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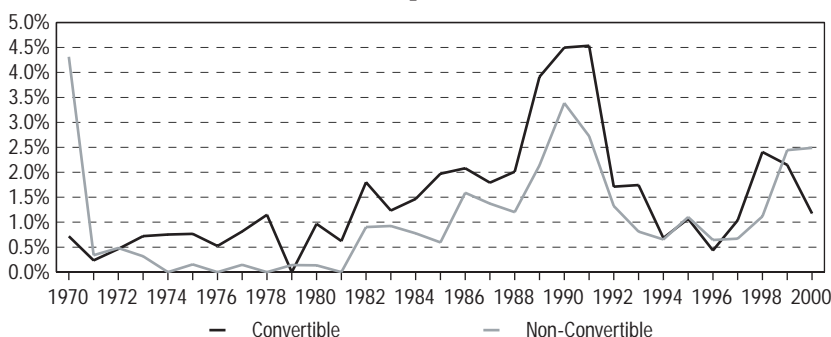
## Default and Recovery Rates of Convertible Bond Issuers: 1970-2000

### Summary

This study refines Moody's corporate bond default research to focus on convertible long-term debt issuers from 1970 to 2000. Given the increased popularity of this asset class, concern about the credit risk of these investments is well placed in the current environment of high and increasing default rates. Briefly this study finds that:

- Since 1970, 280 convertible bond issuers have defaulted on \$86.7 billion of long-term convertible debt. The distribution of convertible bond defaulters by broad industry grouping is comparable to that for all long-term corporate defaulters.
- Default rates for all rated convertible debt issuers are higher than for those of issuers without convertible bonds in their capital structures. For speculative-grade-rated issuers, however, default rates do not differ from non-convertible issuers in a statistically meaningful way.
- Convertible bond issuers that do not convert/redeem their bonds early face heightened risk of default not only in the third year following issuance, as is typical of most issuers, but also again in the fifth and sixth years.
- Recovery rates for defaulted convertible bonds are significantly lower than those for non-convertible bonds, recovering \$29 on average compared with \$43 per \$100 par for straight bonds. The results hold even after controlling for security and level of subordination.
- Historical loss rates for convertible bonds are significantly higher than those of non-convertible issues. The one-year average loss rate for convertible bonds is 1.05%, compared with 0.63% for all non-convertible bonds. The fact that most convertible bonds are contractually or effectively subordinated seems to underlie this result.
- Higher expected credit losses for convertible securities resulting from their subordinated status relative to other obligations are reflected in ratings that are often two or more notches below the issuer's senior implied rating.

**Annual One-Year Default Rates, 1970-2000**  
**Convertible Bond Issuers vs. Corporate (Ex-Convertible) Bond Issuers**



*continued on page 3*

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## Introduction

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The dollar volume of outstanding convertible debt securities grew by more than 50% per year between 1995 and 2000, driven in part by issuers in search of cheap debt financing and in part by investors seeking the upside potential of a stock with the security of a bond. (Convertibles allow holders of interest-bearing fixed-income securities to swap these obligations for common stock when the company's stock price hits a predetermined level.) Given the rapid rise in popularity of this asset class, concern about the credit risk of these investments relative to straight bond issuers is well placed in the current environment of high and increasing default rates.

When choosing between convertible and straight bonds, many investors focus only on the tradeoff between a higher promised coupon rate on the straight bond and the potential equity "kicker" option imbedded in the convertible bond. This choice implicitly assumes that expected investor losses due to default are equivalent for similarly rated convertible and non-convertible bonds. This assumption is quite natural because most corporate capital structures contain cross-default covenants that imply all bonds, both convertible and nonconvertible, will be drawn into default at the same time, under the same circumstances. Moreover, one might expect that loss severity in default should generally be the same for convertible and nonconvertible issues of the same security class, because all debt issues within a given security class theoretically share the same priority of claim in bankruptcy.

However, this assumption – that investor expected loss rates are equal for equivalently rated convertible and nonconvertible bonds – might not be correct if convertible bonds issuance were subject to either adverse (or favorable) selection bias.<sup>1</sup> In particular, convertible bonds could experience higher (or lower) default incidence than similarly rated straight bonds if convertible bond issuers were more likely than non-convertible bond issuers to bring debt to market when their credit profile or broader credit market conditions were improving (or declining). Similarly, selection bias could lead to differences in average loss severity in the event of default for convertible and non-convertible bonds.

This study provides evidence that convertible bond issuance is subject to adverse selection bias that leads to higher average investor loss rates relative to non-convertible bonds. However, to maintain comparability with Moody's standard corporate bond default study, we analyze this issue somewhat indirectly, focusing on default experience at the issuer level, rather than on the bond level. We contrast the incidence of default among companies that issue convertibles (many of whom also issue non-convertibles) to the incidence of default among firms that issue only straight bonds. Default severity, in contrast, is measured at the bond level.

This study also supplements Moody's Special Comment *Critical Issues in Evaluating the Creditworthiness of Convertible Debt Securities* (Stumpp 2001). Whereas here we take a panoramic view of the default and loss experience of convertible bond issuers for the thirty-one year period 1970-2000, that report focuses more closely on the 1995-2000 period. This report provides quantitative measures of credit risk (default rates and loss severity rates), while Stumpp evaluates the fundamental credit issues related to convertible debt securities. Taken together, the two studies provide a comprehensive picture of the credit risks associated with convertible bond issuers.

The first section of this report describes the sources of data used in the analysis and provides a general overview of the characteristics of the data set and our methodology. The second section examines default rates for convertible bond issuers in detail. We examine recovery rates and historical credit loss rates for defaulted convertible debt in the third and fourth sections. The final section presents Moody's conclusions. Tables detailing one-year and cumulative default rates by rating category and over time are contained in the appendix.

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1. Adverse selection is a problem that can arise as a result of asymmetric information when the undesirable (adverse) members of a population of buyers or sellers are more likely to participate (selection) in a voluntary exchange.

# Ratings Distribution

Moody's bases the results of this study on a proprietary database of ratings and defaults for industrial and transportation companies, utilities, financial institutions, and sovereigns that issued long-term debt to the public. Municipal debt issuers, structured finance transactions, and issuers with only short-term debt ratings are excluded. In total, the data cover the credit experiences of over 16,000 issuers that sold long-term debt publicly at some time between 1920 and 2000. Moody's default database contains over 3,400 bond defaults, rated and unrated.

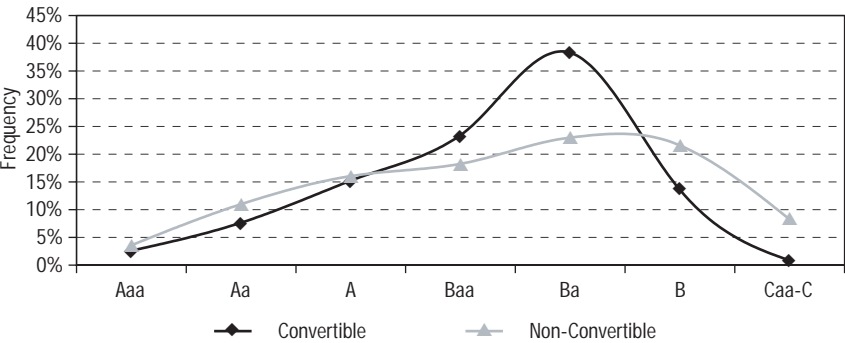
For our sample of 1,993 rated convertible issuers, we tracked rating events (i.e. upgrades, downgrades, defaults and rating withdrawals) over time, producing a panel dataset of 7,392 issuer/rating observations. Of these, 6,497 are from US issuers, 417 from Japanese issuers, 83 from the UK and 69 from Canada, with the rest coming from issuers in over 30 countries in Europe, Asia, Australia, and the Caribbean.

Following the methodology of previous default studies, we use the issuer's estimated senior unsecured rating as the standard unit of account for measuring default rates by rating category. This approach, which provides a common basis for comparison across issuers, is discussed more fully in the following section.<sup>2</sup>

The distribution of estimated senior unsecured ratings held by issuers at the time they issued convertible debt between 1970 and 2000 is presented in Exhibit 1 below. Our data show that, similar to non-convertible issuers, speculative-grade senior unsecured ratings (Ba or lower) are about as common as investment-grade ratings at the time of issuance for issuers of convertible bonds. Convertible issuers, however, show a distribution that is characterized by thinner tails: i.e., there are fewer initial ratings in the Aaa-Aa and single-B-Caa-C ranges relative to firms that do not issue convertibles.

The distribution of ratings for convertible bond issuers has come to be dominated by the more risky, speculative-grade rating categories over the last twenty years, for both investment-grade and non-investment-grade-rated firms. Exhibit 2 shows the change (and emerging bi-modality) in the ratings distribution that has occurred since 1980. In the 1970s, the ratio of investment-grade to non-investment grade-rated issuers was more heavily weighted toward investment-grade issuers: 76% of convertible bond issuers held investment-grade ratings at the time of issuance. A marked shift occurred in 1982, resulting in nearly equal numbers of speculative- and investment-grade convertible issuers. Another dramatic shift began in 1986, ultimately producing a ratio exceeding two speculative-grade issuers for every one investment-grade. Currently, the distribution of ratings for investment-grade convertible bond issuers is concentrated in the Baa ratings. The proportion of issuers holding the highest speculative-grade ratings (Ba1-3) has fallen from 46% in the 1980s to 33% at the end of 2000.

**Exhibit 1 – Distributions of Estimated Senior Ratings at the Time of Issuance, Convertible vs Non-Convertible, 1970-2000**

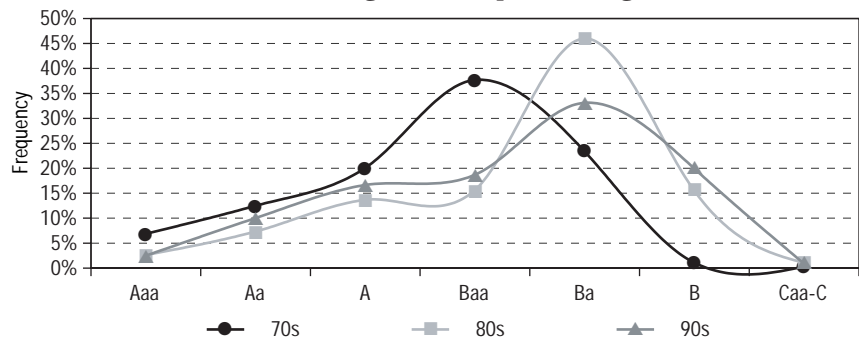


2. See Hamilton (2001) for a full explanation of estimated senior ratings.

The shift in the distribution of ratings for convertible bond issuers mirrors that of corporate issuers generally, especially over the last five years. For investment-grade corporate issuers, the rise in leverage, partly driven by stock-buybacks and mergers and acquisitions, implied willingness by management to exchange higher bond ratings for higher growth potential and/or higher equity share prices. An overall rise in the number of issuers with B2 ratings and below, as well as a deteriorating upgrade-downgrade ratio, reflected a heightened tolerance for risk among investors on the speculative-grade side.<sup>3</sup>

The shift in the distribution of ratings and – as we shall see – the consequent rise in default rates and loss severity provides evidence for the adverse selection hypothesis described in the introduction. A unique combination of a strong domestic economy, buoyant equity markets, low interest rates and yield spreads, and a historically high tolerance for risk and speculation set the stage for a surge of low credit quality debt issuance, of which convertible bonds played a special part. Growth stories, particularly for issuers in the telecommunications sector, and soaring equity values made convertibles attractive to investors with an appetite for risk. For convertible bond issuers, that appetite for risk allowed them to acquire financing they might not have been able to get through conventional high-yield or equity offerings.<sup>4</sup>

**Exhibit 2 – Distributions of Estimated Senior Ratings at the Time of Convertible Bond Issuance by Decade**  
*Credit risk for both investment-grade and speculative-grade issuers has increased*



## Historical Defaults and Default Rates

Moody’s defines default as any missed or delayed disbursement of interest and/or principal, bankruptcy, receivership, or distressed exchange where (i) the issuer handed bondholders a new security or package of securities that amount to a diminished financial obligation (such as preferred or common stock, or debt with a lower coupon or par amount) or (ii) the exchange had the apparent purpose of helping the borrower avoid default.

To calculate default rates, which are estimates of the default probability component of ratings, we use the issuer as the unit of study rather than individual debt instruments or outstanding dollar amounts of debt. Because Moody’s intends its ratings to support credit decisions, which do not vary with either the size or number of bonds that a firm may have outstanding, we believe this methodology produces more meaningful estimates of the probability of default. Because the likelihood of default is essentially the same for all of a firm’s public debt issues, irrespective of size, weighting our statistics by the number of bond issues or their par amounts would simply bias our results towards the characteristics of large issuers.

The default rates we calculate are fractions in which the numerator represents the number of issuers that defaulted in a particular time period and the denominator represents the number of issuers that could have defaulted in that time period. In this study, the numerators are the numbers of issuers defaulting on Moody’s-rated convertible debt. The denominators are the numbers of issuers that potentially could have defaulted on Moody’s-rated convertible debt.

3. See Keenan (2000) and Hamilton (2001).  
4. Lewis, Rogalski, and Seward (2000) find that cash flow and investment-related operating performance worsens on average after the issuance of convertible debt. The authors conclude that adverse selection leads firms that are rationed out of equity markets to issue convertible debt.

If an issuer’s convertible bond rating is withdrawn, it is subtracted from the denominator. Failing to correct the denominators in this way tends to generate artificially low estimates of the risk of default. It is important to note that Moody’s does not withdraw ratings because of deterioration in credit quality. In such cases, the issuer’s bonds are simply downgraded.

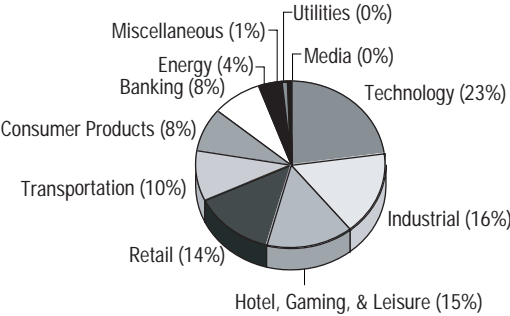
Moody’s ratings incorporate both the likelihood and the severity of default. So, in order to calculate the default probability component of ratings, we must hold severity considerations constant. We do this by taking the rating on each company’s senior unsecured debt or, if there is none, by statistically implying such a rating on the basis of rated subordinated or secured debt. In most cases, this will yield an assessment of risk that is relatively unaffected by special considerations of collateral or of position within the capital structure.

**CONVERTIBLE BOND DEFAULT OVERVIEW**

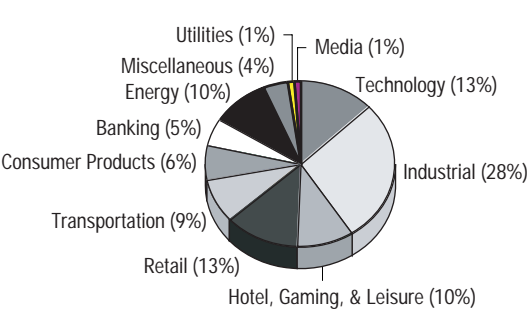
Between 1970 and 2000, 280 issuers have defaulted on approximately \$86.7 billion of Moody’s-rated, convertible, long-term, publicly held corporate debt. Exhibit 3 presents a detailed breakdown of convertible issuer defaults by major industrial sector in terms of defaulted dollar amounts, and Exhibit 4 presents the industry breakdown as a percentage of issuers.

By dollar volume, financial institutions comprise the largest portion of convertible defaults – \$19.6 billion (22.6%). In second-place were technology firms (which includes the telecommunications sector), contributing another \$15.3 billion (17.7%). The third-place slot was filled by industrial firms, which defaulted on another \$11 billion (12.7%). These percentages conform closely to those observed over the broader universe of all Moody’s-rated issuers over the same period.

**Exhibit 3 – Defaulted Convertible Debt Volume By Broad Industry**  
*Financial institutions and technology firms contribute bulk of defaults by dollar volume...*



**Exhibit 4 – Defaulted Convertible Debt Issuers by Broad Industry**  
*... But more industrial firms default than all others*



**CONVERTIBLE BOND DEFAULT RATES**

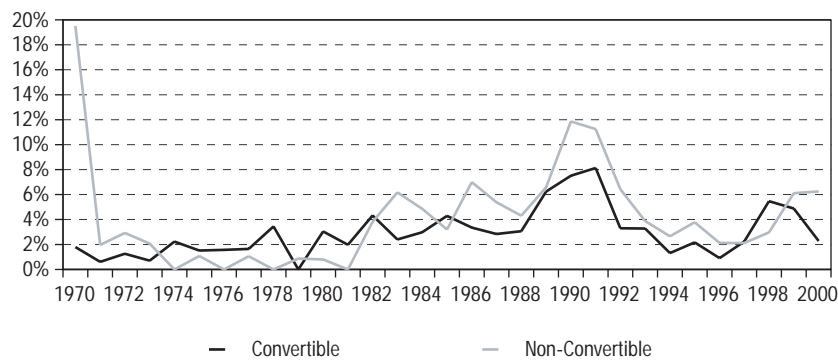
The chart on the cover of this report shows the annual 12-month trailing average default rate for all rating categories, from 1970 to the present, for convertible issuers versus issuers without convertible bonds in their capital structures. While the two series track each other closely in terms of their direction, the default rate for convertible issuers is almost everywhere higher than the rate for issuers ex-converts, and is significantly higher in 1991. The average annual default rate for convertible issuers over this period is 1.47%, compared to 1.06% for non-convertible issuers. The difference is statistically significant at the 5% level of confidence.<sup>5</sup>

5. *t*=2.29; the difference is not significant at 1%. The standard significance test might not be appropriate if one believes that issuers of convertible bonds face correlated shocks that are imperfectly correlated with shocks to straight debt issuers. Since most convertible debt issuers also issue straight debt, the standard approach seems appropriate. See Cantor and Falkenstein (2001) for further discussion.



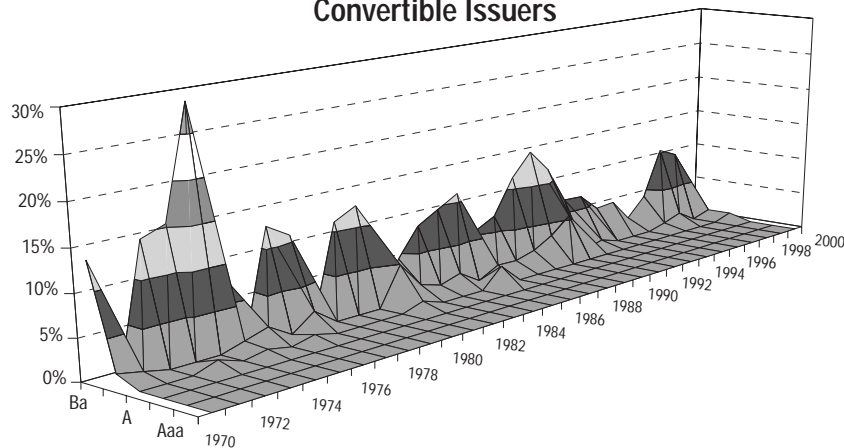
Exhibit 5, which plots the two series calculated for speculative-grade-rated issuers only, shows no statistical difference, however. Here the two rates track each other more closely, nearly lying on top of one another. Despite the larger difference in the average annual default rate – 4.23% for spec-grade convertible issuers versus 2.93% (3.72% excluding 1970) for non-convertible issuers – the difference is not statistically significant.<sup>6</sup> The higher default rates for all corporate convertible issuers shown on the cover chart (as opposed to Exhibit 5) therefore reflects the distribution of ratings for convertible debt issuers, which is more heavily weighted toward speculative-grade (refer to Exhibit 2).

**Exhibit 5 – Annual One-Year Speculative Grade Default Rates, 1970-2000**



One-year default rates by rating category provide an alternative view of the default experience of convertible issuers and more carefully controls for observable credit quality. We define one-year default rates for any rating classification in a manner analogous to that used for calculating overall, one-year corporate default rates. For the single-B rating category, for example, the one-year default rate is the number of B-rated convertible bond issuers that defaulted over the following one-year period divided by the number of B-rated convertible bond issuers that could have defaulted over that one-year period. Exhibit 6 plots one-year default rates by letter rating from 1970 to 2000 for convertible issuers and Exhibit 7 presents the same calculation for issuers without convertible debt.

**Exhibit 6 – Annual One-Year Default Rates by Letter Rating: Convertible Issuers**



Exhibits 6 and 7 highlight the higher incidence of default for both convertible and non-convertible speculative-grade-rated issuers than for investment-grade issuers, as one would expect. We see in Exhibit 6, however, that one-year default rates for speculative-grade-rated convertible issuers are generally higher than for issuers without convertible bonds.

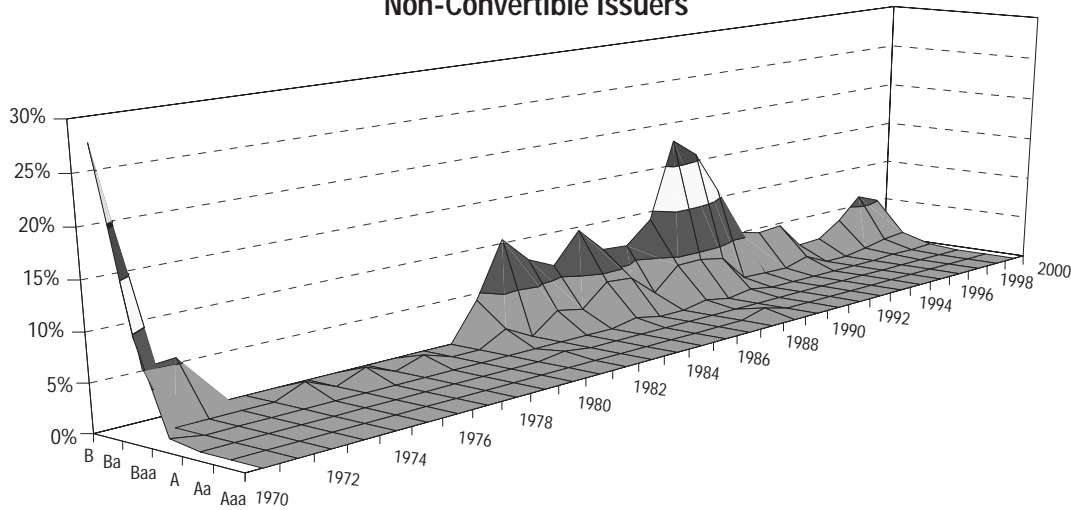
6.  $t=1.96$  at 5% confidence level.



Also notable are the relatively high default rates during the mid-1970s for convertible issuers, when for non-convertible issuers the default rate is zero for virtually all rating categories. Here again, the distribution of ratings exerts an influence on the default statistics. Over the 1970s, ratings for convertible issuers were concentrated in the Baa and, to a slightly lesser extent, in the Ba rating categories. Default rates for single-B issuers were higher for that decade, therefore, due to the relatively smaller size of the denominators.

Between 1980 and the present, the trend and magnitude of default rates for convertible and non-convertible issuers are roughly the same. Both series reflect the junk bond market collapse of the late 1980s, the peak in defaults in 1991, and the recent surge in defaults through 2000.

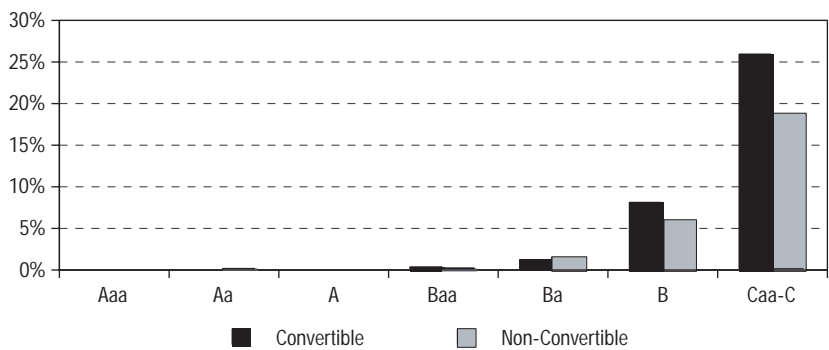
**Exhibit 7 – Annual One-Year Default Rates by Letter Rating:  
Non-Convertible Issuers**



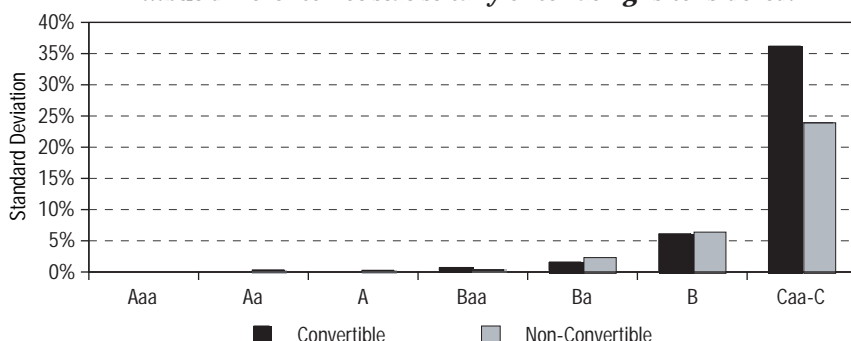
The issuer-weighted average of default rates (defined as of the start of each year) is an average of one-year default rates through time and represents an estimate of the risk of default within any one-year period. (The underlying one-year default rates for each rating category from 1970 through the present are included in Exhibit 18 of the appendix. The issuer-weighted average of these is presented in the first column of Exhibit 20 in the appendix).

Exhibit 8 breaks out issuer-weighted default rates by broad rating category, comparing all issuers with convertible issuers. Again, we find that default rates for convertible issuers are generally higher than for non-convertible issuers. The largest difference in default rates are for speculative-grade-rated issuers, particularly for the Caa-C rating buckets. However, in light of the standard deviation for each rating category, presented in Exhibit 9, the differences in one-year default rates observed must be considered small in a statistical sense. We cannot reject the hypothesis that the default rates for convertible bond issuers are the same as those for the Moody's-rated universe at large once the rating has been considered.

**Exhibit 8 – One-Year Average Default Rates by Letter Rating, 1970-2000**  
*One-year average rates also reveal higher risk for convertibles...*



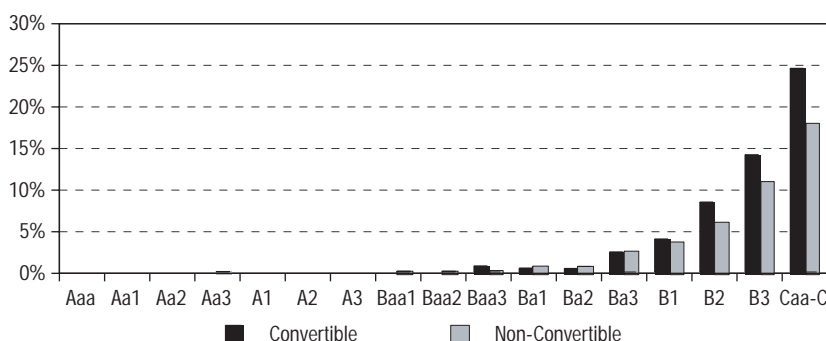
**Exhibit 9 – One-Year Default Rate Volatilities**  
*...but difference not statistically once rating is considered.*



Moody's refined its rating scale in April 1982 by adding numerical modifiers. The ratings from Aa to single-B were expanded to include three numerical modifiers each in order to provide finer gradations of credit risk. Exhibit 19 in the appendix presents one-year default rates for each of these modified rating categories. The issuer weighted averages of these default rates for each rating category are presented in the first column of Exhibit 21. The results suggest that the relationship between ratings and default likelihood holds for numerically modified rating categories as well as for the letter rating categories, as average one-year default rates climb from 0.0% for Aaa to 24.5% for Caa-C ratings. Again, the average default rates are generally higher for convertibles for almost all of the rating categories.

**Exhibit 10 – One-Year Average Default Rates by Alpha-Numeric Rating, 1983-2000**

*Relationship between default and rating holds for modified categories*



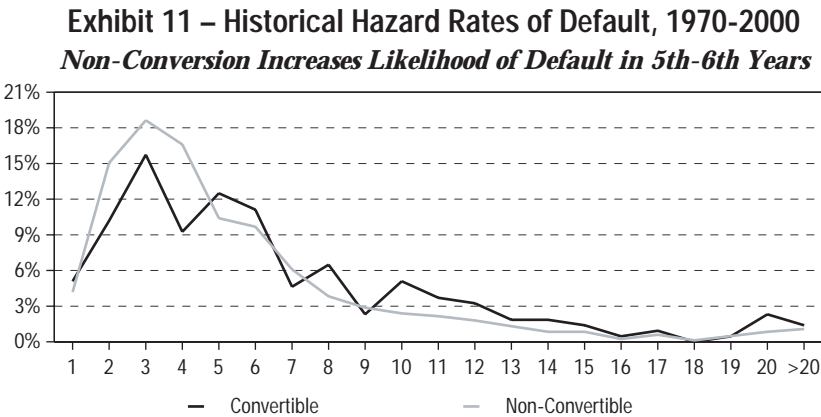
The aggregate default statistics presented above show that default rates for convertible bond issuers differ meaningfully from those of issuers that do not have convertible bonds in their capital structures. Those statistics are, however, aggregate averages over a long period of time and macro in scope. A separate, but related question is: "Does default risk for *individual* issuers of convertible bonds differ significantly from that of individual non-convertible issuers?"

One way to answer that question is to calculate default rates as a function of time in the market (hazard rate of default) for convertible issuers and non-convertible issuers and compare the two. We do this in Exhibit 11. The chart shows the frequency of default plotted against the time after which an issuer was first rated.

For straight bond issuers, this mortality curve has the familiar, single-peaked shape that reaches a maximum at about the third or fourth year after the first rating date. The curve falls off sharply thereafter, signifying rapidly and almost completely monotonically decreasing default risk.

Convertible issuers exhibit a somewhat different "seasoning effect," as the hazard rate of default is sometimes called. There appears to be two critical periods in the lifecycle of firms that issue convertible bonds. The first mirrors that of non-convertible issuers, peaking in the third year. Here, the conventional explanation applies: at a certain point, the cash available from the debt sale is used up, and the firm demonstrates itself and its business plan to be viable or it defaults.

A second hurdle exists for convertible bond issuers at the fifth and sixth years, however. That the hazard rate of default shows a second peak at those times seems to corroborate the findings in Stumpp (2001), that issuers of convertible bonds that do not redeem or convert the bonds early face heightened default risk.<sup>7</sup>



### MULTI-YEAR CONVERTIBLE BOND DEFAULT RATES

Although one-year default rates may be the most commonly reported, some investors find default rates for longer time horizons more relevant. A 10-year default rate, for example, estimates the share of a portfolio of bonds that can be expected to default over a 10-year period.

To quantify the risk of default over time horizons longer than one year, we formed cohorts of issuers as of the start of each year since 1970. A cohort consists of all issuers holding a given senior rating at the start of a given year. These issuers are then followed through time, keeping track of when they default or leave the rated universe, in order to estimate the cumulative risk of default over multi-year horizons. By forming cohorts of all Moody's-rated issuers with debt outstanding at January 1 of each year, our approach provides an indicator of the experience of a portfolio of both seasoned and new-issue bonds purchased in a given year.

Exhibit 22 in the appendix traces for up to 15 years the cumulative default rates of cohorts of Moody's-rated issuers formed at the beginning of each year since 1970. This table answers the question, for example, "What was the risk that a Ba-rated issuer with bonds outstanding as of January 1, 1983 would default after 15 years?" The answer – 39.89% – is found in the last row and last column of the section labeled "Cohort Formed January 1, 1983".

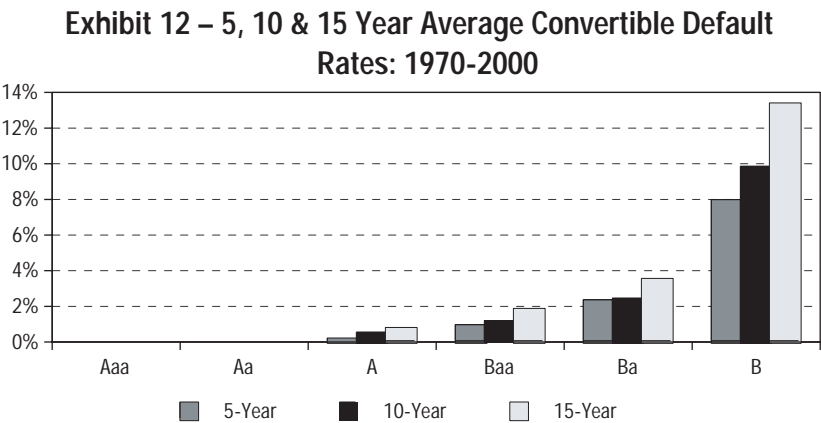
The cohort methodology has the advantage of allowing users to make year-over-year comparisons of actual default experience. In cases in which an investor feels that the business conditions of the current year are similar to those of some previous year, she may consult that year's cohort directly to ascertain what default patterns to expect.

To estimate the average risk of default over time horizons longer than one year, we calculate the risk of default in each year since a cohort was formed. The issuer-weighted average of each cohort's one-year default rate forms the average cumulative one-year default rate. The issuer-weighted average of the second-year default rates added to that of the first year yields the two-year average cumulative default rate. In this manner, we compute average cumulative default rates for one to 10 years for each rating category.

7. Convertible securities that do not see early redemption or conversion also exhibit credit stress as reflected in downward rating migration. See Stumpp (2001), p.11.

Exhibit 12 presents default rates for 5, 10, and 15-year time horizons based on data since 1970. Exhibit 16 in the appendix presents these data in detail for the period 1970 to the present. Exhibit 20 presents average cumulative default rates by broad rating category and Exhibit 21 by numerically modified ratings for up to ten years.

Exhibit 12 shows that higher default risk for lower rating categories remains evident for convertible issuers over investment periods exceeding one year. For example, average default rates for five-year holding periods climb from 0.0% for the Aaa rating category to 7.9% for the B rating category. Exhibit 12 also shows that the pattern recurs for average default rates for 10-year and 15-year holding periods. These patterns are relatively smooth and well behaved, suggesting that the convertible issuer subset has had a default experience very similar to the full sample of corporate issuers when broken down by rating category.



## Recovery Rate Estimates

A critical aspect of a corporate bond default is the severity of the loss incurred. Eventually, most bond default resolutions provide bondholders with some amount of recovery, which may take the form of cash, other securities, or even physical assets. The recovery rate, defined here as the percentage of par value returned to the bondholder, is a function of several variables. These variables include the seniority of the issue within the issuer’s capital structure, the quality of collateral (if any), the overall state of the economy, and the thickness of the market for corporate assets.<sup>8</sup>

What may seem the most straightforward methodology for calculating recovery rates is not particularly practical. This methodology would track all payments made on a defaulted debt instrument, discount them back to the date of default, and present them as a percentage of the par value of the security. However, this methodology is problematic because it relies on many assumptions. One must make a separate estimate of the discount rate to apply to each payment generated by the defaulted instrument. Furthermore, one often must make assumptions concerning the values of certain payments. The resolution may hand bondholders various equity and derivative instruments, enhancements to the terms of the surviving debt, or sometimes even physical assets in place of cash. As there is frequently no market for such payments, there is no precise and accurate measure of their value.

For these reasons, we use the trading price of the defaulted instrument as a proxy for the present value of the ultimate recovery. Although it is only an estimate of the actual recovery, it has the advantage of being the definite measure of the recovery realized by those debtholders who liquidate a position soon after default.

One may translate defaulted debt prices into recovery rate estimates by presenting them as percentages of par (not percentages of original issue prices or accreted values). Investors are entitled to receive face value at maturity, even though they may have paid somewhat less or more for the bond either at issue or in the secondary market. Because discount bonds have unique pricing features, we have removed them from the sample.

8. See Hamilton (1999).

We collected, from several sources, prices for many of the bonds that defaulted between 1970 and 2000. For each defaulted issue, we considered the convertibility, seniority, date of default, and the price approximately one month after default. Exhibit 13 maps out the yearly average of defaulted non-convertible and convertible subordinated bond prices in our database since 1970.<sup>9</sup>

The data reveal considerable volatility in average defaulted bond prices year-over-year, as well as some degree of correlation with macroeconomic variables and the risk of default. The lows of 1990 correspond to a peak in the corporate default rate and an economic recession in the US. Interpretation of the 1981 and 1979 lows for the average defaulted convertible bond prices should be tempered by the fact that sample sizes for these years are critically low.

Overall, the average defaulted convertible bond price series tracks that of the non-convertible bonds closely suggesting that these instruments react similarly to prevailing business conditions.

**Exhibit 13 – Annual Average Defaulted Bond Prices: 1970-2000**  
*Convertible and non-convertible recoveries respond similarly to macroeconomic and market conditions ...*

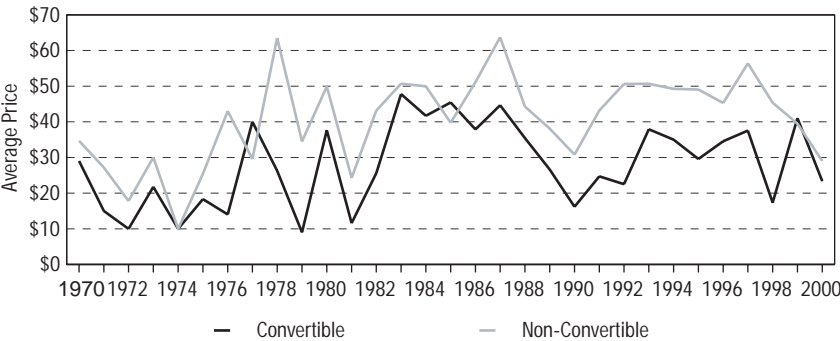


Exhibit 14 below also compares the average defaulted bond pricing observed for non-convertible bonds versus convertible bonds, this time examining the manner in which these recoveries are correlated with the seniority of the respective claims.<sup>10</sup> The average prices of the non-convertible bonds decline as the seniority and security of the claim falls from senior and secured, \$51.81, to junior subordinated and unsecured, \$18.72, as expected.

However, the pattern is not as clearly defined for the average convertible bond prices. The average price is highest for the senior unsecured convertible bonds, \$34.07 Furthermore, the average prices for defaulted convertible bonds are considerably different than those of non-convertible defaulted bonds at the senior secured through senior subordinated levels.

Overall, recovery rates for convertible debt are statistically significantly lower than recovery rates for non-convertible, straight debt. When broken out by level of subordination and security, t-statistics do not suggest statistically significant differences, except for subordinated debt, where convertibles’ lower recovery is statistically significant.

**Exhibit 14 – Average Defaulted Bond Prices, 1970-2000**  
*... But convertible recoveries are lower for all seniorities*

Seniority	Convertible bonds			Non-Convertible Bonds			t-stat
	Avg. Price	Std. Deviation	Count	Avg. Price	Std. Deviation	Count	
Sr. Secured	\$32.78	\$8.05	5	\$51.81	\$27.21	212	-1.56
Sr. Unsecured	\$34.07	\$31.19	14	\$49.42	\$30.04	664	-1.89
Sr. Subordinated	\$27.04	\$15.67	21	\$34.33	\$24.81	327	-1.33
Subordinated	\$28.59	\$21.23	225	\$32.87	\$20.91	343	-2.37
Jr. Subordinated	\$15.37	\$25.36	5	\$18.72	\$12.86	15	0.09
All	\$28.84	\$21.26	276	\$43.17	\$28.21	1485	-8.03

9. For the period before 1979 sample sizes are small; they are included in these results for the sake of completeness.  
10. Security and the level of subordination have been found to be the strongest univariate determinant of recovery values in default. See Hamilton (1998).

These anomalies are largely attributable to the small sample sizes available for defaulted convertible bonds at the senior secured through senior subordinated levels. The average recovery rate for defaulted senior secured convertible bonds, for example, is based upon prices for just five convertible mortgage bond issues of the same issuer – Damson Oil. While the sample size is slightly larger for defaulted senior unsecured convertible issues, for which there are six different issuers, the sample size is still too small to draw any reliable conclusions from these data.

The recovery estimates presented in Exhibit 14 are simple averages of defaulted bond prices. They approximate the most likely bond price to arise from a particular default, but they do not convey the range of possible outcomes. For example, while the estimated recovery for all convertible subordinated bonds is \$28.84 per \$100 par amount, frequently prices above and below \$28.84 were observed. This volatility in defaulted bond prices is an important additional consideration when determining likely recovery rates.

Exhibit 14 includes the standard deviation of the average bond prices presented. Again, small samples generally make it hazardous to draw conclusions about the volatility of defaulted senior secured, senior unsecured, senior subordinated or junior subordinated convertible debt relative to non-convertible debt of the same seniority and security. However, in the case of defaulted convertible subordinated debt, the sample size is adequate and the standard deviation is very near to that for non-convertible debt of the same seniority.

An F-test for the difference between the two variances (that of the defaulted convertible subordinated bonds and that of the defaulted non-convertible bonds) fails to reject the hypothesis that the two are the same at the 10% level of confidence. Hence, the uncertainty that surrounds the value of defaulted non-convertible subordinated claims seems also to characterize defaulted convertible subordinated claims.

However, these average defaulted bond prices are only indirect estimates of any difference that may exist between the value of a defaulted convertible and straight bonds. In order to accurately estimate the effect of a bond’s convertibility provisions on recovery, we must hold constant the circumstances peculiar to each default. We accomplish this by comparing the prices of convertible and non-convertible bonds of the same security and level of subordination and the same issuing firm. Exhibit 15 presents a summary of this analysis.

**Exhibit 15 – Comparison Between Defaulted Convertible and Non-Convertible Debt Pricing**  
***Defaulted convertibles are worth, on average, \$7.74 less than non-convertible bonds of the same issuer***

Default Date	Defaulter Name	Debt Seniority	Convertible Price	Straight Price	Difference
01-Sep-80	White Motor Corporation	Subordinated	\$32.00	\$44.00	(\$12.00)
15-Apr-82	Saxon Industries, Inc.	Subordinated	\$22.25	\$22.63	(\$0.38)
15-Sep-82	Tridex Corporation	Subordinated	\$59.00	\$62.00	(\$3.00)
07-Feb-85	Oak Industries, Inc.	Subordinated	\$53.50	\$65.00	(\$11.50)
01-Mar-85	Castle & Cooke, Inc.	Subordinated	\$79.00	\$73.13	\$5.88
01-Aug-85	Global Marine Inc.	Sr. Subordinated	\$33.00	\$31.46	\$1.54
01-Sep-85	Pettibone Corp.	Subordinated	\$40.00	\$40.75	(\$0.75)
25-Sep-85	Crystal Oil Company	Subordinated	\$46.50	\$53.75	(\$7.25)
20-Oct-87	Pathe Communications Corporation	Sr. Subordinated	\$27.00	\$36.00	(\$9.00)
13-Nov-87	Care Enterprises, Inc.	Sr. Subordinated	\$30.00	\$29.00	\$1.00
14-Jul-89	Southmark Corporation	Subordinated	\$8.00	\$8.50	(\$0.50)
01-Sep-89	Lomas Financial Corporation	Subordinated	\$30.06	\$31.10	(\$1.03)
31-Jan-90	One Bancorp, The	Subordinated	\$13.00	\$84.31	(\$71.31)
25-Apr-90	Ames Department Stores, Inc.	Subordinated	\$13.75	\$36.25	(\$22.50)
15-Jun-90	Western Union Corporation	Subordinated	\$34.25	\$19.50	\$14.75
15-May-91	Nortek Inc.	Sr. Unsecured	\$42.38	\$48.00	(\$5.63)
14-Jun-91	Lionel Corp.	Subordinated	\$21.50	\$35.50	(\$14.00)
19-Sep-91	Southeast Banking Corporation	Subordinated	\$1.25	\$4.00	(\$2.75)
16-Apr-99	Altos Hornos de Mexico, S.A. de C.V.	Sr. Unsecured	\$29.50	\$36.50	(\$7.00)
19-Jul-99	Daewoo Corporation	Sr. Unsecured	\$73.17	\$84.50	(\$11.33)
01-Nov-99	Integrated Health Services, Inc.	Sr. Subordinated	\$1.00	\$6.75	(\$5.75)
				Average	(\$7.74)
				Standard Deviation	\$16.52



For each of the 21 defaults for which we have pricing for both convertible and non-convertible bonds of the same seniority/security, the fourth column of Exhibit 15 presents the price of the convertible debt of the seniority/security indicated in the third column.<sup>11</sup> The fifth column of Exhibit 15 presents the price of the non-convertible debt of the seniority indicated in the third column. The last column presents the difference between these two prices and so is an indication of the market's perception of the value of the convertibility of the debt holding constant the circumstances of each particular default, the seniority of the claim and its security.

The average difference between the prices of the defaulted convertible and non-convertible debt presented in Exhibit 15 amounts to \$7.74. That is, convertible defaulted bonds are worth, on average, \$7.74 less than their non-convertible counterparts. Although the variability of this statistic, as indicated by its standard deviation (\$16.52), is large, we reject the hypothesis that the difference is actually zero.<sup>12</sup> Hence, the data provide further evidence that there is a statistically significant difference between the way that defaulted convertible debt claims are priced and the way that defaulted non-convertible claims are priced. The next section discusses some of the reasons that lead to this result.

## Historical Loss Rates

Moody's rating process is designed to produce a consistent measure of relative credit risk, the primary consideration of which is Moody's evaluation of expected credit loss. Moody's evaluation of expected credit loss reflects both the probability of default and the severity of loss in the event of default expressed through a simple rating symbol on a uniform rating scale. Moody's ratings are designed to provide investors with a consistent indicator of credit quality with the full consideration of geographic, sectoral, structural, and contractual standing of the obligation.<sup>13</sup>

The historical loss associated with a particular bond type is, mathematically, the frequency of default multiplied by the average severity of default. As we saw above, default severity can be measured as the original claim minus the amount recovered. The historical loss calculation is presented in Exhibit 16.

### Exhibit 16 – Historical Credit Loss Rate Definition

$$\text{Historical Loss Rate} = (\text{Frequency of Default}) * (1 - \text{Average Recovery Rate})$$

The results from the sections above on default and recovery rates provide us with the data necessary to calculate annual historical loss rates. Based on the historical data, expected credit losses from defaults of convertible bond issuers are higher on average than for issuers of just straight debt. The average difference is 42 basis points: straight debt issuers show an average 0.63% loss rate versus 1.05% for convertible issuers. The difference, moreover, is statistically significant at the 5% confidence level.<sup>14</sup>

Exhibit 17 depicts the distributions of annual credit losses for convertible and non-convertible debt issuers between 1970 and 2000. The distributions of historical credit losses for convertible and non-convertible bond issuers are both skewed to the right, with long tails. The "center" of the distribution of historical losses for convertible issuers lies to the right of that for straight debt issuers, however. Furthermore, the tail of the distribution is longer and fatter, indicating that not only are historical losses higher on average, but that exceptionally high losses are also relatively more likely.

11. In cases where more than one non-convertible bond price of the same seniority was available, we considered the average of these debts' prices.

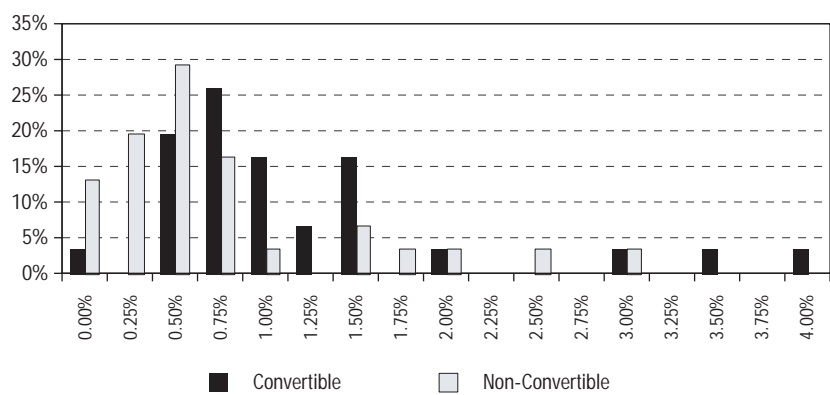
12.  $t=2.147$ , significant at the 5% level. The median difference is (\$5.63).

13. See Cantor and Pinkes (1999).

14.  $t = 2.08$



**Exhibit 17 – Distribution of Annual Historical Loss Rates, 1970-2000**  
*Convertible bonds experienced higher loss rates compared to non-convertibles*



Since we have already seen that default rates are higher and recovery rates lower (severity higher), on average, for convertible issuers than for non-convertible issuers, it is not surprising that historical loss rates are commensurately higher. Several fundamental credit factors characteristic of convertible debt motivate this result:

- Convertible debt issues are often low in priority (subordinated) in the capital structure. As we saw in Exhibit 14 in the recovery rates section, 225, or 82% of the convertible bonds with available prices were subordinated.
- When not contractually subordinated, convertibles are often structurally subordinated, usually issued by a holding company. This structural subordination often increases over time, putting increasing distance between debt holders and the sources of recovery in the event of default.<sup>15</sup>
- Absent upstream guarantees and/or meaningful covenants, holders of convertible debt usually have no seat at the negotiating table and virtually no say in restructuring at the operating company level. In other words, structural subordination caused by the absence of a guarantee leaves the converts with a claim against the holding company only. Moreover, since they have no covenants that restrict what happens at the operating company, their consent is not needed for a restructuring at the operating company. In essence, convert holders can only passively take a "wait and see" approach while the better positioned creditors at the operating company do other things to try to improve their position (such as take collateral).

If there were no structural subordination because the convertibles were issued by the operating company directly, or if the convertibles were issued by the holding company with guarantees (unlikely), higher credit losses could still occur relative to pari-passu bonds in situations where the bonds have negative pledges and the creditors want to take collateral. In this case, the consent of the bondholders may be required and the bondholders may get a second lien on collateral, thereby improving their position vis-a-vis the convertible holders. These situations exist because the bonds may have better terms (such as covenants) that give them more negotiating leverage.

Moody’s ratings of convertible debt issues reflect the effects of these factors on expected credit loss. Assuming a simplified legal firm structure, convertible subordinated debt will likely be rated at least one notch below the senior implied or senior unsecured rating for companies whose senior implied rating is Ba2 and above. For issuers whose senior implied rating is Ba3 and below, the debt will be notched down at least two notches.<sup>16</sup>

15. See Stumpp (2001), p.5, for an elaboration on the effect of structural subordination.  
 16. Ibid.

## Conclusion

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The study extends the research of Stumpp (2001) into the unique credit features of convertible bond issuers. We have been concerned with quantitatively documenting the historical default and loss severity rates of convertible bond issuers and contrasting the results with issuers that do not include convertibles in their capital structures. We uncovered several distinguishing findings and some evidence for adverse selection among issuers of convertible debt:

- **Higher average, aggregate, annual default rates.** Default rates for convertible bond issuers tend to be higher on average. Once credit ratings for convertible issuers are taken into consideration, however, default rates do not differ meaningfully from issuers that do not issue convertible debt. These differences are largely the artifact of the distribution of the rated convertible sub-universe and the growth (or decline) in the number of convertible issuers (which comprise the denominator of default rates).

Evidence for adverse selection need not manifest itself in higher default rates, though. As we saw, the distribution of ratings for convertible bond issuers has changed since 1970, exhibiting higher concentrations of firms in the lower rating categories for both investment- and speculative grade. That default rates by rating category are somewhat higher, but not statistically significantly higher, for convertible issuers supports the conclusion that the default risk of these firms was recognized and captured in the initial rating (or possibly in subsequent rating revisions). One interpretation is that the information problem that gives rise to adverse selection seems to be mitigated by Moody's credit ratings.

- **Higher average default loss severity rates.** Convertible bonds' recovery values in default are on average \$14 lower than straight debt – a statistically as well as economically significant difference. Lower recovery values are largely a product of convertibles' contractual or effective subordination compared with non-convertible debt issues. The statistical significance of convertibles' higher loss rates persists even when security and level of subordination are controlled for, however. Convertible debt of the same security/seniority as straight debt shows recovery rates that are \$7.74 lower, on average.
- **Higher credit loss rates.** The distribution of credit loss rates, which includes both the probability and severity of default, shows higher expected (average) credit loss rates as well as a longer, fatter right tail indicating a relatively higher likelihood of large credit losses compared to firms that do not issue convertible debt.

## Bibliography

- Cantor, Richard and K. Pinkes, "The Evolving Meaning of Moody's Bond Ratings," A Moody's Special Report, September 1999.
- Cantor, Richard and E. Falkenstein, "Testing for Consistency in Annual Default Rates," A Moody's Special Report, February 2001.
- Hamilton, David T., "Debt Recoveries for Corporate Bankruptcies," A Moody's Special Report, June 1998.
- Hamilton, David T., "Default and Recovery Rates of Corporate Bond Issuers: 2000," A Moody's Special Report, February 2001.
- Keenan, Sean C., "Historical Default Rates of Corporate Bond Issuers, 1920-1999," A Moody's Special Report, January 2000.
- Lewis, Craig M., R. Rogalski, and J. Seward, "The Long-Run Performance of Firms That Issue Convertible Debt: An Empirical Analysis of Operating Characteristics and Analyst Forecasts," Working Paper, Vanderbilt University, May 2000.
- Stumpp, Pamela M., "Critical Issues in Evaluating the Creditworthiness of Convertible Debt Securities," A Moody's Special Report, June 2001.

Appendix – Convertible Bond Default Rate Tables

Exhibit 18 – One-Year Default Rates by Year and Letter Rating, 1970-2000 (Percent)

	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa	0.36	0.00	0.00	0.65	0.00	0.37	0.00	0.45	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00
Ba	4.66	0.48	0.00	0.00	0.00	1.29	1.38	0.00	1.65	0.88	0.00	0.00	4.55	1.54	0.78	1.54
B	26.67	6.67	12.12	7.14	17.65	5.13	0.00	13.33	8.70	0.00	9.52	10.81	6.25	4.30	7.84	9.38
Investment-Grade	0.22	0.00	0.00	0.41	0.00	0.21	0.00	0.23	0.00	0.00	0.00	0.00	0.36	0.00	0.00	0.00
Speculative-Grade	9.88	0.87	1.82	1.54	1.63	1.70	1.21	1.92	2.74	0.74	2.50	1.67	5.38	2.79	2.76	4.01
All Corporates	3.67	0.28	0.56	0.73	0.45	0.62	0.32	0.67	0.73	0.20	0.66	0.47	1.98	1.32	1.27	1.76
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa	0.36	0.00	0.00	0.65	0.00	0.37	0.00	0.45	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71
Ba	4.66	0.48	0.00	0.00	0.00	1.29	1.38	0.00	1.65	0.88	0.00	0.63	1.37	0.00	0.71	
B	26.67	6.67	12.12	7.14	17.65	5.13	0.00	13.33	8.70	0.00	9.52	4.03	10.19	9.09	5.00	
Investment-Grade	0.22	0.00	0.00	0.41	0.00	0.21	0.00	0.23	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Speculative-Grade	9.88	0.87	1.82	1.54	1.63	1.70	1.21	1.92	2.74	0.74	2.50	2.11	5.18	4.63	2.17	
All Corporates	3.67	0.28	0.56	0.73	0.45	0.62	0.32	0.67	0.73	0.20	0.66	0.96	2.24	2.00	1.09	

Exhibit 19 – One-Year Default Rates by Year and Alpha-Numeric Rating, 1983-2000 (Percent)

	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa3	0.00	0.00	0.00	10.26	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.50
Ba1	0.00	1.85	0.00	0.00	1.29	0.00	1.47	1.71	0.00	0.00	1.92	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ba2	0.00	0.00	3.13	0.00	0.00	0.00	0.00	2.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.22
Ba3	5.88	0.00	2.70	0.00	2.47	3.26	3.75	4.88	11.76	0.00	0.00	0.00	0.00	0.00	1.53	3.60	0.00	0.00
B1	0.00	10.91	0.00	7.41	3.92	2.92	4.92	3.88	8.33	0.00	0.00	5.63	5.56	0.00	0.00	5.26	9.23	3.13
B2	0.00	12.50	0.00	14.81	0.00	22.22	10.81	18.18	0.00	3.85	9.52	0.00	4.88	0.00	5.00	14.71	8.11	7.23
B3	12.50	0.00	23.08	12.50	10.34	6.15	22.54	26.09	20.00	17.02	13.95	5.26	0.00	6.45	11.43	15.38	13.33	0.00
Investment-Grade	0.00	0.00	0.00	0.78	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.31
Speculative-Grade	2.79	2.76	4.01	3.17	2.75	2.97	6.03	7.21	8.14	3.14	3.10	1.25	2.07	0.86	2.11	5.18	4.63	2.17
All Corporates	1.32	1.27	1.76	1.89	1.65	1.86	3.61	4.14	4.34	1.56	1.58	0.63	0.99	0.40	0.96	2.24	2.00	1.09

Exhibit 20 – Average Cumulative Default Rates From 1 to 15 Years (Percent)

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.23	0.50	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
A	0.00	0.05	0.21	0.41	0.56	0.65	0.65	0.77	0.91	1.39	1.77	1.99	2.24	2.54	3.27
Baa	0.23	0.71	1.31	2.17	3.05	3.88	4.90	5.99	7.23	8.28	9.62	11.05	12.59	14.07	15.62
Ba	1.10	3.12	5.31	7.45	9.57	11.44	13.27	15.21	17.06	19.04	21.69	24.90	28.20	30.85	33.27
B	7.99	15.05	21.09	26.71	32.51	37.48	42.87	46.83	51.31	56.07	58.97	60.31	62.20	65.11	69.76
Investment-Grade	0.11	0.37	0.73	1.22	1.72	2.21	2.78	3.43	4.13	4.85	5.68	6.53	7.44	8.33	9.40
Speculative-Grade	3.25	6.67	9.83	12.79	15.72	18.23	20.69	22.99	25.24	27.59	30.23	33.05	36.01	38.48	40.82
All Corporates	1.54	3.21	4.79	6.33	7.83	9.13	10.43	11.70	12.96	14.25	15.69	17.19	18.76	20.13	21.56

Exhibit 21 – Average Cumulative Default Rates by Alpha-Numeric Rating From 1 to 15 Years  
(Percent, 1983-2000)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa1	0.00	0.00	0.00	0.00	0.00	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41	2.41
Aa2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A1	0.00	0.00	0.32	0.32	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80	0.80
A2	0.00	0.00	0.00	0.29	0.29	0.29	0.29	1.02	1.95	3.14	3.14	3.14	3.14	3.14	3.14
A3	0.00	0.23	0.52	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91	0.91
Baa1	0.00	0.25	0.93	1.37	1.95	2.70	4.75	6.17	8.21	8.21	8.21	8.21	8.21	8.21	8.21
Baa2	0.00	0.23	0.52	1.29	2.32	3.02	3.02	3.02	4.46	6.21	8.47	11.47	11.47	11.47	11.47
Baa3	0.75	2.01	3.29	5.13	7.84	9.15	12.75	17.66	17.66	17.66	17.66	17.66	32.63	55.09	55.09
Ba1	0.49	1.23	2.64	4.65	6.48	9.93	13.15	16.21	16.99	19.04	22.99	24.68	26.96	26.96	26.96
Ba2	0.44	2.84	5.70	8.18	10.17	11.67	13.56	14.37	15.45	15.45	17.21	22.23	26.43	26.43	26.43
Ba3	2.43	6.29	10.12	13.58	17.15	19.34	22.31	25.77	27.36	28.49	31.81	34.60	39.44	48.76	48.76
B1	3.99	10.40	15.54	21.67	28.72	34.28	41.04	44.15	48.87	53.62	57.33	57.33	57.33	57.33	57.33
B2	8.42	15.46	23.15	27.54	31.54	36.96	42.44	50.11	59.77	69.24	69.24	69.24	69.24	69.24	69.24
B3	14.10	23.70	31.38	38.17	45.04	49.96	54.62	59.96	66.12	71.33	71.33	71.33	71.33	71.33	71.33
Investment-Grade	0.08	0.30	0.61	1.01	1.47	1.80	2.23	2.78	3.32	3.79	4.11	4.55	5.18	6.10	7.47
Speculative-Grade	3.46	7.55	11.52	15.30	19.09	22.45	26.15	29.33	31.80	34.03	36.73	38.94	41.48	43.00	43.00
All Corporates	1.83	4.04	6.22	8.33	10.45	12.28	14.30	16.10	17.51	18.78	20.15	21.36	22.76	23.85	24.72



Exhibit 22 – Cumulative Default Rates From 1 to 15 Years (Percent)

Cohort Formed January 1, 1970															
Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	2.20	2.20	2.20	2.20	2.20	4.88	4.88	4.88	4.88	4.88
Baa	0.00	0.00	0.00	1.25	1.90	1.90	2.61	4.10	5.66	5.66	6.54	6.54	8.68	9.88	9.88
Ba	1.26	1.91	2.60	3.32	4.83	6.39	7.23	7.23	9.18	9.18	9.18	12.11	18.62	18.62	18.62
B	13.33	13.33	13.33	13.33	13.33	13.33	13.33	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Investment-Grade	0.00	0.00	0.00	0.91	1.38	1.88	2.39	3.47	4.60	4.60	5.87	5.87	7.39	8.23	8.23
Speculative-Grade	1.79	2.41	3.71	4.40	5.84	7.34	8.14	8.99	10.85	10.85	10.85	13.64	19.81	19.81	19.81
All Corporates	0.72	0.96	1.48	2.30	3.16	4.05	4.68	5.67	7.07	7.07	7.90	8.83	11.87	12.43	12.43
Cohort Formed January 1, 1971															
Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	1.90	1.90	1.90	1.90	1.90	4.33	4.33	4.33	4.33	4.33	4.33
Baa	0.00	0.00	1.19	1.80	1.80	2.47	3.87	5.37	5.37	6.21	6.21	8.33	9.52	9.52	12.49
Ba	0.63	1.30	2.01	3.49	5.03	5.84	5.84	7.71	7.71	7.71	10.48	16.66	16.66	16.66	16.66
B	0.00	0.00	0.00	0.00	0.00	0.00	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33	33.33
Investment-Grade	0.00	0.00	0.85	1.29	1.75	2.23	3.25	4.32	4.32	5.54	5.54	7.02	7.84	7.84	9.78
Speculative-Grade	0.61	1.89	2.58	4.01	5.50	6.29	7.14	8.94	8.94	8.94	11.66	17.75	17.75	17.75	17.75
All Corporates	0.23	0.73	1.51	2.33	3.19	3.79	4.74	6.08	6.08	6.88	7.78	10.76	11.31	11.31	12.63
Cohort Formed January 1, 1972															
Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	1.87	1.87	1.87	1.87	1.87	1.87	1.87	1.87	1.87	1.87	1.87	1.87
Baa	0.00	1.08	1.63	1.63	2.23	3.51	4.87	4.87	6.45	6.45	8.43	9.53	9.53	12.19	12.19
Ba	0.00	0.70	2.17	3.70	4.51	4.51	6.34	6.34	6.34	9.03	15.05	15.05	15.05	17.17	22.19
B	14.29	14.29	14.29	14.29	14.29	35.71	35.71	35.71	35.71	35.71	35.71	35.71	35.71	35.71	35.71
Investment-Grade	0.00	0.78	1.19	1.61	2.06	3.00	3.99	3.99	5.13	5.13	6.52	7.28	7.28	9.07	9.07
Speculative-Grade	1.26	1.93	3.33	4.79	5.57	6.38	8.13	8.13	8.13	10.71	16.52	16.52	16.52	18.56	23.35
All Corporates	0.46	1.21	1.98	2.78	3.35	4.24	5.51	5.51	6.26	7.11	9.93	10.44	10.44	12.29	13.73
Cohort Formed January 1, 1973															
Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77	1.77
Baa	1.00	1.51	1.51	2.06	3.24	4.49	4.49	5.96	5.96	7.81	8.84	8.84	11.34	11.34	11.34
Ba	0.00	1.54	3.16	4.02	4.02	5.94	5.94	5.94	8.70	16.25	16.25	16.25	18.24	22.98	26.26
B	15.38	15.38	15.38	15.38	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54	36.54
Investment-Grade	0.73	1.11	1.50	1.91	2.78	3.70	3.70	4.75	4.75	6.05	6.77	6.77	8.45	8.45	8.45
Speculative-Grade	0.71	2.19	3.74	4.57	5.43	7.27	7.27	7.27	9.94	17.26	17.26	17.26	19.23	23.91	27.15
All Corporates	0.72	1.47	2.26	2.81	3.67	4.90	4.90	5.62	6.44	9.58	10.08	10.08	11.84	13.20	14.06

Exhibit 22 – Continued

Cohort Formed January 1, 1974

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa	0.00	0.54	1.10	2.31	3.59	3.59	5.10	5.10	7.03	8.10	8.10	10.69	10.69	10.69	10.69
Ba	0.00	1.68	2.57	2.57	4.57	4.57	4.57	6.02	13.85	13.85	13.85	15.90	20.71	23.94	23.94
B	28.57	28.57	28.57	38.78	38.78	38.78	38.78	52.38	52.38	52.38	52.38	52.38	52.38	52.38	52.38
Investment-Grade	0.00	0.40	0.81	1.68	2.60	2.60	3.66	3.66	4.97	5.68	5.68	7.35	7.35	7.35	7.35
Speculative-Grade	2.23	3.78	4.60	5.47	7.30	7.30	7.30	9.93	17.13	17.13	17.13	19.11	23.73	26.84	26.84
All Corporates	0.75	1.54	2.09	2.96	4.18	4.18	4.91	5.72	8.86	9.36	9.36	11.11	12.46	13.31	13.31

Cohort Formed January 1, 1975

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa	0.55	0.55	1.17	2.49	2.49	4.03	4.03	5.94	7.00	7.00	9.55	9.55	9.55	9.55	12.56
Ba	0.83	2.60	3.55	4.54	4.54	4.54	6.06	14.45	14.45	14.45	16.64	21.85	25.49	25.49	30.45
B	8.33	8.33	16.67	25.00	25.00	25.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00	35.00
Investment-Grade	0.39	0.39	0.81	1.71	1.71	2.74	2.74	4.01	4.72	4.72	6.35	6.35	6.35	6.35	8.06
Speculative-Grade	1.52	3.12	4.81	6.60	6.60	6.60	9.25	16.62	16.62	16.62	18.66	23.44	26.70	26.70	31.14
All Corporates	0.77	1.30	2.15	3.34	3.34	4.05	4.85	7.96	8.45	8.45	10.19	11.53	12.37	12.37	14.84

Cohort Formed January 1, 1976

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa	0.00	0.65	1.34	1.34	2.15	2.15	4.21	5.35	5.35	8.07	8.07	8.07	8.07	11.48	19.91
Ba	1.73	2.65	4.61	4.61	5.84	7.31	15.52	15.52	15.52	17.74	22.96	26.54	26.54	31.44	36.93
B	0.00	8.33	16.67	16.67	16.67	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	26.47	63.24
Investment-Grade	0.00	0.41	0.84	0.84	1.34	1.34	2.57	3.24	3.24	4.78	4.78	4.78	4.78	6.38	10.16
Speculative-Grade	1.57	3.23	5.86	5.86	6.95	9.51	16.69	16.69	16.69	18.73	23.44	26.56	26.56	30.76	40.31
All Corporates	0.52	1.35	2.51	2.51	3.19	3.96	6.97	7.44	7.44	9.11	10.38	11.17	11.17	13.48	18.89

Cohort Formed January 1, 1977

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.26
Baa	0.66	1.38	1.38	1.38	1.38	3.55	4.75	4.75	7.64	7.64	7.64	7.64	11.33	20.43	25.91
Ba	0.00	2.00	2.00	3.23	4.70	12.84	12.84	12.84	15.05	20.28	23.82	23.82	28.58	34.08	40.67
B	12.50	18.98	18.98	26.35	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	34.53	67.27	67.27
Investment-Grade	0.41	0.84	0.84	0.84	0.84	2.06	2.74	2.74	4.26	4.26	4.26	4.26	5.84	9.54	13.79
Speculative-Grade	1.64	4.24	4.24	6.36	8.85	15.86	15.86	15.86	17.84	22.47	25.51	25.51	29.54	38.93	44.75
All Corporates	0.82	1.97	1.97	2.64	3.41	6.40	6.86	6.86	8.51	9.76	10.54	10.54	12.81	18.09	22.73

Exhibit 22 – Continued

Cohort Formed January 1, 1978

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.56	5.56
Baa	0.00	0.00	0.00	0.00	2.22	3.46	3.46	6.43	6.43	6.43	6.43	10.50	20.73	20.73	20.73
Ba	2.05	2.05	2.05	3.58	12.11	12.11	12.11	14.43	19.78	23.26	23.26	27.78	32.76	43.97	51.44
B	10.81	10.81	22.70	29.14	29.14	29.14	29.14	29.14	29.14	29.14	29.14	29.14	57.49	57.49	NA
Investment-Grade	0.00	0.00	0.00	0.00	1.24	1.91	1.91	3.45	3.45	3.45	3.45	5.09	8.96	11.21	11.21
Speculative-Grade	3.45	3.45	5.56	8.04	15.01	15.01	15.01	16.96	21.51	24.42	24.42	28.11	36.57	46.72	53.82
All Corporates	1.15	1.15	1.82	2.59	5.59	6.06	6.06	7.71	8.97	9.75	9.75	12.02	17.35	22.03	23.95

Cohort Formed January 1, 1979

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.41	5.41	5.41
Baa	0.00	0.87	0.87	3.02	4.22	4.22	7.08	7.08	7.08	7.08	11.03	26.28	26.28	26.28	26.28
Ba	0.00	0.00	1.59	10.53	10.53	10.53	16.81	20.77	20.77	26.06	31.97	44.93	52.80	64.60	64.60
B	0.00	11.76	18.07	18.07	18.07	18.07	27.71	27.71	27.71	27.71	27.71	48.36	48.36	NA	NA
Investment-Grade	0.00	0.48	0.48	1.68	2.33	2.33	3.80	3.80	3.80	3.80	5.37	10.93	13.08	13.08	13.08
Speculative-Grade	0.00	2.15	4.69	11.80	11.80	11.80	13.90	18.90	22.01	22.01	26.01	35.26	46.52	54.16	65.62
All Corporates	0.00	1.00	1.76	4.70	5.16	5.16	6.79	8.04	8.81	8.81	11.06	17.70	22.35	24.27	26.60

Cohort Formed January 1, 1980

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.13	5.13	5.13	5.13
Baa	0.00	0.00	2.21	3.44	3.44	6.37	6.37	6.37	6.37	10.19	25.16	25.16	32.64	32.64	32.64
Ba	0.00	1.52	9.93	9.93	12.16	12.16	15.08	18.78	18.78	24.02	24.02	37.83	46.71	60.03	60.03
B	11.11	17.04	17.04	17.04	17.04	25.77	36.37	36.37	36.37	36.37	64.65	64.65	NA	NA	NA
Investment-Grade	0.00	0.00	1.18	1.82	1.82	3.25	3.25	3.25	3.25	4.75	10.05	12.05	14.42	14.42	14.42
Speculative-Grade	3.05	5.44	12.05	12.05	13.78	15.69	20.25	23.10	23.10	26.85	35.46	46.21	53.90	65.42	65.42
All Corporates	0.97	1.70	4.55	5.00	5.48	7.04	8.24	8.98	8.98	11.12	17.38	21.73	25.29	27.46	27.46

Cohort Formed January 1, 1981

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.41	5.41	5.41	5.41	5.41	5.41	5.41	5.41
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.65	4.65	4.65	4.65	18.27
Baa	0.00	1.83	2.88	4.03	6.54	6.54	6.54	6.54	9.61	20.45	20.45	25.43	25.43	25.43	25.43
Ba	0.00	6.54	8.03	11.60	13.57	18.18	21.00	21.00	24.76	29.19	40.08	47.57	57.10	57.10	57.10
B	12.50	12.50	12.50	12.50	21.71	32.89	32.89	32.89	32.89	62.72	62.72	NA	NA	NA	NA
Investment-Grade	0.00	1.01	1.57	2.17	3.44	3.44	3.44	4.53	5.80	10.15	11.75	13.69	13.69	13.69	17.53
Speculative-Grade	1.98	7.46	8.70	11.64	14.89	20.62	22.96	22.96	25.92	36.26	45.36	52.19	60.89	60.89	60.89
All Corporates	0.62	3.04	3.81	5.09	6.91	8.47	9.12	9.89	11.67	17.80	21.32	24.26	26.09	26.09	29.04

Exhibit 22 – Continued

Cohort Formed January 1, 1982

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	4.88	4.88	4.88	4.88	4.88	4.88	4.88	4.88	4.88
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.00	4.00	4.00	4.00	4.00	4.00
Baa	0.91	0.91	2.09	4.68	4.68	4.68	4.68	7.71	17.78	17.78	22.48	22.48	22.48	31.60	31.60
Ba	4.93	8.36	11.12	14.08	19.14	21.13	21.13	23.76	29.98	37.99	43.89	51.37	51.37	51.37	51.37
B	0.00	7.69	7.69	17.95	31.62	31.62	31.62	31.62	58.97	58.97	NA	NA	NA	NA	NA
Investment-Grade	0.46	0.46	1.02	2.21	2.21	2.21	3.22	4.36	8.16	9.55	11.23	11.23	11.23	14.52	14.52
Speculative-Grade	4.33	8.32	10.70	14.58	20.57	22.36	22.36	24.71	33.08	40.51	46.18	53.35	53.35	53.35	53.35
All Corporates	1.80	3.16	4.29	6.33	8.20	8.77	9.44	10.98	16.19	19.19	21.69	23.26	23.26	25.70	25.70

Cohort Formed January 1, 1983

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65	4.65
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4.76	4.76	4.76	4.76	4.76	4.76
Baa	0.00	2.11	2.11	2.11	2.11	2.11	2.11	7.00	12.64	12.64	12.64	12.64	12.64	12.64	12.64
Ba	1.65	2.61	5.77	9.40	10.93	10.93	15.56	26.63	26.63	26.63	31.87	31.87	39.89	39.89	39.89
B	4.40	11.75	19.90	23.17	26.82	26.82	31.87	38.06	55.76	70.51	70.51	70.51	70.51	70.51	70.51
Investment-Grade	0.00	0.69	0.69	0.69	0.69	1.91	1.91	3.35	4.92	6.80	6.80	6.80	6.80	6.80	6.80
Speculative-Grade	2.40	5.16	9.71	13.24	15.41	15.41	20.19	29.81	34.57	37.76	41.65	41.65	47.48	47.48	47.48
All Corporates	1.23	2.96	5.20	6.94	8.00	8.63	10.80	15.69	18.47	20.77	22.18	22.18	24.38	24.38	24.38

Cohort Formed January 1, 1984

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	2.33	2.33	2.33	2.33	5.69	5.69	5.69	5.69	5.69	5.69	5.69
Baa	0.00	0.00	0.00	0.00	0.00	0.00	4.35	9.25	9.25	9.25	9.25	9.25	9.25	9.25	9.25
Ba	0.85	5.48	9.73	12.40	12.40	18.44	28.48	31.59	31.59	31.59	31.59	38.11	38.11	38.11	38.11
B	8.00	14.49	17.05	17.05	23.55	27.38	36.45	48.01	56.01	64.80	64.80	64.80	64.80	64.80	64.80
Investment-Grade	0.00	0.00	0.00	0.00	1.03	1.03	2.27	3.61	5.21	5.21	5.21	5.21	5.21	5.21	5.21
Speculative-Grade	2.98	8.17	11.92	13.76	15.99	21.28	31.02	37.10	39.78	43.04	43.04	47.42	47.42	47.42	47.42
All Corporates	1.47	4.01	5.85	6.75	8.35	10.80	15.66	18.81	20.76	21.97	21.97	23.76	23.76	23.76	23.76

Cohort Formed January 1, 1985

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	1.55	3.48	3.48	3.48	3.48	6.59	6.59	6.59	6.59	6.59	6.59	6.59	6.59
Baa	0.00	3.31	3.31	3.31	6.95	6.95	11.28	11.28	11.28	11.28	11.28	11.28	11.28	11.28	40.85
Ba	1.67	2.63	6.24	6.24	9.95	21.65	27.35	27.35	27.35	27.35	32.73	32.73	32.73	32.73	32.73
B	9.52	18.31	22.20	26.58	29.35	39.44	48.10	55.02	64.01	64.01	64.01	64.01	64.01	64.01	64.01
Investment-Grade	0.00	1.07	1.76	2.65	3.68	3.68	4.90	6.37	6.37	6.37	6.37	6.37	6.37	6.37	11.87
Speculative-Grade	4.29	7.95	11.63	13.41	16.70	27.54	34.28	36.51	39.21	39.21	46.36	46.36	46.36	46.36	46.36
All Corporates	1.97	4.25	6.39	7.73	9.86	14.77	18.26	19.99	21.08	21.08	24.37	24.37	24.37	24.37	27.89

Exhibit 22 – Continued

Cohort Formed January 1, 1986

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64	1.64
Baa	2.53	2.53	6.86	9.45	9.45	12.74	16.90	16.90	16.90	16.90	16.90	16.90	16.90	44.60	44.60
Ba	0.00	4.29	6.40	10.22	21.05	24.86	24.86	30.32	30.32	30.32	30.32	35.68	35.68	35.68	35.68
B	11.02	14.58	18.75	21.46	34.83	47.44	54.01	63.21	63.21	77.93	77.93	77.93	77.93	77.93	77.93
Investment-Grade	0.89	0.89	2.30	3.94	3.94	4.95	6.17	6.17	6.17	6.17	6.17	6.17	6.17	10.86	10.86
Speculative-Grade	3.35	7.36	10.13	13.54	24.93	31.34	33.02	39.02	39.02	44.21	44.21	48.34	48.34	48.34	48.34
All Corporates	2.08	4.07	6.16	8.67	14.00	17.34	18.74	21.37	21.37	24.04	24.04	26.04	26.04	28.83	28.83

Cohort Formed January 1, 1987

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71	1.71
Baa	0.00	0.00	0.00	2.35	7.70	11.12	11.12	11.12	11.12	11.12	11.12	11.12	11.12	22.23
Ba	1.38	4.03	9.00	15.72	19.38	20.46	26.77	26.77	26.77	26.77	32.09	32.09	36.62	41.90
B	5.49	10.37	17.37	30.73	47.52	50.44	54.11	54.11	61.17	61.17	61.17	61.17	61.17	61.17
Investment-Grade	0.00	0.00	0.78	1.63	3.51	4.64	4.64	4.64	4.64	4.64	4.64	4.64	8.31	8.31
Speculative-Grade	2.84	6.11	11.60	20.22	27.73	29.25	34.69	34.69	37.30	37.30	41.48	41.48	45.14	49.36
All Corporates	1.79	3.91	7.74	13.47	18.68	20.03	23.35	23.35	25.02	25.02	27.52	27.52	30.97	32.84

Cohort Formed January 1, 1988

Years:	1	2	3	4	5	6	7	8	9	10	11	12	13
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.52	1.52
Baa	0.00	0.00	1.65	5.33	7.53	7.53	7.53	7.53	7.53	7.53	7.53	15.94	15.94
Ba	1.27	6.17	11.94	15.41	17.84	22.59	22.59	22.59	24.27	28.60	28.60	31.92	35.70
B	6.78	15.34	25.57	38.83	42.98	50.58	53.49	57.53	57.53	57.53	69.67	69.67	69.67
Investment-Grade	0.00	0.60	1.27	2.71	3.55	3.55	3.55	3.55	3.55	3.55	3.55	6.05	6.05
Speculative-Grade	3.06	9.14	16.34	22.84	25.68	31.06	31.89	33.92	35.14	38.31	40.43	42.97	45.89
All Corporates	2.01	6.19	11.01	15.50	17.51	20.76	21.26	22.47	23.19	24.90	25.94	28.33	29.67

Cohort Formed January 1, 1989

Years:	1	2	3	4	5	6	7	8	9	10	11	12
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa	0.00	1.49	4.80	6.73	6.73	6.73	6.73	6.73	6.73	6.73	15.21	15.21
Ba	1.99	7.22	10.73	13.20	18.02	18.02	18.02	19.85	24.49	24.49	28.01	32.00
B	11.40	22.87	34.94	40.36	46.99	49.51	59.29	59.29	59.29	70.92	70.92	70.92
Investment-Grade	0.00	0.58	1.85	2.58	2.58	2.58	2.58	2.58	2.58	2.58	4.85	4.85
Speculative-Grade	6.24	13.58	19.91	23.22	28.44	29.25	32.28	33.52	36.72	38.90	41.50	44.50
All Corporates	3.91	8.64	12.85	15.03	18.02	18.48	20.16	20.84	22.46	23.46	25.76	27.06

Exhibit 22 – Continued

Cohort Formed January 1, 1990

Years:	1	2	3	4	5	6	7	8	9	10	11
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa	0.00	1.59	1.59	1.59	1.59	1.59	1.59	1.59	1.59	11.43	11.43
Ba	3.36	8.77	11.15	15.80	15.80	15.80	15.80	22.11	22.11	22.11	25.82
B	14.35	25.55	31.50	37.13	39.42	45.33	48.97	48.97	57.48	68.11	68.11
Investment-Grade	0.00	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	2.43	2.43
Speculative-Grade	7.51	15.01	18.57	23.45	24.20	27.01	28.13	32.45	34.40	36.75	39.50
All Corporates	4.50	8.99	10.95	13.66	14.07	15.56	16.15	18.28	19.15	21.14	22.27

Cohort Formed January 1, 1991

Years:	1	2	3	4	5	6	7	8	9	10
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.70	8.70
Ba	5.46	6.27	9.20	9.20	9.20	9.20	15.53	15.53	18.78	22.65
B	11.46	19.45	27.50	29.41	36.71	39.88	39.88	46.56	54.19	54.19
Investment-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.77	1.77
Speculative-Grade	8.13	11.60	16.39	17.13	20.81	21.93	26.08	27.88	32.25	34.86
All Corporates	4.54	6.41	9.04	9.44	11.36	11.93	13.96	14.78	17.64	18.72

Cohort Formed January 1, 1992

Years:	1	2	3	4	5	6	7	8	9
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	8.00	8.00
Ba	0.00	0.95	0.95	0.95	0.95	7.27	7.27	10.47	10.47
B	6.58	15.55	17.33	24.41	27.38	27.38	32.96	39.67	47.71
Investment-Grade	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.52	1.52
Speculative-Grade	3.30	7.81	8.51	12.03	13.10	17.05	18.74	22.91	25.43
All Corporates	1.71	4.06	4.42	6.13	6.64	8.48	9.22	11.81	12.79

Cohort Formed January 1, 1993

Years:	1	2	3	4	5	6	7	8
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa	0.00	0.00	0.00	0.00	0.00	0.00	5.88	5.88
Ba	0.75	0.75	1.86	1.86	5.11	5.11	7.51	7.51
B	6.45	9.40	14.83	16.96	19.64	27.48	37.84	44.06
Investment-Grade	0.00	0.00	0.00	0.00	0.00	0.00	1.42	1.42
Speculative-Grade	3.28	4.39	7.77	8.57	11.57	14.19	19.00	20.93
All Corporates	1.74	2.33	4.06	4.47	5.99	7.25	10.24	11.10

Exhibit 22 – Continued

Cohort Formed January 1, 1994

Years:	1	2	3	4	5	6	7
Aaa	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Baa	0.00	0.00	0.00	0.00	0.00	3.39	3.39
Ba	0.00	0.75	0.75	3.03	4.45	6.13	6.13
B	4.17	7.62	11.87	14.67	22.79	33.44	39.49
Investment-Grade	0.00	0.00	0.00	0.00	0.00	0.99	0.99
Speculative-Grade	1.31	3.87	5.11	7.51	10.63	14.38	15.92
All Corporates	0.68	1.99	2.61	3.75	5.15	7.35	7.99

Cohort Formed January 1, 1995

Years:	1	2	3	4	5	6
Aaa	0.00	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00	0.00
Baa	0.00	0.00	0.00	0.00	2.20	2.20
Ba	0.00	0.00	0.93	2.07	4.77	4.77
B	4.41	7.95	12.44	21.66	29.69	34.38
Investment-Grade	0.00	0.00	0.00	0.00	0.71	0.71
Speculative-Grade	2.16	3.18	5.13	8.43	12.41	13.65
All Corporates	1.07	1.56	2.44	3.85	5.91	6.39

Cohort Formed January 1, 1996

Years:	1	2	3	4	5
Aaa	0.00	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00	0.00
Baa	0.00	0.00	0.00	0.00	1.98
Ba	0.00	0.81	2.82	6.47	6.47
B	1.54	5.33	12.70	18.94	22.80
Investment-Grade	0.00	0.00	0.00	0.00	0.69
Speculative-Grade	0.90	3.15	6.68	11.00	12.08
All Corporates	0.43	1.46	2.98	4.76	5.60

Cohort Formed January 1, 1997

Years:	1	2	3	4
Aaa	0.00	0.00	0.00	0.00
Aa	0.00	0.00	0.00	0.00
A	0.00	0.00	0.00	0.00
Baa	0.00	0.00	0.00	1.53
Ba	0.67	3.90	5.84	7.03
B	4.08	12.35	18.61	23.95
Investment-Grade	0.00	0.00	0.00	0.55
Speculative-Grade	2.23	7.09	10.38	12.84
All Corporates	1.04	3.20	4.61	5.91



Exhibit 22 – Continued

Cohort Formed January 1, 1998

Years:	1	2	3
Aaa	0.00	0.00	0.00
Aa	0.00	0.00	0.00
A	0.00	0.00	0.00
Baa	0.00	0.00	1.12
Ba	1.47	1.47	2.50
B	10.32	24.36	30.10
Investment-Grade	0.00	0.00	0.44
Speculative-Grade	5.47	10.87	13.49
All Corporates	2.41	4.70	6.01

Cohort Formed January 1, 1999

Years:	1	2
Aaa	0.00	0.00
Aa	0.00	0.00
A	0.00	0.00
Baa	0.00	0.91
Ba	0.00	0.83
B	9.21	15.37
Investment-Grade	0.00	0.39
Speculative-Grade	4.88	7.46
All Corporates	2.15	3.48

Cohort Formed January 1, 2000

Years:	1
Aaa	0.00
Aa	0.00
A	0.00
Baa	0.78
Ba	0.76
B	5.06
Investment-Grade	0.34
Speculative-Grade	2.29
All Corporates	1.17



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