. Moody's and Standard & Poor's

assess default rates of all bonds of a given bond rating, *regardless of their age*. Moody's was of the view that macroeconomic phenomena are more important than vintage effects. It should also be noted that Moody's uses the issuer as the basic unit of account. And, a recent paper (Cantor and Hamilton, 2006), discussed Moody's more refined measure that now does specifically incorporate an aging factor in their cumulative default rate calculations as well as the pros and cons of calculating default rates that are adjusted for rating withdrawals. Their method does not, however, analyze default rates from the date of original issuance (see discussion below).

Altman (1989) retains the notion that default rates for individual periods - - yearly, for example - - are measured on the basis of defaults in the period relative to some base population in that same period. The calculation, however, becomes more complex when we begin with a specific cohort group, such as a bond-rating category, and track that group's performance for multiple time periods. Because the original population can change over time as a result of a number of different events, Altman considers mortalities in relation to a survival population and then inputs the defaults to calculate mortality rates. Bonds can exit from the original population because of at least five different kinds of events: defaults, calls, sinking funds, merger-takeouts and maturities.

The individual mortality rate of bonds in a specific rating class for each year (marginal mortality rate, or MMR) is calculated using the equation:

$$MMR_{(t)} = \frac{total\ value\ of\ defaulting\ debt\ in\ the\ year\ (t)}{total\ value\ of\ the\ population\ of\ bonds\ at\ the\ start\ of\ the\ year\ (t)}$$

The cumulative mortality rate (CMR) is measured over a specific time period (1, 2, . . ., T years) by subtracting the product of the surviving population of each of the previous years from one (1.0); that is,

$$CMR_{(T)} = 1 - \prod_{t=1}^{T} SR_{(t)}$$

Where $CMR_{(T)}$ = cumulative mortality rate in (T),
$SR_{(t)}$ = survival rate in (t); 1 – MMR(t).

The individual years' marginal mortality rates for each bond rating are based on a compilation of that year's mortality measured from issuance over the entire sample period, e.g., 1971-2006. For example, all of the one-year mortalities (36 weighted compilations) are combined for the sample period to arrive at the one-year rate; all (35) of the second-year mortalities are combined to compute the two-year rate, and so on.

The mortality rate is a value-weighted rate for the particular year after issuance rather than an unweighted average. If we were simply to average each of the year-one rates, year-two rates, and so on, our results would be susceptible to significant specific-year bias. If, for example, few new bonds were issued in a given year and the defaults emanating from that year were high in relation to the amount issued, the unweighted average could be improperly affected. Altman's (1989) weighted-average technique correctly biases the results towards the larger-issuance years, especially the more recent years.

Using data going back to 1971, Altman has measured and updated corporate bond default rates from each of the major S&P rating categories (similar results could be expected if Moody's ratings were used). The most recent estimate of marginal and cumulative mortality rates for up to ten years after issuance are for the period 1971-2006 and are shown in Table 15.2. The expected hierarchy of cumulative default rates can be observed, i.e., higher rates for comparable years after issuance for lower credit rating cohorts, except for two anomalies. One is the higher AA cumulative rates than the single-A. The other is the second-year marginal rates for BBB bonds compared to BB bonds or compared to year three BBBs. The former is caused by the large Texaco Corporation's Chapter 11 bankruptcy filing in 1987, which involved over $3.0

billion of originally AA rated bonds. The latter was due to an even larger amount of WorldCom bonds that were originally rated BBB and issued in 2000 and defaulted two years later in 2002. These anomalies would not manifest if the issuer denominated rates were observed.

The *loss* rates for AA bonds show the expected hierarchy, however, as Texaco's bonds recovered over 80% of their face value just after default - - far above the average recovery of about 40% for all bonds. Table 15.3 shows the mortality-loss rates for the same period 1971-2006. Note that the loss rates are based on the mortality default rates found in Table 15.2, adjusted for recoveries at default. For an in-depth discussion of recovery rates, see Chapter 16.

There are several noteworthy aspects to the mortality rate table. First, we can observe that the marginal rates for high-yield bonds in the first three or four years of a bond's life rise each year and then tend to level off for several years thereafter. Hence, we do note an aging effect, which can be observed only by tracking default rates from original issuance. The aging effect is intuitively sound, since most companies have a great deal of cash just after they issue a bond. Even if their operating cash flow is negative, they are usually able to meet several periods of interest payments.

It should be noted that the lower-rated categories, such as single-B, have default rates that appear to be very high. Cumulative defaults are nearly 28 percent by the fifth year and 37 percent by the tenth year. But these rates are not so high when viewed in relation to promised yield spreads, which averaged nearly 5 percent per year over the sample period. Factoring in average recovery rates of at least 40 percent (and higher of late), a 28 percent five-year default rate results in an 18 percent cumulative loss rate, or a loss of about 2.5 percent per year. Indeed, the high-yield bonds, of which single-B's have been the dominant category, returned 2.56 percent per year above the risk-free rate in the 1978-2006 period (Altman and Ramayanam, 2006). The investor should also factor in the volatility of returns as well as the average spread.

Comparing Cumulative Default Rates

We have mentioned the major differences between the rating agencies' reported default rates and Altman's. These different methodologies, which are summarized in Table 15.4, include (1) face value dollar amount (Altman) versus issuer basis, (2) actual ratings (Altman) versus implied senior-unsecured rating, (3) domestic straight debt only (Altman) versus domestic (including convertibles) and foreign, (4) original issuance (Altman) versus cohort grouping, regardless of age, (5) mortality rates (Altman) versus default rates, and (6) different sample periods. Of particular relevance is point # 4. In contrast to Altman's original issue rating approach, Moody's and the other rating agencies "cohort method" is based on pools of issuers holding a given rating on the cohort date regardless of original rating or time since issuance.

Table 15.5 shows the one- to ten-year cumulative rates from the three primary sources of data. The primary empirical difference between the mortality/original issuance approach, the *static pool* method used by Standard & Poor's, and the *dynamic cohort* method used by Moody's, is the observed default rates in the first several years - - particularly in the lower-grade classes. For example, Altman's first-year rate for single-B bonds is 2.84%, while Moody's and Standard & Poor's are 5.24% and 4.99%, respectively. These relative differences persist until the third year, after which the results are quite similar. For example, the fifth-year Moody's rate is 26.79% versus 27.82% for Altman. Standard & Poor's rate is actually lower (22.55%) than Altman's in the fifth year due to lower marginal rates in some years. This difference is difficult to explain. As noted earlier, the main reason for these differentials is the aging effect.

Which method is best to use probably depends upon the age distribution of the relevant portfolio of individual bonds. For new issuance analysis, which is often the perspective for investors in corporate bonds, the mortality rate approach would seem to be more relevant. For

portfolios of seasoned bonds, the rating agency approach would perhaps be more relevant. All of the methods include sample periods that cover many business cycles.

Altman's marginal rates could also be used, but only for assessing the one-year marginal default rates for bonds which have survived up to that point. A portfolio manager's strategy regarding the weighting of bonds could also influence the choice of approach. Altman weights the larger issues more than smaller ones, while the rating agencies weight each issuer equally.

Age of Defaults

Table 15.6 shows the age distribution of defaults for the period 1989-2006. Note that the traditional pattern of low defaults in the first year after issuance followed by increased levels for years two and three are found in 2006 as well as for the entire sample period. All of these years, however, had lower proportions in 2006 compared to historical averages. Also, the distribution is rather flat in 2006 in the periods two to nine years after issuance, with a slight spike in the sixth year (by number of issues). However, 2006 follows a trend seen over the last several years in which defaults are occurring later (years 6-9), than are observed from the historical averages.

Fallen Angel Defaults

One factor that can impact the aging of defaults is whether the defaulting issues were at any point in time investment grade and then downgraded (fallen-angels). Table 15.7 shows a time series of the proportion of defaulting issues that were fallen-angels. Table 15.8 shows that comparison between the fallen-angel default rate (measured as a percent of issuers) and original issue high-yield bonds. Although fallen-angels have a lower average annual rate, the difference (about 1.0%) is not statistically significant.

Industry Defaults

Tables 15.9 and 15.10 show the number of defaults from the large industrial sectors over the period 1970-2006 and by dollar amount per year from 1990-2006. We can observe that the

largest "contributor" has been the communications sector, with more than $100 billion of defaults, the bulk in the four-year period 2000-03, led by telecoms. One firm, WorldCom, contributed about $30 billion! More recently, the sector with the most financial distress has been the automotive industry, primarily auto-parts suppliers.

Forecasting Default Rates

When discussing the forecast of annual default rates, we again differentiate between dollar-denominated and issuer-denominated rates. In either case, the fact that default-risk is a critical measure in determining required rates of return on investing in any debt class makes this estimation important. So, in a benign default risk environment, a seemingly small yield-spread available may be acceptable if default rates are expected to continue at a very low rate.

Issuer-Based Default Rate Forecasts

A very fine summary of issuer-based default rate forecasting is provided in Keenan, Sobehart and Hamilton (Moody's, 1999). Probably the first study on the topic was Fons (1991), where he found that about half of the variation in historical default rates could be explained by "credit quality" and the overall state of the economy. The former was proxied by the historical one-year default rates by rating category and the distribution of issuers at the point in time that the forecast was being made. It was found that the distribution of current ratings plus the expected variation based on the state of the economy did a very good job in terms of forecasting accuracy. A consensus forecast of GNP growth was used as a proxy for the expected state of the economy and a two-factor regression model fit the data very well.

Helwege and Kleiman (1996), building upon the Fons framework, explained the annual fluctuation in high-yield bond default rates with an adjusted R^2 of as much as 81%. They added an aging factor, discussed earlier in the Altman models, as well as an adjusted non-symmetrical group of macroeconomic factors. They found that an economic growth threshold of 1.5%

(dummy variable) was important in determining if default rates were going to spike up for the bottom-tier of speculative grade credits (e.g., B3 or lower), while higher-tier speculative grade credits would not be as vulnerable. An arbitrarily determined GDP growth threshold was also used by Altman, et al (2005) in explaining default recovery rates (see next Chapter), but with very little added explanatory power to their supply/demand based model.

Jonsson and Fridson (1996) and Jonsson, Fridson and Zhong (1998), using a different set of issuer-based default rate macroeconomic indicators, were able to explain 86.5% of the variation in historical speculative-grade default rates. Their models also included a variable that measured the aging-factor of existing issuers and the existing credit profile of issuers. The latter was based on the proportion of existing issuers with a B3 or lower rating - - again the concentration on the "bad-cohort." The macroeconomic factors included corporate profits as a percentage of GNP, the size of current liabilities of business failures, the NASDAQ and S&P 500 Index P/E ratios and the gross proceeds of IPOs. These measures were used to assess the degree of optimism/pessimism of the economy, as well as the cost of equity capital and access to equity capital for firms in the economy. The expected inverse correlation between macroeconomic performance and optimism with default rates were shown to be evident.

Finally, with respect to a global, speculative grade issuer-based default rate forecasting model, Keenan, et al (1999) provided an approach that to this day (2007), is still being used by Moody's Investors Service. They used a revised measure of possible defaulting issuers which subtracted out those issuers which had their rating "withdrawn" over the past twelve months. So, a forecast of market size reflecting the expected withdrawal rate was necessary. The authors argued that the withdrawals were fairly stable over time averaging about 4% for speculative grade issuers and 2% for all-corporate categories. A simple autoregressive model was used to extrapolate this withdrawal rate. Withdrawals play an important role in Moody's published

cumulative default rates - - discussed earlier - - and also in Altman's mortality rate estimates (discussed above, and also to come in his default rate forecasting model).

The Moody's model then proceeds to forecast the next 12-month default rate based on a poisson-regression model postulated to be appropriate when the variable to be estimated is a non-negative integer-value which is a function of a set of explanatory variables. They argue that the poisson-based model was appropriate for the Duffie and Singleton (1997) aggregated default activity model as well as CSFB's CreditRisk+ portfolio model (1997). An important assumption of this modeling process is the assumption that the defaults within each monthly observation can be assumed to be uncorrelated. The authors state that they find little evidence of clustering, whether across industries or within an industry, even in high default months.

Moody's predictors of default included (1) changes in credit quality, (2) the aging effect of existing issuers, and (3) a number of variables that reflect macroeconomic conditions in the economy. The latter include the index of total industrial production in the US, adjusted by the producer price index, and the ten-year US Treasury bond yield. The authors found that they could explain up to 85% of the variation in the all-corporate global-trailing 12-month default rate and about 80% of the variation in the 12-month trailing speculative-grade default rate.

The Mortality Dollar-Based Rate Approach

Using the mortality rate approach to calculating default rates, discussed earlier in this chapter, Altman has for a number of years, e.g., Altman and Ramayanam (2007), been forecasting future one-year default rates. This dollar-denominated rate yields both a dollar estimate as well as a percentage of the high-yield market that can be expected to default. The approach is extremely simple and does not utilize any forecasts of macroeconomic factors to arrive at its forecast. He simply observes the past ten years' new issuance of bonds of all ratings, from AAA to CCC, and applies the latest, updated mortality rate matrix, see Table 15.2, to

estimate the marginal mortality rates and dollars expected to default in the next calendar year. So, for example, the single-B new issuance in 2006 multiplied by the one year's marginal mortality rate 2.84%, will give us the B-rated first year's contribution to 2007's defaulted bonds' dollar amount; the 2nd year's marginal rate (6.78%) multiplied by 2005's new issuance of single-B bonds will give us that year's contribution, and so on. One can then simply aggregate each year's contribution by rating class for all rating classes to determine the total amount of defaults one year ahead. Since Altman's default rate method (see Table 15-1), uses the mid-year convention for determining the denominator in its calculation, the total forecasted default rate calculation requires an estimate of the size of the high-yield bond population as of mid-year of the year the forecast is for.

A Final Note on Forecasted Default Rates

Both of the forecasting methods, described above, were forecasting at the start of the year, approximately a 2.5% high-yield bond default rate for 2007. While these techniques were quite accurate in their forecasts in the past, they all over-estimated the 2006 rate by a considerable margin. The extreme low rate in 2006 was consistent with the recent benign credit markets and if these conditions continue in 2007 (the time of the writing of this chapter), then we can expect that forecasting techniques that rely on estimates based on a long history of observations (e.g., over 35 years in the case of the Moody's and Altman's methods) will again over-estimate the default rate. At some point, however, we expect a reversion to the mean default rate and a more accurate set of forecasts.

Leverage Loan Default Rates

The loan analog to the high-yield bond market is known as the leverage loan market. These are mostly term-loans provided to non-investment grade companies or loans which yield at least 150bp over LIBOR. Most of these loans are held by non-bank, institutional investors and

are typically 3-7 year maturities with similar covenants to their public bond "cousins." This market has grown tremendously of late and was estimated to be about $1.4 trillion in 2006 (Figure 15.3), about 40% larger than the high-yield bond market in the US. Indeed, in 2006, the new issuance was a record $480 billion compared to a near record $140 billion of newly issued high-yield bonds. These loans are the main provider of debt financing in the recent binge of highly-leveraged-transactions (HLTs), primarily leverage buyouts (LBOs).

Similar to the unusually low default rates in the high-yield bond market in 2006, we can observe a very low default rate in the leverage loan market (see Figure 15.4). Indeed, the last 12-month dollar-denominated default rate (from S&P/LSTA) fell from about 3.0% in 2005 to 1.1% in 2006 and fell even further to 0.24% in February 2007. The comparable issue-denominated rate was about 0.8% of the pool of 2006, down from 2.0% one year earlier and also fell to a miniscule 0.46% in February. These statistics are consistent with our observation that the risky debt markets were enjoying an unusually high liquidity, low default risk environment in 2006 and the remarkable thing was that lenders were requiring an almost all-time low yield spread over risk-free Treasuries. Some observers (e.g., Altman, 2006) felt that the risk fundamentals of the market were far greater than the yield-spreads, default rates and credit default swap premiums were implying and that a reversion-to-the-mean was likely to manifest in the next few years. Still, others were arguing that a type of new-paradigm had taken place and that the 2006 scenario of credit risk management was likely to continue for the foreseeable future. We guess the old adage, "time will tell" is relevant here!

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Figure 15-1

Size of the US High-Yield Bond Market

1978 – 2006 *(Mid-year US$ billions)*

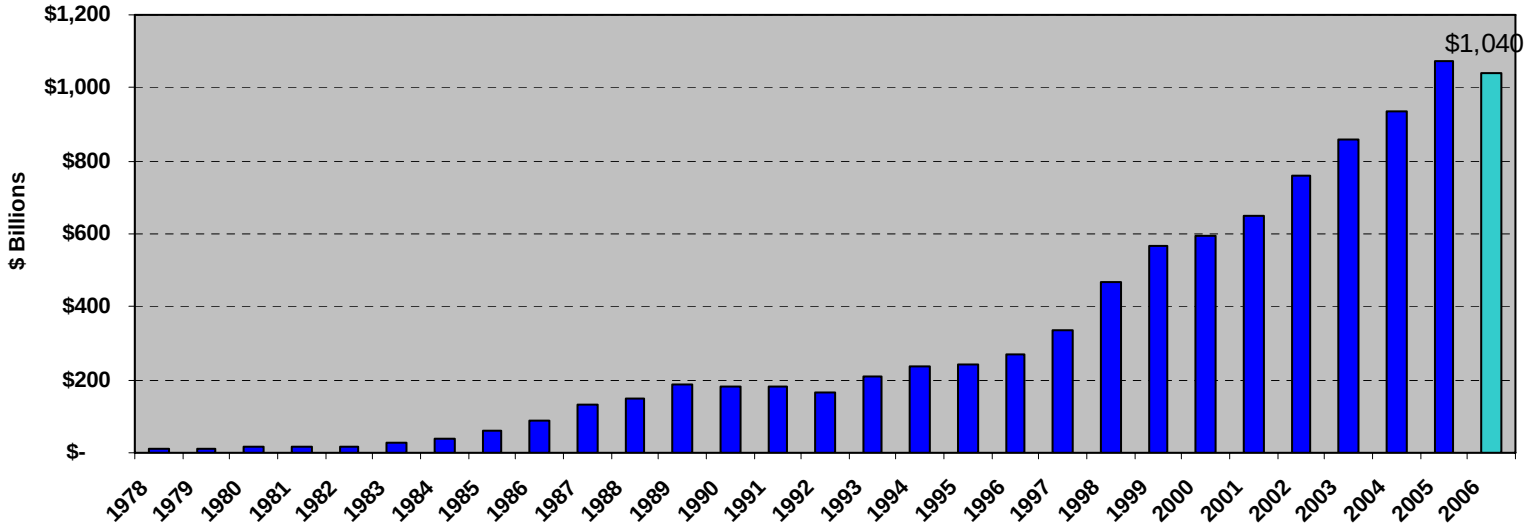


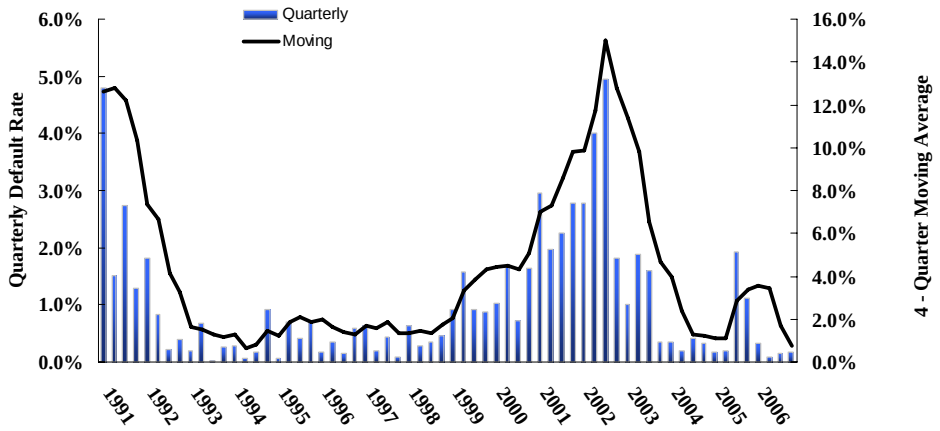
Table 15.1. Historical Default Rates — Straight Bonds Only Excluding Defaulted Issues From Par Value Outstanding, 1971 – 2006 ($ Millions)

Year	Par Value Outstanding ($)[a]	Par Value Defaults ($)	Default Rates (%)
2006	993,600	7,559	0.761
2005	1,073,000	36,209	3.375
2004	933,100	11,657	1.249
2003	825,000	38,451	4.661
2002	757,000	96,858	12.795
2001	649,000	63,609	9.801
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
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 2006**	**3.167**	**3.072**
	1978 to 2006	**3.464**	**3.283**
	1985 to 2006	**4.189**	**3.428**
Weighted Average Default Rate[b]	**1971 to 2006**	**4.244**	
	1978 to 2006	**4.258**	
	1985 to 2006	**4.303**	
Median Annual Default Rate	**1971 to 2006**	**1.802**	

[a] As of mid-year. [b] Weighted by par value of amount outstanding for each year.
Sources: Authors' compilations.

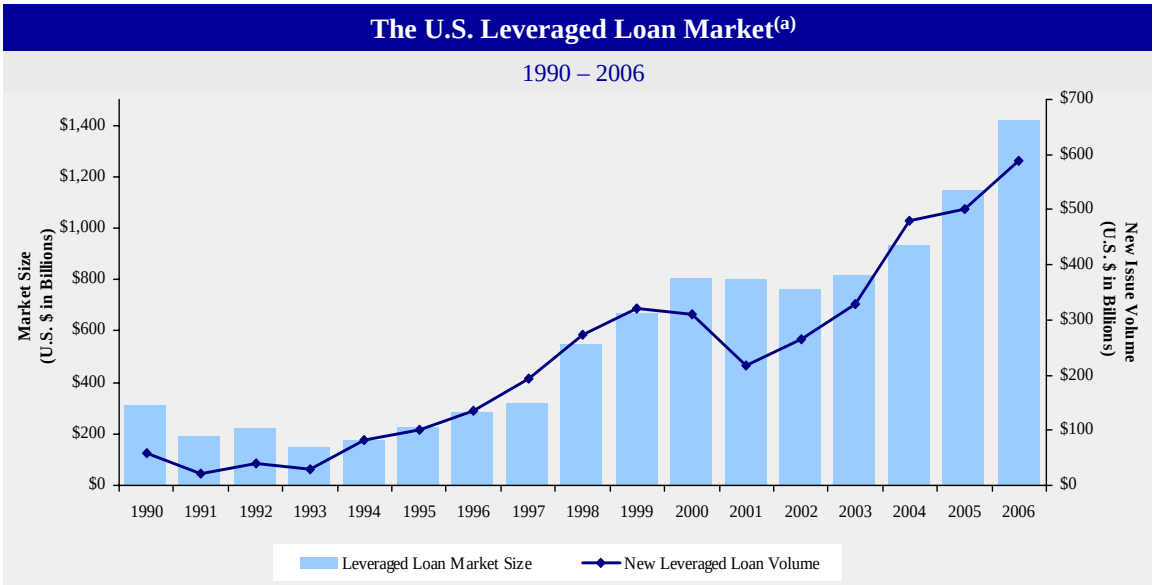
Figure 15.2. Quarterly Default Rate and Four-Quarter Moving Average 1991 – 2006



Source: Authors' compilations.

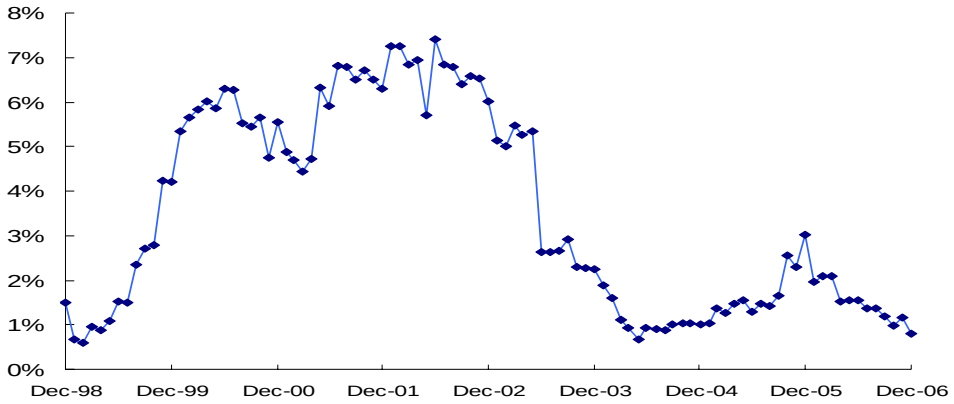
Figure 15-3

Leveraged Loan Market
U.S. Distressed Market Update



(a) Defined as speculative grade with a LIBOR spread of 150 basis points or greater.
Source: Credit Suisse

Figure 15-4. S&P Leveraged Loan Index 12 Month Moving Average Default Rate 1998 –2006



Sources: Standard & Poor's/LSTA compilation.

Table 15-2. Mortality Rates By Original Rating – All Rated Corporate Bonds (a) (1971 - 2006)

		Years after issuance									
		1	2	3	4	5	6	7	8	9	10
AAA	Marginal	0.00%	0.00%	0.00%	0.00%	0.05%	0.03%	0.01%	0.00%	0.00%	0.00%
	Cumulative	0.00%	0.00%	0.00%	0.00%	0.05%	0.08%	0.09%	0.09%	0.09%	0.09%
AA	Marginal	0.00%	0.00%	0.30%	0.14%	0.02%	0.02%	0.00%	0.00%	0.05%	0.01%
	Cumulative	0.00%	0.00%	0.30%	0.44%	0.46%	0.48%	0.48%	0.48%	0.53%	0.54%
A	Marginal	0.01%	0.08%	0.02%	0.06%	0.06%	0.09%	0.05%	0.20%	0.09%	0.05%
	Cumulative	0.01%	0.09%	0.11%	0.17%	0.23%	0.32%	0.37%	0.57%	0.66%	0.71%
BBB	Marginal	0.33%	3.13%	1.34%	1.24%	0.74%	0.31%	0.25%	0.19%	0.14%	0.40%
	Cumulative	0.33%	3.45%	4.74%	5.92%	6.62%	7.10%	7.33%	7.51%	7.63%	8.00%
BB	Marginal	1.15%	2.42%	4.32%	2.26%	2.53%	1.27%	1.61%	1.11%	1.71%	3.47%
	Cumulative	1.15%	3.54%	7.72%	9.88%	12.10%	13.20%	14.60%	15.56%	17.00%	19.88%
B	Marginal	2.84%	6.78%	7.35%	8.49%	6.01%	4.32%	3.95%	2.40%	1.96%	0.83%
	Cumulative	2.84%	9.43%	16.08%	23.21%	27.82%	30.94%	35.67%	35.26%	36.53%	37.06%
CCC	Marginal	8.12%	15.42%	18.75%	11.76%	4.14%	9.33%	5.79%	5.70%	0.85%	4.70%
	Cumulative	8.12%	22.30%	36.86%	44.30%	46.60%	51.57%	54.38%	56.98%	57.34%	59.36%

(a) Rated by S&P at issuance based on 1,955 issues

Source: Standard & Poor's (New York) and Author's Compilation

Table 15-3. Mortality Losses By Original Rating – All Rated Corporate Bonds (a) (1971 - 2006)

Years after issuance

		1	2	3	4	5	6	7	8	9	10
AAA	Marginal	0.00%	0.00%	0.00%	0.00%	0.01%	0.01%	0.01%	0.00%	0.00%	0.00%
	Cumulative	0.00%	0.00%	0.00%	0.00%	0.01%	0.02%	0.03%	0.03%	0.03%	0.03%
AA	Marginal	0.00%	0.00%	0.05%	0.04%	0.01%	0.01%	0.00%	0.00%	0.02%	0.00%
	Cumulative	0.00%	0.00%	0.05%	0.09%	0.10%	0.11%	0.11%	0.11%	0.13%	0.14%
A	Marginal	0.00%	0.03%	0.01%	0.04%	0.03%	0.04%	0.02%	0.03%	0.06%	0.00%
	Cumulative	0.00%	0.03%	0.04%	0.08%	0.11%	0.15%	0.17%	0.20%	0.26%	0.26%
BBB	Marginal	0.23%	2.19%	1.06%	0.45%	0.44%	0.21%	0.10%	0.11%	0.07%	0.23%
	Cumulative	0.23%	2.41%	3.45%	3.88%	4.31%	4.54%	4.63%	4.74%	4.80%	5.02%
BB	Marginal	0.67%	1.41%	2.50%	1.27%	1.47%	0.65%	0.90%	0.48%	0.85%	1.25%
	Cumulative	0.67%	2.07%	4.52%	5.73%	7.12%	7.72%	8.55%	8.99%	9.76%	10.89%
B	Marginal	1.83%	4.74%	4.92%	5.49%	3.90%	2.37%	2.56%	1.34%	1.03%	0.61%
	Cumulative	1.83%	6.48%	11.08%	15.97%	18.37%	19.24%	21.31%	22.36%	23.16%	23.63%
CCC	Marginal	5.44%	11.10%	13.50%	8.46%	2.90%	7.00%	4.34%	4.41%	0.51%	3.01%
	Cumulative	5.44%	15.94%	27.38%	33.44%	35.37%	39.89%	42.50%	45.04%	45.32%	46.96%

(a) Rated by S&P at issuance based on 1,777 issues

Source: Standard & Poor's (New York) and Author's Compilation.

Table 15.4

Comparing Cumulative Default Rate Methodologies

	Altman		**Moody's/S&P**
1.	Face value-weighted basis.	1.	Issuer, unweighted basis
2.	Domestic, straight bonds.	2.	Domestic straight and convertible and foreign bonds - - considered at the issuer level.
3.	Based on actual rating from original issuance up to 10 years.	3.	Based on implied senior unsecured rating from cohort or static-pool groups, combining bonds of all ages up to 20 years (Moody's) and 15 years (S&P).
4.	Mortality default calculation adjusting for calls, maturities, and defaults.	4.	Default rate based on percentage of original cohort group. Adjusts for withdrawn ratings in marginal default rate calculations.
5.	Based on full rating class categories, AAA to CCC (no sub-grades).	5.	Based on full rating class categories And also sub-grades, Aaa to Caa/AAA/ CCC.
6.	Sample period 1971-2006.	6.	Moody's sample period 1970 for full grade and 1983-2006 for sub-grades; S&P 1981-2006.

Table 15.5

Cumulative Default Rate Comparison (in % for up to 10 years)

	1	2	3	4	5	6	7	8	9	10
AAA/Aaa										
Altman	0.00	0.00	0.00	0.00	0.05	0.08	0.09	0.09	0.09	0.09
Moody's	0.00	0.00	0.00	0.03	0.10	0.17	0.25	0.34	0.42	0.52
S&P	0.00	0.00	0.09	0.19	0.29	0.43	0.50	0.62	0.66	0.70
AA/Aa										
Altman	0.00	0.00	0.30	0.44	0.46	0.48	0.48	0.48	0.53	0.54
Moody's	0.01	0.02	0.04	0.11	0.18	0.26	0.34	0.42	0.46	0.52
S&P	0.01	0.05	0.10	0.20	0.32	0.43	0.56	0.68	0.78	0.89
A/A										
Altman	0.01	0.09	0.11	0.17	0.23	0.32	0.37	0.57	0.66	0.71
Moody's	0.02	0.10	0.22	0.34	0.47	0.61	0.76	0.93	1.11	1.29
S&P	0.06	0.17	0.31	0.47	0.68	0.91	1.19	1.41	1.64	1.90
BBB/Baa										
Altman	0.33	3.45	4.74	5.92	6.62	7.10	7.33	7.51	7.63	8.00
Moody's	0.18	0.51	0.93	1.43	1.94	2.45	2.96	3.45	4.02	4.64
S&P	0.24	0.71	1.23	1.92	2.61	3.28	3.82	4.38	4.89	5.42
BB/Ba										
Altman	1.15	3.54	7.72	9.88	12.10	13.20	14.60	15.56	17.00	19.88
Moody's	1.21	3.22	5.57	7.96	10.22	12.24	14.01	15.71	17.39	19.12
S&P	1.07	3.14	5.61	7.97	10.10	12.12	13.73	15.15	16.47	17.49
B/B										
Altman	2.84	9.43	16.08	23.21	27.82	30.94	35.67	35.26	36.53	37.06
Moody's	5.24	11.30	17.04	22.05	26.79	30.98	34.77	37.98	40.92	43.34
S&P	4.99	10.92	15.90	19.76	22.55	24.72	26.54	28.00	29.20	30.42
CCC/Caa										
Altman	8.12	22.30	36.86	44.30	46.60	51.57	54.38	56.98	57.34	59.36
Moody's	19.48	30.49	39.72	46.90	52.62	56.81	59.94	63.27	66.28	69.18
S&P	26.29	34.73	39.96	43.19	46.22	47.49	48.61	49.23	50.95	51.83

Source: Altman, Market value weights, by number of years from original Standard & Poor's issuance, 1971-2006, based on actual ratings, (Altman and Ramayanam, 2007).

Moody's, Issuer weighted, cohort analysis, 1971-2006, based on actual or implied senior unsecured ratings (Moody's Investors Service, 2007).

S&P, Issuer weighted, static-pool analysis, 1981-2006, based on actual or implied senior unsecured ratings (Standard & Poor's, 2007).

Table 15-6. Distribution of Years to Default From Original Issuance Date (by Year of Default), 1989–2006

Years to Default	1989		1990		1991		1992		1993/1994		1995		1996		1997		1998	
	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	No. of Issues
1	4	6	3	3	0	0	0	0	175	9	1	3	2	8	5	20	2	6
2	12	18	25	23	18	13	0	0	333	17	9	28	3	13	4	16	5	15
3	15	23	23	21	26	19	7	13	362	19	7	22	3	13	4	16	10	30
4	13	20	18	17	29	21	10	19	291	15	3	9	8	33	9	36	3	9
5	1	2	23	21	35	26	8	15	239	12	1	3	1	4	3	12	10	30
6	7	11	5	5	10	7	12	22	151	8	2	6	5	21	0	0	2	6
7	7	11	5	5	4	3	5	9	124	6	2	6	0	0	0	0	1	3
8	2	3	4	4	10	7	4	7	56	3	2	6	0	0	0	0	0	0
9	1	2	1	1	3	2	0	0	38	2	4	13	0	0	0	0	0	0
10	3	5	1	1	2	1	8	15	164	8	1	3	2	8	0	0	0	0
Total	**65**	**100**	**108**	**100**	**137**	**100**	**54**	**100**	**1,933**	**100**	**32**	**100**	**24**	**100**	**25**	**100**	**33**	**100**

Years to Default	1999		2000		2001		2002		2003		2004		2005		2006		1989-2006	
	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	% of Total	No. of Issues	% of Total
1	32	26	19	10	40	12	29	8	18	9	8	10	16	9	2	4	184	9
2	37	30	51	28	69	21	51	15	30	15	7	9	13	7	4	8	344	17
3	15	12	56	31	87	26	61	18	26	13	8	10	9	6	6	12	368	18
4	14	11	14	8	65	19	56	16	23	11	6	8	22	12	5	10	300	15
5	7	6	13	7	27	8	45	13	40	20	10	13	14	8	4	8	246	12
6	8	6	5	3	14	4	21	6	20	10	16	21	17	9	9	17	161	8
7	10	8	12	7	21	6	8	2	25	12	9	12	13	7	6	12	135	7
8	2	2	4	2	5	1	7	2	3	1	6	8	11	6	7	13	67	3
9	0	0	3	2	4	1	12	3	5	2	1	1	5	3	6	12	45	2
10	0	0	6	3	3	1	54	16	13	6	6	8	64	34	3	6	168	8
Total	**125**	**100**	**183**	**100**	**335**	**100**	**344**	**100**	**203**	**100**	**77**	**100**	**184**	**100**	**52**	**100**	**2018**	**100**

Source: Authors' compilations.

Table 15-7. Defaults by Original Ratings (Investment Grade Versus Non-Investment Grade), by Year, 1977 - 2006

	Total # Defaulted Issues[a]	% Originally Rated Investment Grade	% Originally Rated Non-Investment Grade
2006	52	13	87
2005	184	49	51
2004	79	19	81
2003	203	33	67
2002	322	39	61
2001	258	14	86
2000	142	16	84
1999	87	13	87
1998	39	31	69
1997	20	0	100
1996	24	13	88
1995	29	10	90
1994	16	0	100
1993	24	0	100
1992	59	25	75
1991	163	27	73
1990	117	16	84
1989	66	18	82
1988	64	42	58
1987	31	39	61
1986	55	15	85
1985	26	4	96
1984	14	21	79
1983	7	43	57
1982	20	55	45
1981	1	0	100
1980	4	25	75
1979	1	0	100
1978	1	100	0
1977	2	100	0
Total	**2,110**	**26%**	**74%**

[a] Where we could find an original rating from either S&P or Moody's.

Sources: Authors' compilations from Standard & Poor's and Moody's records.

Table 15-8. Fallen Angels vs. Original Issue and All U.S. High Yield Default Rates

Year	Fallen Angel Average 12 Month Default Rate	Original Issue Speculative Grade Default Rates[a]	All Speculative Grade Bond Default Rates
2006	**1.40%**	**n.a.**	**1.26%**
2005	**2.74%**	**3.70%**	**2.48%**
2004	**0.83%**	**2.65%**	**2.23%**
2003	**5.88%**	**5.46%**	**5.53%**
2002	**6.59%**	**8.55%**	**8.32%**
2001	**8.46%**	**10.14%**	**10.99%**
2000	**7.01%**	**7.10%**	**7.03%**
1999	**4.01%**	**5.10%**	**4.62%**
1998	**3.31%**	**2.75%**	**2.23%**
1997	**2.04%**	**2.10%**	**1.71%**
1996	**1.38%**	**2.00%**	**1.71%**
1995	**0.25%**	**3.90%**	**3.07%**
1994	**0.00%**	**2.31%**	**1.70%**
1993	**1.72%**	**1.99%**	**1.79%**
1992	**4.50%**	**5.48%**	**5.45%**
1991	**7.53%**	**10.86%**	**11.66%**
1990	**5.77%**	**8.30%**	**8.20%**
1989	**3.74%**	**4.93%**	**5.33%**
1988	**4.25%**	**3.39%**	**3.95%**
1987	**4.36%**	**2.92%**	**2.41%**
1986	**2.46%**	**6.29%**	**4.78%**
1985	**6.77%**	**4.06%**	**3.24%**
Arithmetic Average	**3.86%**	**4.95%**	**4.69%**
Weighted Average(By number of issuers)	**4.22%**	**5.15%**	**5.10%**
Standard Deviation	**2.43%**	**2.64%**	**2.96%**

Source: Author Compilation from Standard &Poor's "Credit Pro" Database, except in 2006 from author.

[a] S&P did not calculate this rate in 2006.

Table 15-9. Corporate Bond Defaults by Industry (Number of Companies)

Industry	1970 – 1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total
Auto/Motor Carrier	3							3	3					1				1			1			**4**	3	19
Conglomerates						1	3	1	1	3	3								1			1	1			15
Energy	3	3	5	7	12	2	4			4	2	3		1			1	13	1		8	9		**1**		78
Financial Services	4	1	1	1			4	11	7	14	3	2	1	2	1	2	6	1	6	4	5	6	2	**3**	2	88
Leisure/Entertainment						2	4	4	8	2	4	3	4	3	1	5	5	8	9	6	5	6			3	81
General Manufacturing	9	1	1	2	6	3	3	1	5	8	8	7	3	8	6	7	6	16	23	43	22	13	17	**12**	6	236
Health Care						1	2		2	1	1	1		2			2	8	6	3	4	3		**2**		39
Miscellaneous Industries	3	1	2	6	3	1			4	4	3	1	1	1		3	3	16	34	38	25	16	6	**1**	4	176
Real Estate/Construction	7		1	1		1	1	3	7	5	1			2	1	2	1	4	6	4	3		2	**1**		53
REIT	11	1									1										1					14
Retailing	6	1					1	2	6	15	6	4	5	6	3	6	6	12	7	12	5	5	3	**2**	2	115
Communications	7	2	2	1	1	3	1		3	4	1	1	3	2	2	1	6	11	8	39	26	21	6	**3**	2	156
Transportation (non auto)	4	2		1	1			1	1	2			2			2	1	8	5	7	7	6	2	**5**	1	58
Utilities						1	1				1				1	1			1		0	0				6
Total	**57**	**12**	**12**	**19**	**23**	**15**	**24**	**26**	**47**	**62**	**34**	**22**	**19**	**28**	**15**	**29**	**37**	**98**	**107**	**156**	**112**	**86**	**39**	**34**	**23**	**1,134**

Source: Authors' compilations.

Table 15-10. Corporate Bond Defaults by Industry (Amounts in $ Millions)

Industry	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Total
Auto/Motor Carrier	**468**	**90**				**215**		**300**	**100**	**430**	**120**	**3,737**	**285**		**280**	**3,573**	**2,692**	**12,290**
Conglomerates													**100**	**690**	**275**			**1,065**
Energy		**60**	**103**	**600**		**75**	**100**			**3,812**	**217**	**4,200**	**4,085**	**11,857**		**8,895**		**34,004**
Financial Services	**928**	**696**	**536**		**78**	**687**	**700**	**66**	**689**	**375**	**1,968**	**5,062**	**3,803**	**1,079**	**110**	**541**	**156**	**17,474**
Leisure/Entertainment	**498**	**1,191**	**159**		**138**	**435**	**293**		**245**	**1,100**	**2,891**	**3,437**	**21,242**	**633**	**1,286**	**6,861**	**715**	**41,124**
General Manufacturing	**2,675**	**3,695**	**488**	**118**		**616**	**641**	**123**	**247**	**2,092**	**2,507**	**3,138**	**2,455**	**2,108**	**225**	**1,396**	**1,486**	**24,010**
Health Care	**18**	**1,120**				**75**			**125**	**2,214**	**1,715**	**692**	**115**	**3,843**		**360**		**10,277**
Miscellaneous Industries	**1,968**	**4,911**	**1,378**	**1,056**	**317**	**1,286**	**832**	**461**	**1,290**	**7,615**	**8,352**	**9,715**	**5,594**	**4,494**	**1,977**	**569**	**409**	**52,224**
Real Estate/Construction	**2,605**	**417**	**113**	**49**	**75**	**190**		**258**	**383**	**385**	**252**	**1,110**	**1,088**	**77**	**1,783**	**174**		**8,959**
Retailing	**4,443**	**2,937**	**1,489**	**18**	**2,814**	**395**	**164**	**2,504**	**1,241**	**2,052**	**3,081**	**1,586**	**4,092**	**877**	**749**	**1,059**	**332**	**29,833**
Communications							**460**	**286**	**1,549**	**2,980**	**5,983**	**34,827**	**47,953**	**7,603**	**2,551**	**150**	**1,496**	**105,838**
Transportation (non auto)	**1,028**	**1,452**			**301**	**562**			**1,125**	**310**	**2,890**	**1,430**	**4,711**	**2,086**	**2,421**	**12,376**	**272**	**30,964**
Utilities		**1,452**	**617**	**85**			**275**	**202**		**75**			**1,150**	**1,417**				**5,273**
Total	**14,631**	**18,021**	**4,883**	**1,926**	**3,723**	**4,536**	**3,465**	**4,200**	**6,994**	**23,440**	**29,976**	**68,934**	**96,673**	**36,764**	**11,657**	**35,954**	**7,559**	**373,336**

Source: Authors' compilations.