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Moody's Rating Migration and Credit Quality Correlation, 1920-1996

Summary

In this study, we examine Moody's bond rating and default databases to document historical patterns in ratings movements and the correlations of the movements of ratings of individual issuers with each other. While the statistics presented in this report will interest a variety of readers, we expect that they will be particularly useful to those readers involved in the pricing of fixed-income instruments and credit derivatives, the credit assessment of pools of corporate debt issues underlying a variety of structured transactions, and in the development of sophisticated credit risk management systems. This analysis includes the credit histories of over 14,000 US and non-US corporate debt issuers since 1920, a time-frame that allows comparison of rating change patterns over a variety of business, interest rate, and other economic cycles. Briefly, the results of this study indicate that:

- Over the past 77 years sudden large changes in credit quality have been very infrequent. Of all rating changes since 1920, only 11% involved changes of more than one rating category.
- Higher ratings have been generally less likely than lower ratings to be revised over any time period from one to 15 years. Since 1920, an issuer that started any given year with a rating of Aaa ended the year with an Aaa 88% of the time. By contrast, an issuer that began the year with a rating of Ba ended the year with that same rating 76% of the time.
- When higher-end investment-grade ratings have changed, they have demonstrated a greater propensity for downward movement than upward. Corporate issuers rated Aa to A have demonstrated a greater probability of ending any given year one rating category lower than that with which they started than they have of ending one rating category higher. However, at the Baa level, issuers are only slightly more likely to drift below Baa as above in any given one-year period. Furthermore, as the time horizon expands, non-defaulting Baa-rated issuers stand a greater probability of moving higher than lower. Continuing down the spectrum, there is a relatively greater chance for a non-defaulting B-rated issuer to enjoy a net upgrade than a non-defaulting Ba-rated issuer.
- There is evidence that movements in credit qualities of different issuers are correlated with each other and that the strength of this correlation is determined, in part, by macroeconomic, industrial, geographic, and temporal factors. The extent to which the changes in credit quality among different issues in a portfolio are or are not correlated can have a significant impact on the overall volatility of that portfolio. Possible correlations can be examined through rating and joint rating transition matrices.

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Introduction

Practitioners and academics alike have made great strides in the measurement and management of many financial risks including those attributable to interest rate, exchange rate, and market fluctuations. Noticeably absent from this list of financial risks is credit risk. The tremendous informational requirements and complexity of issuer-specific credit analysis combined with the difficulty of directly observing the price of credit risk has conspired to hinder progress in the theory and practice of credit risk management. Yet there is a real need to more precisely quantify credit exposures, particularly within a portfolio context and investors are increasingly adapting variants of the theories and methodologies previously used to address other financial risks to credit risk. The new approaches are typically differentiated from previous credit risk management methodologies in that they require more detailed knowledge of the statistical characteristics of credit quality. One specific need is for a more complete understanding of the evolution, through time, of firm credit quality. This report begins to address this need by examining historical patterns in the movements and co-movements of Moody's ratings.

Changes in credit quality are of interest to investors for a variety of reasons. The accurate pricing of total return and default swaps, as well as of other credit derivatives, depends critically upon the distribution of the reference asset's future credit quality. The ability of a structured transaction to meet contractual payments may be dependent on the credit quality of an underlying pool of corporate debt issues. Loan indentures may offer a rated entity the option to repay a loan before maturity in the event of an upgrade. Finally, for a "total return"-oriented fixed-income investor, the movements and co-movements of credit qualities are of critical importance in understanding the credit risk characteristics of his or her portfolio and the effects of prospective purchases or sales.

A factor critical to understanding the future distribution of the value of a credit-sensitive investment is the likelihood that a change in credit quality will occur. The rating transition matrices presented in this report describe various aspects of the probability of rating changes and default for corporate debt issuers for some or all of the last 77 years. A factor critical to understanding the future distribution of the value of a portfolio of credit-sensitive investments is the likelihood that changes in the credit quality of several issuers will occur jointly. We therefore present additional statistics — summarized in joint rating transition matrices — that describe the likelihood of various joint rating changes and defaults.

The first section of this report describes the database and methodology that underlie this research, as well as Moody's corporate bond default research. The second section gives an overview of the broad patterns rating changes have displayed over the past 77 years. The third section addresses the volatility and correlation of rating changes, while the final section summarizes broadly the report's findings and their implications for investors.

Data & Methodology

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 14,000 issuers that sold long-term debt publicly between 1919 and 1996. As of January 1, 1997, approximately 3,500 of those issuers held Moody's ratings. These issuers account for the bulk of the outstanding dollar amount of U.S. public long-term corporate debt and a substantial part of public issuance abroad.

As with Moody's special reports on long-term public debt defaults[1], the unit of study is the long-term, public corporate debt issuer, as opposed to either the par amount of debt or the number of debt issues. The rationale for this methodology is that Moody's intends its ratings to support credit decisions. Separately tabulating multiple issues or the par amounts of a single issuer would bias the results toward the default characteristics of issuers with multiple issues or large amounts of outstanding debt and would therefore be of less utility to an investor contemplating credits without these features. We have also omitted firms whose rated debt consists solely of issues backed by entities which are not members of the issuer's corporate family, since the ratings of such debt would reflect that support and not the credit quality of the issuing firm.

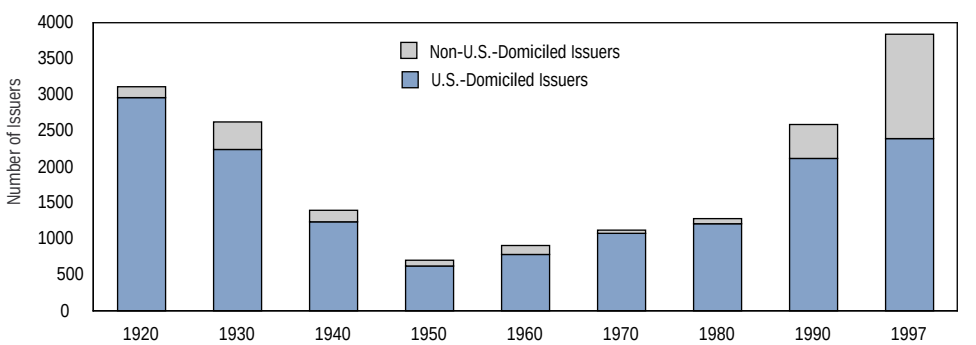
1 "Historical Default Rates of Corporate Bond Issuers, 1920-1996," A Moody's Special Comment, 1/97.

In order to count each legal entity separately, we track each issuer's actual, or implied, senior unsecured long-term debt rating. If the issuer has rated senior unsecured debt, we use that rating as the measure of the issuer's credit quality for as long as such an obligations' ratings are outstanding. In cases where an issuer does not have senior unsecured debt, we estimate what this debt would most likely be rated if it did exist. We derive the estimated senior unsecured rating from actual ratings assigned to an issuer's other rated debt via a simple notching algorithm intended to reflect observed ratings relationships. While correct on average, in any particular case, the estimated senior unsecured ratings may differ from what Moody's would have actually rated a particular senior unsecured obligation. The estimated senior unsecured ratings have not been examined by Moody's analysts and benefit only indirectly from the full scope of analysis underlying Moody's bond ratings.

We compiled the default histories used in this study from a variety of sources, including our own Industrial, Railroad, and Public Utilities Manuals; reports of the National Quotation Service; various issues of The Commercial and Financial Chronicle; our library of financial reports; press releases; press clippings; internal memoranda; and records of analyst contact with rated issuers. We also examined documents from the Securities and Exchange Commission, The Dun & Bradstreet Corp., the New York Stock Exchange, and the American Stock Exchange. The default database covers approximately 3,000 defaults by issuers both rated and unrated by Moody's.

Exhibit 1 details the number of firms included in our ratings database as of the start of each decade since 1920. The downward trend from 1920 through 1950 reflects the public bond market's retrenchment following the Great Depression and World War II, increasing financial intermediation, and consolidation in the railroad and utilities industries. Since 1950, however, the number of rated firms has increased steadily, with sharp increases over the 1980s and 1990s. The increase of the 1980s reflects, in part, the development of the junk bond market in the U.S., which attracted a new set of issuers to the public bond market. The increase of the 1990s, on the other hand, primarily reflects the growth of, and Moody's continued expansion into, non-U.S. markets. It was not until 1994 that Moody's again rated as many corporate issuers as it did in 1920.

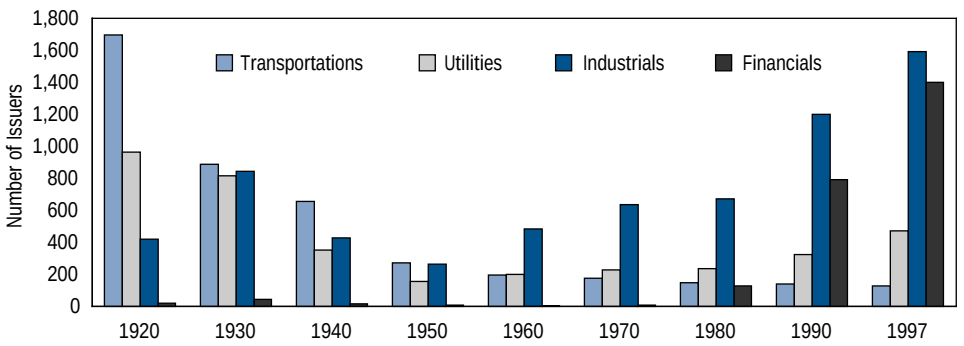
Exhibit 1 - Moody's-Rated Corporate Bond Issuers, 1920-1997



Non-U.S. issuers comprised nearly as large a percentage of the Moody's-rated universe in January of 1930 (15%) as they did in January of 1990 (18%). The portion of rated issuers domiciled outside of the United States hit a high in 1930 but trailed off to an all-time low in 1970. Since then, this fraction has grown significantly to higher than it has ever been in the past and stood at more than 35% as of the beginning of 1997. Before 1980, the non-U.S. issuers Moody's rated were predominantly those that tapped the U.S. bond market. In recent years, however, Moody's has extended ratings to many more issuers placing debt in non-U.S. markets.

Historically, the industrial cross-section of U.S. bond issuers has shifted with broad patterns in the country's capital formation process. Consequently, the industrial composition of firms with Moody's-rated debt has also shifted. Exhibit 2 traces the industrial composition of Moody's-rated, corporate issuers from 1920 to the present. In the early part of the century, railroads absorbed the majority of the country's investment. As of 1920, more than half of the issuers Moody's rated were railroad companies. Since 1920, railroads have consolidated so that by January 1997, the entire transportation industry comprised only 4% of Moody's-rated, corporate public debt issuers. On the other hand, industrials have expanded to represent 44% of the total number of rated firms from 14% in 1920. Since Moody's began rating bank debt in 1971, financial companies have expanded significantly to comprise more than 35% of the Moody's-rated universe as of the start of 1997.

Exhibit 2 - Industrial Composition of Issuers, 1920-1997



Rating Migration

Trends in Corporate Credit Quality From 1920 Through 1996

In order to measure general trends in the credit quality of the Moody's-rated corporate universe through time, we consider annual rating drift. To calculate annual rating drift we subtract from the total number of upward rating changes (weighted by the number of ratings changed per upgrade) per year, the total number of downward rating changes (similarly weighted) per year, and divide this difference by the number of non-defaulted issuers at risk of a rating change during the course of the year.[2] Rating drift summarizes the overall increase or decrease in the credit quality of the rated universe as a percentage of one rating grade per issuer.

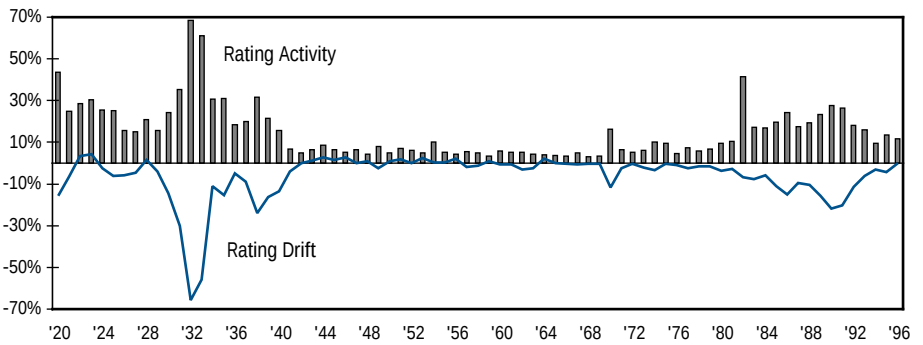
We measure annual rating activity in this report by computing the sum of all upward and downward letter rating changes (again, weighted by the number of ratings changed) and dividing by the number of non-defaulted issuers at risk of a rating change during the course of the year. This measurement captures both the effects of multiple rating changes for a single issuer within a given year and the relative sizes of rating changes. In effect, it shows the pace at which ratings change, based on units of ratings changed per issuer.

Exhibit 3 details annual rating drift and activity from 1920 through 1996 and is based upon letter rating changes as opposed to changes of alpha-numeric ratings. Moody's altered its long-term rating scale in April 1982. The traditional nine-tiered letter rating scale (Aaa, Aa, A, Baa, Ba, B, Caa, Ca, C) was expanded by attaching three numerical modifiers (a "1," "2," or "3," in order of increasing credit risk) to each of the ratings from Aa through B. The new alpha-numeric rating system is comprised of 19 grades (Aaa, Aa1, Aa2, Aa3, A1, ...etc.). Because the alpha-numeric ratings did not exist before April 1982, none of the statistics reported for these rating categories are based upon pre-April, 1982 ratings data. Statistics reported for the original letter rating scale are extended through the post April 1982 period by collapsing the alpha-

2 The number of issuers at risk of a rating change during the course of the year is the number of non-defaulted issuers holding ratings as of the start of the year less one half of the number of issuers whose ratings were withdrawn during the course of the year. The adjustment for the issuers whose ratings were withdrawn reflects the assumption that, on average, such issuers were at risk of a rating revision for only one half of one year.

numeric ratings into the original letter rating categories. For example, the Baa1, Baa2, and Baa3 ratings all would be simply considered Baa.

Exhibit 3 - Long-Term Rating Activity and Drift, 1920-1996[3]



Since 1920, annual rating drift has averaged a negative 6% while annual rating activity has averaged 15%. The rating drift time series illustrates prolonged deteriorations (represented by negative values) in overall corporate credit quality during the depression of the 1930s and the 16-year period beginning 1980. Annual rating drift averaged -24% during the 1930s and -9% during the eighties and the first half of the nineties, versus an average of just -1% for the period from 1940 to 1979. Annual rating drift was non-negative in 1996 for the first time since 1975.

The negative average annual drift for the 1930s reflects the most severe economic contraction of this century, coupled with severe asset deflation. This combination put even highly creditworthy borrowers at considerable risk of default. The increased risk of default was reflected by an increase in the incidence and size of downgrades relative to upgrades.

The significant credit deterioration beginning in 1980 was the result of a slew of special events and an overall trend towards increased corporate leverage. The recession of 1982 proved to be the most severe of the post-World War II era. Sharply lower oil prices in the mid-1980s prompted large numbers of industrial and financial company downgrades. Concerns about problem loans in the banking system led to numerous downgrades in 1989, just one year before the onset of another recession.

Rating Change Magnitude

We define the magnitude of a rating change as the number of rating categories that a rating change spans. For example, an upgrade from Ba to Baa covers one letter rating category while a downgrade from Ba to Caa covers 2 categories. This same concept applies analogously to our alpha-numeric ratings. Exhibits 4 and 5 display the frequency of rating revisions by the magnitude of change for the entire period spanned by our database.

Changes of smaller magnitude are relatively more frequent than are large rating revisions. Rating changes of three ratings or more have occurred historically only about 2% of the time. For the alpha-numeric ratings, changes of more than four rating notches have occurred historically only about 3% of the time.

3 Figures for 1982 are straight-line interpolations between 1981 and 1983. We use this interpolation because our algorithm for implying senior ratings artificially inflated the numbers of upgrades and downgrades during our 1982 adoption of numerically modified ratings. For example, an issuer with subordinated debt rated Ba prior to 1982 has a senior implied rating of Baa. If, upon adoption of the modified rating system, this issue comes in at the lower end of the Ba scale, say Ba3, then its senior implied rating is now Ba1. This corresponds to the letter rating Ba. Hence our algorithm has artificially created a downgrade from Baa to Ba even though there has been no rating revision. The actual numbers occurred in nearly the same ratio as those presented here.

Exhibit 4 - Frequency of Letter Rating Changes of Various Magnitudes
January, 1920 - March, 1997

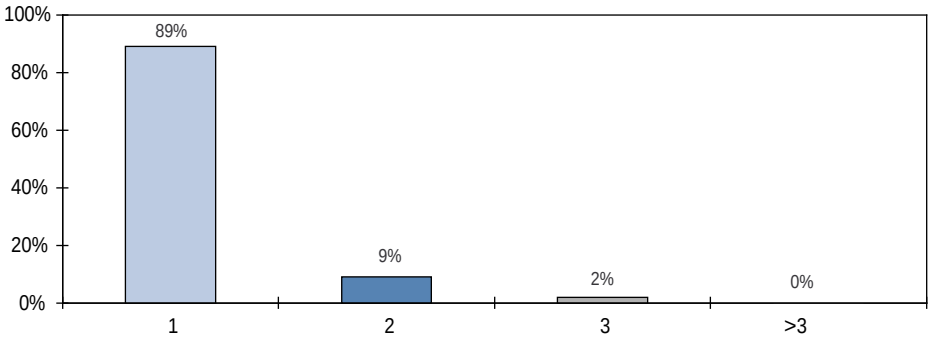
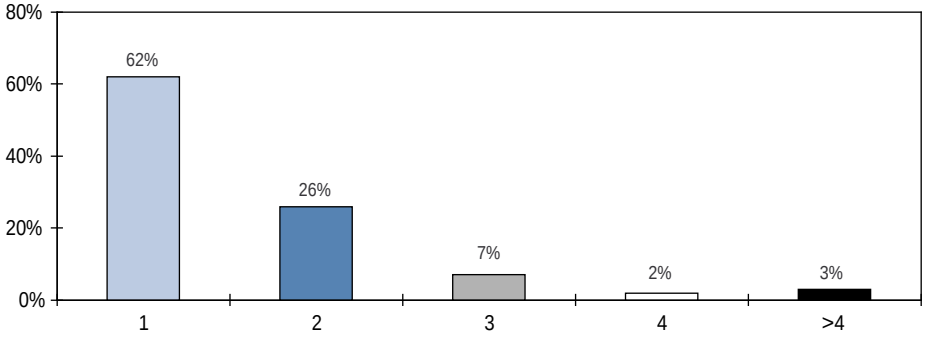


Exhibit 5 - Frequency of Alpha-Numeric Rating Changes of Various Magnitudes
April, 1982 - March, 1997



Rating Change Magnitude and Direction—Rating Transition Matrices

Unlike the charts above, an average transition matrix is a concise representation not only of the size, but also the direction of typical rating changes. Exhibit 6 below depicts an average rating transition matrix defined for a one-year time horizon. Each row indicates the rating group at the beginning of a one-year time period. Each column corresponds to a rating group, default, or withdrawn rating ("WR") as of the end of the one-year period. Each cell entry, excluding the "Default" and "WR" columns, is the average fraction of issuers who held the row rating at the beginning of the time period and the column rating or status at the end of the time period.

The upper left-hand corner, for example, indicates that on average over the period from 1920 to the present, 88.32% of Aaa's have remained at that level over the course of one year. The next percentage to the right indicates that 6.15% of Aaa's have, on average, suffered a downgrade to Aa. Also, by way of example, the chart indicates that 2.30% of all A-rated companies enjoyed a net improvement of one letter rating (to Aa) by the end of any one year period.[4]

4 The increase in credit quality is net since a rating transition matrix is a snapshot of the evolution of the rating profile at a specific point in time. Therefore, they do not address the dynamics of how the hypothetical A-rated issuer arrived at the Aa rating one year later. It may well have been upgraded to Aaa and then downgraded to Aa between the beginning and end of the one-year period.

Exhibit 6—Average One-Year Rating Transition Matrix, 1920 to 1996

	Rating To:								
Rating From:	**Aaa**	**Aa**	**A**	**Baa**	**Ba**	**B**	**Caa-C**	**Default**	**WR**
Aaa	88.32%	6.15%	0.99%	0.23%	0.02%	0.00%	0.00%	0.00%	4.29%
Aa	1.21%	86.76%	5.76%	0.66%	0.16%	0.02%	0.00%	0.06%	5.36%
A	0.07%	2.30%	86.09%	4.67%	0.63%	0.10%	0.02%	0.12%	5.99%
Baa	0.03%	0.24%	3.87%	82.52%	4.68%	0.61%	0.06%	0.28%	7.71%
Ba	0.01%	0.08%	0.39%	4.61%	79.03%	4.96%	0.41%	1.11%	9.39%
B	0.00%	0.04%	0.13%	0.60%	5.79%	76.33%	3.08%	3.49%	10.53%
Caa-C	0.00%	0.02%	0.04%	0.34%	1.26%	5.29%	71.87%	12.41%	8.78%

The largest values in the transition matrix are along the diagonal, indicating that the most likely rating for an issuer at the end of a one-year time horizon is the rating with which the issuer started the period. Moving off of the diagonal, the values fall off very quickly as very large changes in credit quality over a one-year period are infrequent.

The patterns in the alpha-numeric rating transition matrix in Exhibit 7 are roughly similar to those of the average one-year letter rating transition matrix. However, note that the estimated likelihood that an Aaa rating is maintained over the course of one year is just 84.64% versus an estimated 88.34% in Exhibit 6. Part of the reason for this difference is that the alpha-numeric transition matrices are estimated on data available since April 1982, when Moody's adopted the current alpha-numeric rating scale. From 1982 until just recently, there has been an overall trend towards decreasing credit quality as documented by Moody's rating drift statistics in Exhibit 3. Hence, while the average letter rating transition matrices incorporate the entire post-WW II to 1979 period of very low credit risk and volatility, the average alpha-numeric rating transition matrices are estimated over a period characterized by historically high credit risk.

Additionally, the diagonal elements of Exhibit 7 are smaller than those of Exhibit 6. This is because the alpha-numeric ratings represent a finer gradation of credit risk than the letter rating scale. Consequently, finer movements in credit quality that would not have been substantial enough to warrant an entire letter rating change can be registered by rating changes of one or two notches. Because finer changes in credit quality are being measured, more rating changes are registered and the average rating transition rates estimated below reflect the greater rating change volatility of the alpha-numeric ratings.

Exhibit 7—Average, One-Year Alpha-Numeric Rating Transition Matrix, 1983-1996

	Rating To :																		
Rating From:	**Aaa**	**Aa1**	**Aa2**	**Aa3**	**A1**	**A2**	**A3**	**Baa1**	**Baa2**	**Baa3**	**Ba1**	**Ba2**	**Ba3**	**B1**	**B2**	**B3**	**Caa**	**Default**	**WR**
Aaa	84.64%	5.53%	3.13%	0.67%	0.77%	0.36%	0.14%	0.00%	0.00%	0.00%	0.05%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	4.71%
Aa1	2.53%	74.04%	8.63%	7.87%	2.61%	0.23%	0.00%	0.24%	0.00%	0.00%	0.12%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	3.74%
Aa2	0.61%	2.54%	76.97%	9.15%	4.30%	1.15%	0.73%	0.21%	0.00%	0.00%	0.00%	0.00%	0.07%	0.07%	0.00%	0.00%	0.00%	0.00%	4.20%
Aa3	0.10%	0.43%	2.90%	76.85%	10.25%	3.83%	0.85%	0.10%	0.25%	0.22%	0.00%	0.05%	0.12%	0.00%	0.00%	0.00%	0.00%	0.00%	4.06%
A1	0.04%	0.10%	0.65%	4.45%	78.75%	7.25%	2.93%	0.70%	0.22%	0.18%	0.37%	0.37%	0.07%	0.17%	0.00%	0.00%	0.00%	0.00%	3.76%
A2	0.03%	0.04%	0.20%	0.63%	5.46%	77.32%	7.23%	3.04%	0.76%	0.28%	0.20%	0.13%	0.13%	0.03%	0.07%	0.00%	0.03%	0.00%	4.42%
A3	0.03%	0.11%	0.00%	0.20%	1.53%	8.56%	71.59%	6.47%	3.68%	1.43%	0.45%	0.18%	0.26%	0.41%	0.04%	0.00%	0.00%	0.00%	5.06%
Baa1	0.06%	0.00%	0.09%	0.11%	0.15%	3.11%	8.49%	69.73%	7.61%	3.03%	0.95%	0.38%	0.45%	0.62%	0.12%	0.00%	0.00%	0.06%	5.05%
Baa2	0.00%	0.12%	0.16%	0.15%	0.14%	0.93%	3.58%	7.49%	69.65%	7.41%	1.89%	0.40%	0.68%	0.40%	0.47%	0.29%	0.00%	0.06%	6.20%
Baa3	0.04%	0.00%	0.00%	0.06%	0.24%	0.57%	0.44%	4.09%	9.89%	64.87%	6.53%	2.94%	1.90%	0.89%	0.31%	0.07%	0.13%	0.52%	6.52%
Ba1	0.11%	0.00%	0.00%	0.00%	0.16%	0.10%	0.62%	0.84%	2.77%	6.12%	68.60%	4.49%	3.75%	0.76%	1.27%	0.91%	0.11%	0.81%	8.59%
Ba2	0.00%	0.00%	0.00%	0.00%	0.00%	0.17%	0.12%	0.30%	0.47%	2.22%	7.23%	66.67%	5.59%	1.25%	3.85%	1.60%	0.24%	0.68%	9.62%
Ba3	0.00%	0.03%	0.03%	0.00%	0.00%	0.21%	0.13%	0.13%	0.20%	0.77%	2.31%	4.59%	69.25%	2.45%	5.69%	2.41%	0.49%	2.69%	8.62%
B1	0.03%	0.00%	0.03%	0.00%	0.06%	0.05%	0.18%	0.08%	0.31%	0.39%	0.33%	2.42%	5.88%	70.45%	1.48%	4.88%	0.90%	4.04%	8.48%
B2	0.00%	0.00%	0.08%	0.00%	0.15%	0.00%	0.06%	0.15%	0.11%	0.00%	0.23%	1.95%	3.42%	5.35%	62.02%	7.30%	2.53%	8.67%	7.99%
B3	0.00%	0.00%	0.06%	0.00%	0.00%	0.00%	0.00%	0.10%	0.16%	0.18%	0.21%	0.29%	1.37%	4.52%	2.28%	64.57%	3.84%	13.36%	9.05%
Caa-C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.60%	0.60%	0.79%	0.00%	2.17%	2.14%	1.34%	2.54%	51.08%	28.33%	10.41%

Withdrawn Ratings

The withdrawn rating category (column heading "WR") in the preceding (average) rating transition matrices corresponds to cases where Moody's has withdrawn all of an issuer's ratings. The likelihood of a rating withdrawal generally increases as credit quality decreases. Exhibit 6 indicates that over a one-year time period, Aaa-rated issuers have an average 4.29% risk of rating withdrawal while B-rated issuers have more than double the risk, 10.53%. At least part of the reason for this pattern is that private debt markets are relatively more attractive for many of the smaller borrowers that generally carry lower ratings. Consequently, such issuers have been more likely to replace rated public bonds with unrated private debt.

The rationale for the withdrawal of all of a company's debt ratings could be important in the overall understanding of the credit dynamics implied by the rating transition matrices given above. For example, Moody's might withdraw a debt rating because the underlying issue has been retired. In this case, the withdrawn ratings simply reflect the issuer's exit from the public bond market and have no negative credit implications. On the other hand, in some cases, Moody's withdraws ratings because the information necessary to accurately rate the company's debt is not available. In such cases, it is conceivable that the withdrawn rating may correlate with increased credit risk.

In order to better understand the reasons why ratings are withdrawn, we examined Moody's corporate bond ratings database. Of the over 35,000 withdrawn long-term individual debt ratings considered, 92% were withdrawn because either an issue had matured or had been called. In the remaining 8% of cases, the reason for the withdrawn rating was not specified or the rating withdrawal was associated with any of a variety of situations including conversions, mergers, defeasances, bankruptcies, or the lack of sufficient information to accurately rate the debt. Of the 8% of all rating withdrawals that were not related to debt maturities, calls, or defaults[5], one-half were withdrawn for unspecified reasons and an additional 1% of the total number of withdrawals occurred for reasons that could be connected with negative credit developments (e.g., insufficient information to maintain the rating or an indenture amendment). In total, 95% of the rating withdrawals were not associated with any deterioration in credit quality. An additional 4% occurred for unspecified reasons and so may have been associated with a credit deterioration. However, this category also includes cases in which the par amount of the obligation outstanding has fallen to such a low level that there is little or no trading or investor interest in the maintenance of the rating. In only 1% of the cases is a deterioration in credit quality likely.

The ratings examined in this report are not Moody's published individual debt ratings, but instead senior unsecured, or estimated senior unsecured, ratings for firms. The circumstances that lead Moody's to withdraw ratings on all of a company's debts may be different from those that lead Moody's to withdraw a rating on any particular debt. To explore this possibility, we looked at each withdrawn rating in Moody's database of senior unsecured, and estimated senior unsecured, rating histories. In 87% of the cases in which Moody's has withdrawn all of a company's debt ratings, the withdrawal was the result of debt maturity, call, conversion or other means consistent with the debts' indentures. Therefore, in only 13% of all cases were ratings withdrawn under circumstances that could be correlated with an increase in credit risk. In 9% of the cases, the reason for the rating withdrawal was unspecified. In the remaining 4% of the cases, ratings were withdrawn because of a lack of sufficient information. The increases in the percentages of rating withdrawals associated with either unspecified, and therefore possibly risky developments, or developments likely associated with a credit deterioration indicates that the reasons that lead Moody's to withdraw a bond's rating are not necessarily the same as those that lead Moody's to withdraw all ratings on debt that a company may have outstanding.

An important use of rating transition data is in the modeling of the prices of credit sensitive securities. In many cases, an investor enters into a long-term agreement and would like to summarize the likely credit position of a counterparty at the end of the transaction. Because the withdrawn rating is most commonly associated with exit from the debt markets, such investors are interested in rating transition matrices that are estimated for rating histories that do not include rating withdrawals. Because rating withdrawals are not directly related to increased default risk, a transition matrix can be created that excludes such withdrawals without generating significant distortion. Such a matrix can be created by distributing the probability mass associated with rating withdrawal across the remaining categories on a probability weighted

5 We do not consider withdrawals associated with a default in this analysis under the rationale that a default has already occurred in such cases and the question of whether the withdrawn rating carries information about the future creditworthiness of the issuer is moot.

basis. Another approach, demonstrated in Exhibit 8, is to estimate rating transition matrices that are conditioned upon the issuer's rating remaining outstanding over the entire period spanned by the matrix. The two methodologies bear similar results.

Exhibit 8—Average One-Year Rating Transition Matrix, 1920 to 1996 (conditional upon no rating withdrawal)

Rating From:	Rating To: Aaa	Aa	A	Baa	Ba	B	Caa-C	Default
Aaa	92.18%	6.51%	1.04%	0.25%	0.02%	0.00%	0.00%	0.00%
Aa	1.29%	91.62%	6.11%	0.70%	0.18%	0.03%	0.00%	0.07%
A	0.08%	2.50%	91.36%	5.11%	0.69%	0.11%	0.02%	0.14%
Baa	0.04%	0.27%	4.22%	89.16%	5.25%	0.68%	0.07%	0.31%
Ba	0.02%	0.09%	0.44%	5.11%	87.08%	5.57%	0.46%	1.25%
B	0.00%	0.04%	0.14%	0.69%	6.52%	85.20%	3.54%	3.87%
Caa-C	0.00%	0.02%	0.04%	0.37%	1.45%	6.00%	78.30%	13.81%

Multi-Year, Rating Transition Matrices

We can define average rating transition matrices over a variety of time horizons. Exhibit 17 in the appendix to this report includes average letter rating transition matrices similar to those previously shown, but defined over two through 10-year, and 15-year time horizons. Exhibit 18 of the appendix presents alphanumeric average rating transition matrices for 2- through 10-year time horizons. These transition matrices include rating withdrawal as a possible transition state. For those readers interested in estimating a transition matrix that does not include rating withdrawal as a state, a simple approximation is obtained by distributing the probability associated with the rating withdrawal across the remaining ratings on a probability weighted basis. As mentioned in the previous section, because rating withdrawal is not directly related to credit deterioration, the error introduced by this technique is generally small.

Higher ratings are more likely to be maintained than are lower ratings over the two to 15 year time horizon presented in these matrices. The higher likelihood of ratings remaining unchanged for higher credit ratings indicates that not only are the higher rating categories associated with lower default risk (as indicated by the default transition rates posted in the "Default" column) but that they are also more stable.

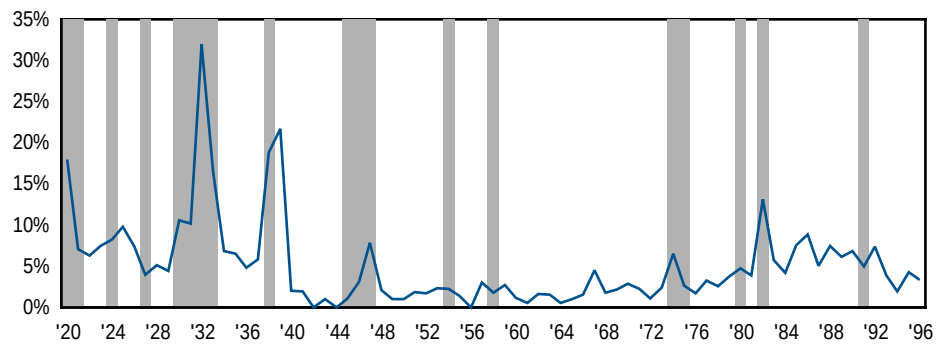
Considering the matrices listed in Exhibit 17 of the appendix, one sees that for the Aa and A ratings, the frequency of net downgrades generally exceeds that of net upgrades. For any of the given time horizons, it is more likely for an issuer starting with one of these ratings to have a lower rating at the end of the period than a higher rating. For issuers rated Baa that have not defaulted, however, this pattern is not as pronounced. Within a one-year horizon, Baa-rated issuers are only slightly more likely to be rated below Baa as above. As the time horizon covered by the transition matrix expands, Baa-rated issuers that have not defaulted are more likely to have a higher rating than lower until, after ten years, there is nearly two times as great a chance of having a single-A rating (11.71%) as there is of having a Ba rating (6.36%). Continuing down the credit spectrum, there is a relatively greater chance of a non-defaulted B-rated issuer enjoying a net upgrade than there is for a Ba-rated issuer. Caa-and-lower rated issuers, however, tend to be too weak to make the uphill climb and tend to fall into default.

Rating Transition Rate Volatility and Credit Quality Correlation

Rating Transition Rate Volatility

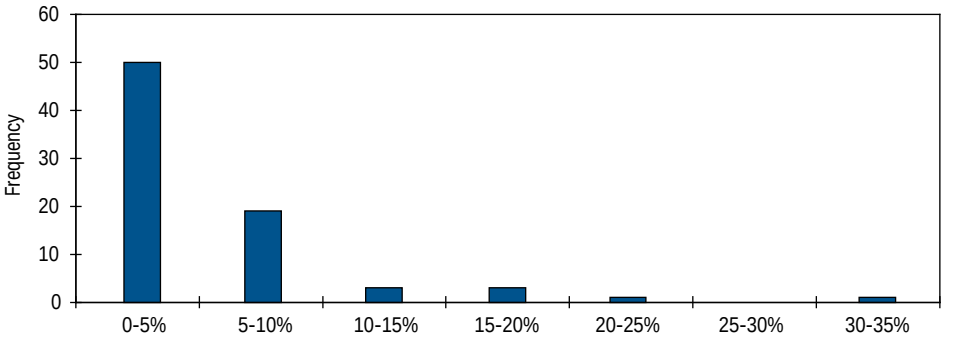
The rating transition matrices above summarize the average risk of changes in credit quality over a specified time period. However, the risk of a change of credit quality varies from year to year as unexpected changes in macroeconomic variables and the business environment in general alter firms' credit outlooks. Consequently, there is volatility in rating transition rates from year to year. The average rating transition matrices reported above are calculated over as many as 77 years, they smooth over variations in the year-to-year rating transition rates caused by fluctuating macroeconomic and business conditions. To investigate rating transition rate volatility, we have, by way of example, expanded the average, one-year, A-to-Baa transition rate into its 77 constituent observations — one for each year since 1920 as shown in Exhibit 9. The gray bars indicate years for which the annual growth rate of real US gross domestic product was negative, hinting at downgrade risk countercyclicality — that is, economic contractions seem to be associated with greater downgrade risk.

Exhibit 9 - Yearly Fraction of Issuers Downgraded from A to Baa (Gray bars indicate years of negative growth in real U.S. GDP)



As presented in the A-row, Baa-column of Exhibit 8, the average fraction of issuers downgraded from A to Baa over the course of one year is 5.11%. However, in three different years during the long period of very low default risk extending from WW II to the 1970s (1942, 1944, and 1956), no issuer (with an A, or estimated A, senior unsecured debt rating) experienced this downgrade. At the height of the Great Depression, 1932, 32% of A-rated issuers were downgraded to Baa.

Exhibit 10 - Histogram of Yearly A-to-Baa Rating Transition Rates, 1920-1996



Statistically, the median value of 3.68% is a more insightful measure of the center of the distribution of A-to-Baa transitions (shown in Exhibit 10) than is the mean. Exhibit 10 reveals that the annual risk of downgrade from A to Baa is concentrated in the 0% to 10% range, but that substantially larger fractions have not been uncommon historically. The frequency distribution of this rating transition rate is truncated on the left at zero and has a long right-hand tail. Consequently, reliance on the mean and standard deviation statistics to describe the distribution's center and dispersion is questionable.

The standard deviation of the transition rates pictured above, 5.33%, coupled with the assumption that rating transition rates are normally distributed generates negative transition rates at the 90% level of confidence. Specifically, a 90% confidence interval for the average transition rate, 5.11%, is (-1.73%, 11.94%). Considering the data directly, approximately 90% of the observations (69 of the 77) lie between 0.56% on the low side and 16.44% on the high side. This indicates that not only are A-to-Baa transition rates below 0.56% relatively rare, but that transition rates greater than 11.94% are not rare. This highlights the limitations of the mean and standard deviation in describing the distribution of transition rates.

The asymmetry of the A-to-Baa transition rate is not unique. Exhibit 19 of the appendix provides selected summary statistics describing the distributions of all of the one-year transition rates. The medians listed in that table can be compared with the average values presented in Exhibit 8. The averages presented there may be used in conjunction with the standard deviation and the 5%- and 95%-tiles to gain a better understanding of the asymmetry of each one-year transition rate's distribution.

Credit Quality Correlation

Differences in the outlooks for firms' credit risks arise as conditions in firms' factor and output markets, and macroeconomic and regulatory environments adjust. For example, Exhibit 9 highlights the sensitivity of the risk of downgrade for A-rated issuers to economic growth. Because operating conditions adjust dynamically and movement in any one macroeconomic variable may affect several issuers, the credit ratings of different obligors are likely to be linked and therefore to move together. In this section, we examine some of the evidence ratings provide on the existence of credit quality correlation and provide some indication of their economic importance to the understanding of the portfolio characteristics of credit risk.

To examine the question of whether credit quality is correlated across firms, we first examine the patterns in the co-movements of ratings that we would expect to see if credit quality were not correlated. We then examine actual rating co-movements in our database of rating histories. Finally, we compare the two results to answer to the question of whether the credit qualities of different firms is likely to be correlated or not.

Consider, for example, two issuers with Baa-rated senior unsecured debt. Historically, over the course of one year, Baa-rated issuers have maintained the same rating, moved to another rating category, or defaulted with the probabilities reported in the Baa row of the one-year transition matrix in Exhibit 8. Because there are eight possible transitions (seven different rating groupings + default) for each of the two issuers, there are a total of 64 (8×8) possible credit quality combinations for the two issuers at the end of one year. If we impose the assumption that the credit qualities of these issuers are uncorrelated, the likelihoods of each possible credit quality combination for the two issuers at the end of one year are easily calculated. They are simply the products of the likelihoods of each issuer making the specified transition. For example, the probability of the first Baa-rated issuer moving to the A rating over a one-year time horizon is estimated to be 4.22% (the Baa-A entry of Exhibit 8). The probability of the second Baa-rated issuer moving to the Ba rating over a one-year time horizon is estimated to be 5.25% (the Baa-Ba entry of Exhibit 8). Assuming no credit quality correlation, the likelihood of the first issuer's rating changing to A and the second issuer's rating changing to Ba over the course of one year is simply the product of these two likelihoods, 0.22%. If we perform this calculation for each of the 64 possible rating combinations, we obtain a matrix describing the joint probability distribution of rating migrations for the portfolio of two issuers at the end of one year. These are detailed in Exhibit 11.

Exhibit 11—Joint Rating Transition Matrix Assuming no Credit Quality Correlation
(Two, initially Baa-rated, issuers. Based on data available since 1920)

			Second Issuer's End-of-Period Rating							
			Aaa	Aa	A	Baa	Ba	B	Caa-C	Default
			0.04%	0.27%	4.22%	89.16%	5.25%	0.68%	0.07%	0.31%
First Issuer's End-of-Period Rating	Aaa	0.04%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%
	Aa	0.27%	0.00%	0.00%	0.01%	0.24%	0.01%	0.00%	0.00%	0.00%
	A	4.22%	0.00%	0.01%	0.18%	3.76%	0.22%	0.03%	0.00%	0.01%
	Baa	89.16%	0.03%	0.24%	3.76%	79.49%	4.68%	0.61%	0.06%	0.28%
	Ba	5.25%	0.00%	0.01%	0.22%	4.68%	0.28%	0.04%	0.00%	0.02%
	B	0.68%	0.00%	0.00%	0.03%	0.61%	0.04%	0.00%	0.00%	0.00%
	Caa-C	0.07%	0.00%	0.00%	0.00%	0.06%	0.00%	0.00%	0.00%	0.00%
	Default	0.31%	0.00%	0.00%	0.01%	0.28%	0.02%	0.00%	0.00%	0.00%

Each cell entry of Exhibit 11 is an estimate of the likelihood that the first Baa-rated issuer will move to the corresponding row rating and the second issuer will move to the corresponding column rating. The first row of numbers represents the sum of each column of probabilities and identically sums to our likelihood estimate that a Baa-rated issuer will move to the corresponding column rating over the course of one year (the Baa row of the one-year rating transition matrix of Exhibit 8).[6] Similarly, the first column of numbers represents the sum of each row of probabilities and also sums to our likelihood estimate that a Baa-rated issuer will move to the corresponding row rating over the course of one year. The 64 interior cells of the joint rating transition matrix above sum to 100%. They completely describe the probabilities associated with the range of possible joint rating outcomes at the end of one year for the two Baa-rated issuers under the assumption that their credit qualities are not correlated. The most likely outcome for the two initially Baa-rated issuers at the end of one year is that they both remain at the Baa rating. The likelihood of this outcome is estimated at 79.49% (the entry in the Baa row and the Baa column of Exhibit 11). The next most likely outcome is for one issuer to be downgraded to Ba while the other remains at Baa, 4.68%. This can happen in either of two ways: the first issuer could be the one downgraded, while the second maintains its Baa rating (this likelihood is given in the Ba row, Ba column cell of Exhibit 11) or vice versa (the Baa row, Ba column cell). There is an estimated 0.00% risk that both issuers default by the end of one year.

We derived Exhibit 11 under the assumption of no credit quality correlation. We obtain evidence about the true nature of credit quality correlation by comparing these results with those we obtain directly from our database of rating histories.

In Exhibit 12 we directly estimate an empirical joint rating transition matrix without imposing the assumption of no correlation. To do that, we formed a dataset of all possible pairs of Baa-rated issuers as of the start of each year since 1920 and then examined the ratings combinations of those pairs at the ends of each one-year period. The relative frequency of the actual historically observed ratings co-movements for each pair of issuers are estimates of the joint migration probabilities. These are presented in Exhibit 12.

Exhibit 12—Empirical Joint Rating Transition Matrix
(Two, initially Baa-rated, issuers. Based on data available since 1920)

			Second Issuer's End-of-Period Rating							
			Aaa	Aa	A	Baa	Ba	B	Caa-C	Default
			0.04%	0.27%	4.22%	89.16%	5.25%	0.68%	0.07%	0.31%
	Aaa	0.04%	0.00%	0.00%	0.00%	0.03%	0.00%	0.00%	0.00%	0.00%
	Aa	0.27%	0.00%	0.00%	0.03%	0.21%	0.03%	0.00%	0.00%	0.00%
	A	4.22%	0.01%	0.03%	0.36%	3.46%	0.31%	0.04%	0.00%	0.02%
	Baa	89.16%	0.03%	0.21%	3.46%	80.50%	4.14%	0.52%	0.05%	0.25%
	Ba	5.25%	0.00%	0.03%	0.31%	4.14%	0.63%	0.10%	0.01%	0.04%
	B	0.68%	0.00%	0.00%	0.04%	0.52%	0.10%	0.02%	0.00%	0.01%
	Caa-C	0.07%	0.00%	0.00%	0.00%	0.05%	0.01%	0.00%	0.00%	0.00%
	Default	0.31%	0.00%	0.00%	0.02%	0.25%	0.04%	0.01%	0.00%	0.00%

6 The columns of this matrix, as reported here, do not all sum exactly to the corresponding entry of the first row because of the roundoff error associated with reporting only 4 decimal points of accuracy.

The first row and the first column of numbers are the same as those of Exhibit 11 and give the "stand alone" likelihood of each issuer moving to each rating category. Each cell entry gives an estimate of the probability that, of a pair of Baa-rated issuers, the first will move to the row rating while the second will move to the column rating. For example, the entry in the Aa row and Baa column is 0.21%, indicating that there is an estimated 0.21% chance that the first issuer will move to Aa and that the second will remain at Baa.

A comparison of Exhibit 11 with Exhibit 12 provides evidence that the credit qualities of these two Baa-rated issuers are positively correlated. Positive credit quality correlation between the two Baa-rated issuers would imply that if one issuer improves in credit quality over the course of one year, the other issuer would be more likely also to improve in credit quality. Similarly, if one issuer deteriorates in credit quality, the other issuer would be more likely also to deteriorate in credit quality. The unshaded cells in the upper left hand quadrants of Exhibits 11 and 12 correspond to the probabilities that both issuers will experience an improvement in their credit ratings. The unshaded cells in the lower right hand quadrants correspond to the probabilities that both issuers will experience a deterioration in their credit ratings. If the credit quality of Baa-rated obligors is positively correlated, then the total likelihood that both obligors' ratings improve (the sum of the unshaded cells in the upper left-hand corner) or deteriorate (the sum of the unshaded cells in the lower right-hand corner) should be larger than those calculated under the assumption of no correlation. The total likelihood of an upgrade for both issuers under the assumption of no correlation is 0.21%, versus the 0.42% actually observed. The total likelihood of downgrades or default for both issuers under the assumption of no correlation is 0.40%, versus the 0.97% actually observed

The joint rating transition matrix derived under the assumption of no credit quality correlation and the empirical joint rating transition matrix, together with the issuer counts used to generate them, can be combined in a more rigorous statistical test of the assumption of no credit quality correlation.[7] Under this test, we can reject the hypothesis of no credit quality correlation at the 1% level of confidence.

The discussion above reveals evidence of credit quality correlation for Baa-rated issuers over the better part of this century. It does not, however, address variations in this outcome across different combinations of rating categories, industries, geographies, or time periods, nor does it provide an indication of the economic impact of such correlation. In the following sections, we provide some indicative calculations that more directly quantify the effects of the credit quality correlation explored above and provide an example of how correlations may vary across rating categories, industries, geographies, and the period considered.

The Impact of Credit Quality Correlation

The correlation of credit quality movements has implications for the credit risk characteristics of portfolios of credit exposures. In general, the higher the correlation, the greater the volatility of a portfolio's value that is attributable to credit risk. Exhibits 11 and 12 yield evidence of positive credit quality correlation for Baa-rated obligors. It is of interest to determine how meaningful this correlation is. Towards that end, we consider one measure of the volatility of a portfolio's value — the standard deviation.[8] We also consider a hypothetical, portfolio consisting of two similar obligations: Baa-rated, 7.5% bonds with 20 years remaining to maturity.[9] We estimate the values of these securities at the end of a one-year time horizon under each possible change in credit quality.[10] Exhibit 13 presents these valuations. If a 7.5% bond were upgraded to A, for example, we estimate that the note's value would climb to $102.06 (the figure on the row corresponding to the Baa-rated note, under the A column).

Exhibit 13—Estimated Bond Values at the End of One Year

Rating at Start of Year	Debt Description	Rating/Status at End of Year							
		Aaa	Aa	A	Baa	Ba	B	Caa-C	Default
Baa	7.5%, 20-Year Bond	$104.96	$104.26	$102.06	$100.31	$81.18	$75.47	$58.59	$44.00

7 *We used Pearson's chi-square statistic to test the hypothesis of no credit quality correlation.*
8 *The standard deviation is only one of many possible measures of portfolio risk (volatility). We examine it here not because we feel that it is the most appropriate measure but because its wide usage promotes easy understanding.*
9 *We consider debt of similar characteristics here in order to focus attention on the effects of credit quality correlation.*
10 *We estimate these values by discounting the bonds' remaining promised cash flows along a forward, zero coupon spot yield curve for that bond's rating. The valuation calculation is not central to this discussion and so we do not comment on it in detail here.*

A portfolio consisting of two of these bonds can then be easily valued under each possible joint credit outcome. For example, if one bond experienced an upgrade to Aa, we estimate its value would climb to $104.26. If the other bond were downgraded to Ba, we estimate its value would be $81.18. The portfolio's value would then be $185.44 ($104.26 + $81.18).

Under the assumption of no credit quality correlation, the expected value and standard deviation of the portfolio's value may be calculated using the probabilities given in the joint rating transition matrix estimated under the assumption of no credit quality correlation (Exhibit 11). However, we need not impose the assumption of no credit quality correlation between these bonds. We can re-estimate the expected value and standard deviation of the portfolio's value without imposing any assumptions about how credit quality moves by instead using the probabilities reported in the empirical joint rating transition matrix instead (Exhibit 12). Exhibit 14 below presents the results of these calculations.

Exhibit 14—Mean and Standard Deviation of Portfolio Value

	Expected Value	Standard Deviation
Without Correlation	$198.04	$8.12
With Correlation	$198.04	$8.43

The positive credit quality correlation manifests itself here as an increase in the standard deviation (risk) of the portfolio's future value from $8.12 under the assumption of no credit quality correlation to $8.43, a 3.8% increase. The greater standard deviation implies more variability, or risk, in the distribution of the portfolio's future value.

The difference between the standard deviation calculated using historical credit quality correlations and that calculated under the assumption of no credit quality correlation increases with the number of exposures. In the example above, if we were to include another similar bond, the difference between the standard deviation as calculated with correlation and without climbs to 7.5%. After adding 40 exposures, the standard deviation as calculated with correlation is double that calculated without.

Industrial and Geographic Considerations for Credit Quality Correlations

The ambient business environment, including capital market conditions, regulatory considerations, and economic growth are likely to contribute to the credit quality correlation highlighted by the empirical joint rating transition matrix above. However, prevailing business conditions vary across countries, industries, and time. For these reasons, the correlation of credit qualities can be expected to vary across industries, geographies, and time. Rather than explore the gamut of possible rating and joint rating transition matrices presented by industrial, geographic, and temporal segmentation, we present a sample calculation that suggests that these factors are, in fact, important determinants of the rating and joint rating migrations.

To explore industry- and geography-specific credit quality correlation further, we have appealed to patterns in ratings movements between debt issuers of different industries and geographies. Proceeding as in the previous sections, we estimated a joint rating transition matrix for two issuers, except this time we chose one A-rated European financial company and one A-rated US industrial company (see Exhibit 15). These results have been obtained from ratings data available since January 1990.

Exhibit 15—Empirical Joint Rating Transition Matrix
(One A-rated European financial issuer and one A-rated US industrial issuer)

			A-Rated US Industrial Issuer							
			Aaa 0.07%	Aa 1.46%	A 94.33%	Baa 3.89%	Ba 0.25%	B 0.00%	Caa-C 0.00%	Default 0.00%
A-Rated European Financial Issuer	Aaa	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Aa	2.29%	0.00%	0.04%	2.15%	0.09%	0.01%	0.00%	0.00%	0.00%
	A	92.13%	0.06%	1.34%	86.96%	3.54%	0.23%	0.00%	0.00%	0.00%
	Baa	5.57%	0.00%	0.08%	5.22%	0.26%	0.01%	0.00%	0.00%	0.00%
	Ba	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	B	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Caa-C	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
	Default	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

As in the discussion of the previous section, the first row of numbers represents the sum of each column and hence, the stand alone likelihood of a US Industrial issuer's (estimated) senior unsecured rating migrating to each other rating category or default. We estimate that an A-rated US industrial will maintain that rating over the course of one year with about 94.33% probability. The first column of numbers represents the sum of each row and so presents the stand alone likelihood of an A-rated European Financial issuer's (estimated) senior unsecured rating migrating to each other rating category or default. Note that these values differ from those of the A-rated US industrial.

At first glance, the evidence in favor of a credit quality correlation between A-rated US industrials and A-rated European financials does not appear to be as strong as the evidence considered earlier for all Baa-rated issuers. Based on the assumption that the credit qualities of these firms are uncorrelated, the total probability of joint upgrade comes to four basis points, while the total risk of joint downgrade amounts to 23 basis points. Exhibit 15 reveals that the historically observed probability of joint rating upgrade also amounts to four basis points, while that observed for joint downgrade climbs slightly to 27 basis points.

To quantify the effects of any possible correlation in these data, consider a portfolio of two A-rated bonds—one issued by a US industrial firm and one issued by a European financial firm. For the sake of simplicity, assume that the terms of these bonds are the same as those of the previous section. We can then re-construct the calculations of that section using the same bond and portfolio valuations, but replacing the Baa-Baa one-year, joint rating transition matrix with the joint rating transition matrix presented in Exhibit 15. The results are presented below in Exhibit 16.

Exhibit 16—Mean and Standard Deviation of Portfolio Value (One A-Rated US Industrial and one A-rated European Financial)

	Expected Value	Standard Deviation
Without Correlation	$203.99	$1.56
With Correlation	$203.99	$1.55

Using the rating and joint rating migration patterns documented in Exhibit 15, the expected value of this portfolio climbs to $203.99. This is as expected since we have effectively upgraded both bonds in the previous example from Baa to A. The standard deviation in both cases falls considerably. This is due, in part, to the increase in ratings from Baa to A. However, it is also because we have estimated these joint rating transition matrices over the period from 1990 to the present, during which there have been very few situations in which either a US industrial or a European financial with the A rating has suffered a large downgrade.

The relative difference in the portfolio's risk, as measured by the standard deviation, is very small in absolute value and suggests a slight negative correlation (thereby reducing the portfolio standard deviation in the case with correlation). This small degree of correlation between these two very different companies hints at the importance of industrial and geographic considerations when estimating the effects of credit quality correlations.

Conclusion

This study of corporate rating drift, defaults, and correlations expands the scope of Moody's previous research in this area and extends it to cover the period from 1920 through the present. Moody's ratings and default databases now cover the credit experiences of over 14,000 US and non-US corporate debt issuers. The long time horizon examined allows us to study rating migration patterns over a variety of business, interest rate, and other economic cycles.

The results indicate that not only are Moody's higher ratings associated with a lower incidence of default, but they are also more stable in the sense that they are generally less likely than lower rating categories to be revised over any time period from 1 to 15 years.

Moody's has also examined the variability of rating transition rates. The distribution of rating transition rates is necessarily asymmetric and there is evidence suggesting that the distribution is affected by macroeconomic factors. That macroeconomic variables may affect the credit quality of many borrowers in turn suggests that different issuers' credit qualities may be linked. A statistical test rejected the hypothesis that the credit qualities of Baa-rated issuers is not correlated at the 99% level of confidence, providing additional evidence of credit quality correlation.

The impact of credit quality correlation was explored by examining the increase in risk, as measured by the standard deviation of a portfolio's distribution of future values, between the case of no credit quality correlation and the case where it is correlated to the extent suggested by Moody's database of historical rating changes and defaults. The results suggest that such correlation is an important feature for those wishing to understand the credit risk characteristics of credit portfolios. Finally, we performed simple indicative calculations suggesting that credit quality correlations are, in part, determined by factors specific to both the issuer's industry and geographic domain.

Exhibit 17—Average Letter Rating Transition Matrices for 2 Through 10 and 15-Year Time Horizons

Two-Year Average Rating Transition Matrix, 1920 to 1995

	Rating To:								
Rating From:	Aaa	Aa	A	Baa	Ba	B	Caa-C	Default	WR
Aaa	79.70%	9.51%	2.01%	0.45%	0.15%	0.01%	0.00%	0.00%	8.16%
Aa	2.00%	76.26%	9.50%	1.43%	0.42%	0.03%	0.02%	0.16%	10.18%
A	0.10%	3.77%	75.79%	7.17%	1.28%	0.22%	0.04%	0.28%	11.34%
Baa	0.05%	0.42%	6.42%	69.73%	6.71%	1.29%	0.12%	0.73%	14.53%
Ba	0.03%	0.14%	0.74%	7.50%	63.73%	7.06%	0.81%	2.37%	17.62%
B	0.00%	0.05%	0.23%	1.18%	8.63%	60.42%	3.95%	6.32%	19.22%
Caa-C	0.00%	0.02%	0.03%	0.77%	2.07%	6.97%	56.11%	18.11%	15.92%

Three-Year Average Rating Transition Matrix, 1920 to 1994

	Rating To:								
Rating From:	Aaa	Aa	A	Baa	Ba	B	Caa-C	Default	WR
Aaa	72.27%	12.33%	2.89%	0.66%	0.32%	0.02%	0.00%	0.03%	11.48%
Aa	2.65%	67.47%	12.47%	2.17%	0.65%	0.08%	0.02%	0.25%	14.25%
A	0.15%	4.88%	67.66%	8.63%	1.84%	0.38%	0.06%	0.53%	15.87%
Baa	0.06%	0.61%	8.19%	60.24%	7.63%	1.69%	0.21%	1.23%	20.14%
Ba	0.04%	0.19%	1.22%	9.16%	52.22%	7.99%	1.09%	3.56%	24.52
B	0.01%	0.07%	0.32%	1.66%	10.04%	48.37%	4.11%	8.84%	26.58%
Caa-C	0.00%	0.00%	0.02%	0.82%	3.06%	7.97%	44.74%	22.17%	21.23%

Four-Year Average Rating Transition Matrix, 1920 to 1993

	Rating To:								
Rating From:	Aaa	Aa	A	Baa	Ba	B	Caa-C	Default	WR
Aaa	66.18%	13.91%	3.68%	0.79%	0.46%	0.07%	0.00%	0.08%	14.82%
Aa	3.07%	60.24%	14.52%	2.85%	0.94%	0.14%	0.02%	0.40%	17.81%
A	0.18%	5.54%	61.07%	9.65%	2.28%	0.49%	0.07%	0.82%	19.91%
Baa	0.07%	0.76%	9.30%	52.93%	7.95%	1.95%	0.28%	1.79%	24.95%
Ba	0.04%	0.24%	1.63%	9.95%	43.41%	8.26%	1.19%	4.81%	30.47%
B	0.01%	0.09%	0.39%	2.15%	10.45%	39.06%	3.89%	11.12%	32.84%
Caa-C	0.00%	0.00%	0.02%	1.31%	3.40%	8.04%	36.26%	25.54%	25.44%

Five-Year Average Rating Transition Matrix, 1920 to 1992

	Rating To:								
Rating From:	Aaa	Aa	A	Baa	Ba	B	Caa-C	Default	WR
Aaa	60.78%	15.21%	4.33%	0.96%	0.49%	0.09%	0.03%	0.14%	17.96%
Aa	3.43%	54.14%	15.93%	3.42%	1.16%	0.20%	0.02%	0.58%	21.12%
A	0.20%	5.85%	55.74%	10.34%	2.58%	0.69%	0.08%	1.08%	23.43%
Baa	0.09%	0.92%	10.01%	47.06%	8.03%	2.00%	0.32%	2.28%	29.28%
Ba	0.04%	0.26%	1.92%	10.40%	36.48%	8.09%	1.29%	5.90%	35.62%
B	0.02%	0.09%	0.48%	2.41%	10.25%	32.12%	3.53%	12.91%	38.19%
Caa-C	0.00%	0.00%	0.02%	1.57%	4.03%	7.77%	29.60%	27.98%	29.04%

Six-Year Average Rating Transition Matrix, 1920 to 1991

	Rating To:								
Rating From:	Aaa	Aa	A	Baa	Ba	B	Caa-C	Default	WR
Aaa	56.03%	16.24%	4.97%	1.12%	0.58%	0.09%	0.03%	0.21%	20.72%
Aa	3.74%	48.82%	17.00%	3.93%	1.40%	0.24%	0.03%	0.78%	24.06%
A	0.21%	6.05%	51.35%	10.67%	2.88%	0.84%	0.10%	1.31%	26.59%
Baa	0.10%	1.04%	10.52%	42.42%	7.79%	2.09%	0.32%	2.75%	32.98%
Ba	0.05%	0.26%	2.13%	10.64%	31.00%	7.73%	1.32%	6.89%	39.98%
B	0.02%	0.07%	0.64%	2.42%	9.81%	26.73%	3.15%	14.43%	42.73%
Caa-C	0.00%	0.00%	0.00%	2.01%	3.72%	7.44%	24.82%	30.17%	31.84%

Seven-Year Average Rating Transition Matrix, 1920 to 1990

	Rating To:								
Rating From:	Aaa	Aa	A	Baa	Ba	B	Caa-C	Default	WR
Aaa	51.82%	17.14%	5.30%	1.44%	0.61%	0.13%	0.01%	0.27%	23.28%
Aa	4.01%	44.24%	17.82%	4.28%	1.62%	0.30%	0.03%	0.97%	26.72%
A	0.23%	6.13%	47.55%	10.77%	3.08%	0.94%	0.13%	1.54%	29.63%
Baa	0.07%	1.14%	10.88%	38.74%	7.36%	2.12%	0.32%	3.20%	36.17%
Ba	0.06%	0.26%	2.36%	10.55%	26.66%	7.35%	1.34%	7.69%	43.74%
B	0.03%	0.06%	0.73%	2.34%	9.28%	22.47%	2.77%	15.81%	46.50%
Caa-C	0.00%	0.00%	0.00%	2.50%	2.89%	7.05%	21.13%	31.97%	34.46%

Eight-Year Average Rating Transition Matrix, 1920 to 1989

	Rating To:								
Rating From:	Aaa	Aa	A	Baa	Ba	B	Caa-C	Default	WR
Aaa	48.19%	17.90%	5.60%	1.62%	0.71%	0.14%	0.01%	0.38%	25.45%
Aa	4.22%	40.36%	18.64%	4.43%	1.80%	0.40%	0.05%	1.16%	28.94%
A	0.25%	6.28%	44.28%	10.92%	3.17%	1.00%	0.16%	1.76%	32.17%
Baa	0.06%	1.23%	11.22%	35.58%	6.95%	2.08%	0.32%	3.64%	38.92%
Ba	0.07%	0.25%	2.62%	10.51%	23.12%	6.98%	1.29%	8.50%	46.66%
B	0.03%	0.07%	0.86%	2.40%	8.82%	19.03%	2.52%	16.89%	49.39%
Caa-C	0.00%	0.02%	0.00%	2.54%	2.52%	6.53%	18.53%	33.87%	36.00%

Nine-Year Average Rating Transition Matrix, 1920 to 1988

	Rating To:								
Rating From:	Aaa	Aa	A	Baa	Ba	B	Caa-C	Default	WR
Aaa	44.96%	18.39%	5.95%	1.84%	0.70%	0.15%	0.01%	0.50%	27.50%
Aa	4.35%	36.93%	19.27%	4.64%	1.98%	0.50%	0.08%	1.30%	30.96%
A	0.27%	6.44%	41.43%	11.03%	3.20%	1.06%	0.18%	1.99%	34.41%
Baa	0.07%	1.27%	11.56%	32.79%	6.62%	2.08%	0.31%	4.04%	41.26%
Ba	0.07%	0.29%	2.81%	10.38%	20.05%	6.58%	1.28%	9.16%	49.37%
B	0.03%	0.08%	0.85%	2.60%	8.27%	16.28%	2.36%	17.71%	51.82%
Caa-C	0.00%	0.02%	0.00%	2.33%	2.94%	5.39%	16.10%	35.63%	37.60%

Exhibit 17—Average Letter Rating Transition Matrices for 2 Through 10 and 15-Year Time Horizons (cont'd)

Ten-Year Average Rating Transition Matrix, 1920 to 1987

Rating From:	Rating To: Aaa	Aa	A	Baa	Ba	B	Caa-C	Default	WR
Aaa	41.57%	19.00%	6.09%	2.11%	0.77%	0.19%	0.02%	0.64%	29.62%
Aa	4.48%	33.35%	19.84%	4.88%	2.21%	0.59%	0.13%	1.45%	33.08%
A	0.30%	6.52%	38.62%	11.07%	3.28%	1.10%	0.20%	2.24%	36.65%
Baa	0.08%	1.33%	11.71%	30.00%	6.36%	2.05%	0.30%	4.41%	43.76%
Ba	0.07%	0.32%	3.00%	10.13%	17.06%	6.08%	1.26%	9.91%	52.18%
B	0.02%	0.06%	0.81%	2.74%	7.78%	13.75%	2.10%	18.62%	54.11%
Caa-C	0.00%	0.02%	0.00%	2.12%	3.21%	5.06%	13.50%	36.92%	39.17%

15-Year Rating Transition Matrix, 1920 to 1982

Rating From:	Rating To: Aaa	Aa	A	Baa	Ba	B	Caa-C	Default	WR
Aaa	32.12%	20.88%	8.10%	2.70%	1.23%	0.31%	0.00%	1.11%	33.55%
Aa	4.39%	24.10%	20.38%	6.18%	3.07%	0.84%	0.28%	2.13%	38.64%
A	0.36%	6.69%	31.07%	11.15%	3.37%	1.05%	0.22%	3.23%	42.86%
Baa	0.09%	1.34%	12.43%	22.71%	5.26%	1.79%	0.31%	5.69%	50.39%
Ba	0.04%	0.38%	3.71%	8.97%	10.62%	4.49%	0.97%	12.27%	58.56%
B	0.03%	0.05%	0.65%	4.00%	4.99%	7.88%	1.56%	20.98%	59.87%
Caa-C	0.00%	0.02%	1.17%	1.02%	3.46%	4.03%	7.11%	41.11%	42.09%

Exhibit 18—Average Alpha-Numeric Rating Transition Matrices for 2 through 10-Year Time Horizons

2-Year Average Rating Transition Matrix, 1983-1995

Rating From:	Rating To : Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa-C	Default	WR
Aaa	72.7%	8.1%	5.2%	2.3%	0.9%	1.0%	0.2%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	9.2%
Aa1	3.8%	53.7%	13.5%	11.9%	5.7%	1.7%	0.4%	0.3%	0.0%	0.3%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.1%
Aa2	1.6%	5.4%	44.8%	16.1%	9.0%	5.9%	2.6%	1.6%	0.6%	0.0%	0.0%	0.0%	0.2%	0.1%	0.0%	0.0%	0.1%	0.1%	12.0%
Aa3	0.5%	1.2%	4.5%	45.7%	18.4%	9.3%	3.6%	1.5%	0.7%	0.6%	0.4%	0.2%	0.5%	0.2%	0.0%	0.0%	0.0%	0.1%	12.6%
A1	0.3%	0.3%	2.0%	9.2%	51.0%	12.3%	5.6%	2.4%	1.7%	1.0%	0.2%	0.5%	0.4%	0.7%	0.1%	0.2%	0.2%	0.4%	11.7%
A2	0.0%	0.1%	0.2%	1.9%	10.0%	47.3%	13.9%	5.1%	3.3%	1.4%	0.9%	0.6%	0.6%	0.3%	0.2%	0.0%	0.1%	0.2%	13.9%
A3	0.1%	0.1%	0.1%	1.1%	4.1%	15.5%	39.3%	11.0%	6.2%	3.1%	1.4%	0.7%	1.3%	0.4%	0.4%	0.0%	0.0%	0.4%	14.8%
Baa1	0.1%	0.0%	0.5%	0.3%	1.5%	7.0%	14.7%	37.3%	11.0%	5.4%	2.1%	0.7%	1.6%	1.0%	0.7%	0.3%	0.3%	0.7%	15.0%
Baa2	0.1%	0.4%	0.2%	0.5%	1.3%	3.3%	6.6%	10.1%	39.3%	9.9%	3.8%	1.1%	1.8%	1.0%	1.0%	0.8%	0.3%	0.3%	18.2%
Baa3	0.1%	0.0%	0.1%	0.1%	0.5%	1.7%	2.7%	9.1%	14.8%	32.3%	7.6%	3.7%	2.7%	2.7%	0.4%	0.6%	0.5%	1.8%	18.7%
Ba1	0.2%	0.0%	0.0%	0.0%	0.2%	1.2%	1.5%	1.9%	6.8%	9.4%	31.7%	6.3%	5.8%	1.8%	2.7%	1.5%	0.6%	3.7%	24.7%
Ba2	0.0%	0.0%	0.1%	0.0%	0.1%	0.4%	0.8%	1.1%	1.6%	4.2%	10.2%	29.6%	8.6%	2.2%	5.6%	2.7%	1.2%	5.4%	26.2%
Ba3	0.0%	0.1%	0.0%	0.1%	0.0%	0.3%	0.4%	0.7%	0.9%	0.8%	4.6%	6.8%	32.5%	4.6%	7.6%	4.3%	0.8%	10.4%	25.2%
B1	0.1%	0.0%	0.2%	0.0%	0.1%	0.1%	0.2%	0.6%	0.7%	1.0%	1.8%	3.5%	6.0%	36.7%	3.4%	7.1%	0.9%	14.1%	23.6%
B2	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	1.1%	1.4%	2.8%	5.4%	7.7%	26.3%	8.9%	3.1%	21.1%	21.4%
B3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%	0.4%	0.5%	0.5%	1.1%	2.9%	7.4%	2.4%	28.0%	3.9%	26.2%	26.2%
Caa-C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.9%	0.0%	0.3%	3.4%	4.2%	1.5%	2.8%	22.1%	36.3%	27.6%

Exhibit 18—Average Alpha-Numeric Rating Transition Matrices for 2 through 10-Year Time Horizons (cont'd)

3-Year Average Rating Transition Matrix, 1983-1994

Rating From:	Rating To : Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa-C	Default	WR
Aaa	62.9%	9.5%	6.8%	3.4%	0.8%	1.5%	0.4%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	13.8%
Aa1	4.5%	40.2%	14.8%	12.5%	9.6%	2.6%	0.8%	1.1%	0.1%	0.6%	0.7%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	12.5%
Aa2	1.6%	5.4%	44.8%	16.1%	9.0%	5.9%	2.6%	1.6%	0.6%	0.0%	0.0%	0.0%	0.2%	0.1%	0.0%	0.0%	0.1%	0.1%	12.0%
Aa3	0.5%	1.2%	4.5%	45.7%	18.4%	9.3%	3.6%	1.5%	0.7%	0.6%	0.4%	0.2%	0.5%	0.2%	0.0%	0.0%	0.0%	0.1%	12.6%
A1	0.3%	0.3%	2.0%	9.2%	51.0%	12.3%	5.6%	2.4%	1.7%	1.0%	0.2%	0.5%	0.4%	0.7%	0.1%	0.2%	0.2%	0.4%	11.7%
A2	0.0%	0.1%	0.2%	1.9%	10.0%	47.3%	13.9%	5.1%	3.3%	1.4%	0.9%	0.6%	0.6%	0.3%	0.2%	0.0%	0.1%	0.2%	13.9%
A3	0.1%	0.1%	0.1%	1.1%	4.1%	15.5%	39.3%	11.0%	6.2%	3.1%	1.4%	0.7%	1.3%	0.4%	0.4%	0.0%	0.0%	0.4%	14.8%
Baa1	0.1%	0.0%	0.5%	0.3%	1.5%	7.0%	14.7%	37.3%	11.0%	5.4%	2.1%	0.7%	1.6%	1.0%	0.7%	0.3%	0.3%	0.7%	15.0%
Baa2	0.1%	0.4%	0.2%	0.5%	1.3%	3.3%	6.6%	10.1%	39.3%	9.9%	3.8%	1.1%	1.8%	1.0%	1.0%	0.8%	0.3%	0.3%	18.2%
Baa3	0.1%	0.0%	0.1%	0.1%	0.5%	1.7%	2.7%	9.1%	14.8%	32.3%	7.6%	3.7%	2.7%	2.7%	0.4%	0.6%	0.5%	1.8%	18.7%
Ba1	0.2%	0.0%	0.0%	0.0%	0.2%	1.2%	1.5%	1.9%	6.8%	9.4%	31.7%	6.3%	5.8%	1.8%	2.7%	1.5%	0.6%	3.7%	24.7%
Ba2	0.0%	0.0%	0.1%	0.0%	0.1%	0.4%	0.8%	1.1%	1.6%	4.2%	10.2%	29.6%	8.6%	2.2%	5.6%	2.7%	1.2%	5.4%	26.2%
Ba3	0.0%	0.1%	0.0%	0.1%	0.0%	0.3%	0.4%	0.7%	0.9%	0.8%	4.6%	6.8%	32.5%	4.6%	7.6%	4.3%	0.8%	10.4%	25.2%
B1	0.1%	0.0%	0.2%	0.0%	0.1%	0.1%	0.2%	0.6%	0.7%	1.0%	1.8%	3.5%	6.0%	36.7%	3.4%	7.1%	0.9%	14.1%	23.6%
B2	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.1%	0.2%	0.2%	1.1%	1.4%	2.8%	5.4%	7.7%	26.3%	8.9%	3.1%	21.1%	21.4%
B3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%	0.4%	0.5%	0.5%	1.1%	2.9%	7.4%	2.4%	28.0%	3.9%	26.2%	26.2%
Caa-C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.7%	0.9%	0.0%	0.3%	3.4%	4.2%	1.5%	2.8%	22.1%	36.3%	27.6%

4-Year Average Rating Transition Matrix, 1983-1994

Rating From:	Rating To : Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa-C	Default	WR
Aaa	54.9%	10.3%	7.5%	3.8%	2.2%	1.5%	0.5%	0.0%	0.0%	0.0%	0.4%	0.0%	0.1%	0.1%	0.0%	0.1%	0.0%	0.1%	18.4%
Aa1	4.7%	32.4%	13.3%	13.1%	11.7%	3.4%	1.3%	1.5%	0.7%	0.2%	0.3%	0.0%	0.0%	0.2%	0.0%	0.0%	0.2%	0.4%	16.6%
Aa2	1.6%	5.2%	36.6%	16.3%	9.6%	7.0%	3.6%	2.5%	0.7%	0.5%	0.0%	0.1%	0.2%	0.2%	0.1%	0.0%	0.1%	0.2%	15.6%
Aa3	0.7%	1.1%	4.7%	38.9%	17.5%	10.7%	3.9%	2.4%	0.9%	0.7%	0.4%	0.2%	0.7%	0.3%	0.0%	0.0%	0.0%	0.2%	16.7%
A1	0.3%	0.4%	2.1%	9.6%	43.5%	12.8%	6.4%	3.0%	1.6%	1.4%	0.5%	0.5%	0.5%	0.6%	0.2%	0.2%	0.2%	0.7%	15.5%
A2	0.0%	0.2%	0.1%	2.2%	10.3%	40.0%	14.6%	5.8%	3.8%	1.7%	1.1%	0.6%	0.6%	0.4%	0.2%	0.0%	0.1%	0.4%	17.9%
A3	0.1%	0.1%	0.1%	1.7%	4.1%	16.6%	32.3%	10.0%	6.7%	3.8%	1.6%	1.0%	1.5%	0.7%	0.5%	0.0%	0.0%	0.5%	18.7%
Baa1	0.0%	0.0%	0.5%	0.3%	2.5%	7.0%	14.9%	30.8%	10.5%	5.9%	2.0%	1.2%	1.4%	1.1%	0.8%	0.4%	0.3%	1.1%	19.2%
Baa2	0.1%	0.4%	0.3%	0.6%	1.4%	4.0%	6.4%	10.6%	34.2%	9.0%	3.1%	1.4%	1.8%	1.0%	1.0%	0.8%	0.4%	0.7%	22.6%
Baa3	0.2%	0.0%	0.1%	0.1%	0.5%	2.0%	4.0%	8.6%	14.6%	26.4%	6.8%	3.7%	3.2%	2.5%	0.6%	0.5%	0.7%	2.4%	23.2%
Ba1	0.2%	0.0%	0.1%	0.1%	0.2%	1.3%	1.5%	2.5%	7.4%	8.9%	24.4%	5.5%	5.6%	2.1%	3.1%	1.3%	0.4%	5.3%	30.4%
Ba2	0.0%	0.1%	0.0%	0.0%	0.2%	0.7%	0.8%	1.3%	2.2%	4.1%	9.6%	21.3%	7.8%	2.4%	5.5%	2.5%	1.1%	7.5%	33.0%
Ba3	0.0%	0.1%	0.0%	0.1%	0.1%	0.4%	0.3%	0.4%	1.0%	1.1%	4.4%	6.5%	23.9%	4.5%	6.9%	4.4%	0.6%	13.3%	32.0%
B1	0.1%	0.1%	0.2%	0.0%	0.2%	0.1%	0.4%	0.4%	1.1%	0.9%	1.7%	3.8%	5.4%	27.2%	3.4%	7.2%	0.7%	17.5%	29.7%
B2	0.0%	0.0%	0.0%	0.2%	0.1%	0.1%	0.2%	0.3%	0.2%	0.8%	1.2%	2.8%	4.7%	8.4%	19.2%	7.7%	3.9%	24.0%	26.5%
B3	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.5%	0.4%	0.7%	0.3%	1.0%	3.1%	6.7%	2.0%	19.4%	3.9%	29.0%	32.3%
Caa-C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%	0.2%	0.0%	0.7%	3.1%	5.4%	0.8%	3.1%	15.4%	38.2%	31.6%

Exhibit 18—Average Alpha-Numeric Rating Transition Matrices for 2 through 10-Year Time Horizons (cont'd)

5-Year Average Rating Transition Matrix, 1983-1992

Rating From:	Rating To : Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa-C	Default	WR
Aaa	48.8%	9.9%	8.0%	4.0%	3.3%	1.4%	0.8%	0.3%	0.0%	0.0%	0.0%	0.1%	0.1%	0.2%	0.0%	0.1%	0.2%	0.3%	22.7%
Aa1	4.7%	28.3%	11.8%	14.1%	9.6%	3.5%	2.6%	3.0%	1.2%	0.1%	0.2%	0.5%	0.2%	0.0%	0.0%	0.0%	0.0%	0.4%	19.7%
Aa2	1.4%	4.5%	31.4%	16.7%	9.8%	7.6%	3.9%	2.7%	1.0%	0.7%	0.3%	0.3%	0.3%	0.1%	0.0%	0.0%	0.0%	0.5%	18.9%
Aa3	0.7%	1.1%	5.1%	33.6%	17.6%	11.1%	4.5%	2.8%	0.9%	0.7%	0.4%	0.3%	0.3%	0.5%	0.0%	0.0%	0.1%	0.4%	20.0%
A1	0.4%	0.3%	2.0%	9.5%	39.5%	13.7%	6.2%	3.3%	1.8%	1.4%	0.8%	0.1%	0.5%	0.6%	0.3%	0.2%	0.2%	0.9%	18.4%
A2	0.0%	0.2%	0.1%	2.1%	10.1%	35.9%	14.5%	6.3%	4.0%	1.8%	1.1%	0.7%	0.7%	0.4%	0.2%	0.0%	0.1%	0.6%	21.3%
A3	0.1%	0.1%	0.2%	1.7%	4.7%	16.2%	28.7%	9.3%	6.8%	3.6%	1.8%	1.1%	1.8%	0.8%	0.3%	0.1%	0.1%	0.5%	22.1%
Baa1	0.0%	0.0%	0.5%	0.3%	2.8%	6.9%	14.7%	27.1%	10.1%	5.7%	1.8%	1.2%	1.6%	0.9%	0.7%	0.2%	0.2%	1.4%	23.6%
Baa2	0.2%	0.4%	0.3%	0.8%	1.2%	3.9%	6.7%	10.8%	30.7%	9.0%	2.5%	1.6%	1.5%	1.0%	0.7%	0.4%	0.6%	1.1%	26.6%
Baa3	0.3%	0.0%	0.1%	0.1%	0.8%	2.2%	4.0%	8.4%	14.6%	22.7%	6.3%	3.9%	3.4%	1.9%	0.9%	0.6%	0.3%	2.9%	26.6%
Ba1	0.1%	0.0%	0.1%	0.1%	0.3%	1.2%	1.5%	3.0%	7.6%	8.1%	19.6%	4.9%	5.5%	2.2%	3.1%	1.2%	0.5%	6.3%	34.8%
Ba2	0.0%	0.1%	0.2%	0.0%	0.4%	0.7%	0.9%	1.2%	2.4%	4.0%	8.8%	16.8%	6.4%	2.7%	5.0%	2.6%	0.7%	9.0%	38.2%
Ba3	0.0%	0.1%	0.0%	0.1%	0.1%	0.3%	0.2%	0.5%	0.7%	1.2%	4.1%	5.9%	19.0%	4.7%	6.1%	4.1%	0.5%	15.4%	37.0%
B1	0.1%	0.1%	0.3%	0.0%	0.2%	0.2%	0.8%	0.1%	0.7%	0.9%	2.0%	3.6%	4.9%	20.8%	3.1%	6.2%	0.7%	20.1%	35.2%
B2	0.1%	0.0%	0.0%	0.2%	0.0%	0.2%	0.3%	0.2%	0.2%	0.6%	1.4%	2.6%	3.1%	9.0%	16.1%	6.3%	3.6%	25.6%	30.4%
B3	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.7%	0.7%	0.4%	0.5%	0.4%	1.0%	2.4%	6.2%	2.1%	14.7%	3.5%	31.0%	36.2%
Caa-C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%	0.2%	0.0%	1.3%	2.8%	4.7%	0.5%	3.1%	12.3%	39.5%	34.3%

6-Year Average Rating Transition Matrix, 1983-1991

Rating From:	Rating To : Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa-C	Default	WR
Aaa	48.8%	9.9%	8.0%	4.0%	3.3%	1.4%	0.8%	0.3%	0.0%	0.0%	0.0%	0.1%	0.1%	0.2%	0.0%	0.1%	0.2%	0.3%	22.7%
Aaa	72.7%	8.1%	5.2%	2.3%	0.9%	1.0%	0.2%	0.0%	0.0%	0.0%	0.3%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	9.2%
Aa1	4.6%	26.1%	11.3%	13.2%	8.6%	2.3%	3.0%	4.6%	1.6%	0.5%	0.0%	0.5%	0.4%	0.0%	0.1%	0.0%	0.0%	0.6%	22.7%
Aa2	1.3%	4.2%	28.2%	16.0%	10.2%	7.5%	4.3%	2.4%	1.5%	0.9%	0.4%	0.4%	0.2%	0.3%	0.1%	0.0%	0.0%	0.5%	21.6%
Aa3	0.7%	0.8%	5.5%	30.1%	17.1%	10.9%	5.5%	3.0%	1.1%	0.6%	0.4%	0.2%	0.1%	0.3%	0.0%	0.0%	0.1%	0.6%	23.0%
A1	0.4%	0.2%	1.8%	8.9%	36.3%	15.0%	6.5%	3.0%	1.9%	1.8%	0.6%	0.1%	0.4%	0.3%	0.4%	0.2%	0.1%	1.1%	21.1%
A2	0.0%	0.2%	0.1%	2.2%	9.6%	33.4%	14.1%	6.5%	4.0%	1.9%	1.0%	0.9%	0.8%	0.4%	0.1%	0.0%	0.1%	0.8%	23.8%
A3	0.1%	0.1%	0.2%	1.6%	5.0%	15.4%	26.9%	9.0%	6.5%	3.8%	1.5%	1.0%	2.1%	0.6%	0.4%	0.1%	0.1%	0.6%	25.1%
Baa1	0.0%	0.0%	0.3%	0.3%	3.3%	7.1%	13.8%	25.1%	9.6%	5.4%	1.5%	1.4%	1.3%	0.5%	0.8%	0.2%	0.2%	1.6%	27.4%
Baa2	0.1%	0.4%	0.3%	0.6%	1.3%	3.6%	6.4%	11.2%	28.7%	8.1%	2.7%	1.9%	1.7%	0.8%	0.6%	0.3%	0.4%	1.4%	29.3%
Baa3	0.3%	0.0%	0.2%	0.3%	0.8%	2.3%	4.3%	8.0%	14.0%	20.9%	6.1%	3.7%	3.1%	1.9%	1.1%	0.4%	0.3%	3.4%	28.9%
Ba1	0.1%	0.1%	0.1%	0.1%	0.2%	1.5%	1.5%	3.4%	7.9%	7.3%	16.2%	4.6%	5.0%	2.4%	2.9%	1.0%	0.4%	7.3%	38.0%
Ba2	0.1%	0.1%	0.3%	0.0%	0.5%	0.7%	1.0%	1.2%	2.6%	4.1%	8.0%	13.8%	5.5%	3.0%	4.6%	2.4%	0.4%	9.8%	42.0%
Ba3	0.0%	0.0%	0.1%	0.0%	0.2%	0.2%	0.3%	0.3%	0.9%	1.3%	4.2%	5.4%	15.8%	5.0%	5.3%	3.5%	0.4%	17.2%	40.0%
B1	0.1%	0.1%	0.3%	0.0%	0.2%	0.5%	0.8%	0.2%	0.5%	1.0%	1.8%	3.4%	4.6%	16.1%	2.9%	5.6%	0.6%	22.5%	39.0%
B2	0.2%	0.0%	0.0%	0.1%	0.0%	0.3%	0.2%	0.2%	0.1%	0.6%	2.3%	2.6%	2.9%	8.5%	13.1%	5.6%	3.2%	27.4%	32.8%
B3	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.7%	0.9%	0.2%	0.3%	0.4%	1.3%	2.5%	5.6%	1.9%	11.2%	3.5%	32.0%	39.4%
Caa-C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.0%	0.2%	0.0%	2.0%	1.5%	4.7%	1.1%	2.8%	9.7%	40.2%	36.5%

Exhibit 18—Average Alpha-Numeric Rating Transition Matrices for 2 through 10-Year Time Horizons (cont'd)

7-Year Average Rating Transition Matrix, 1983-1990

Rating From:	Rating To : Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa-C	Default	WR
Aaa	40.3%	9.3%	7.3%	5.9%	4.1%	2.2%	1.2%	0.3%	0.3%	0.0%	0.1%	0.1%	0.0%	0.2%	0.0%	0.0%	0.1%	0.4%	28.4%
Aa1	4.6%	24.7%	11.1%	12.6%	7.0%	2.7%	3.0%	4.9%	1.8%	1.1%	0.0%	0.6%	0.5%	0.0%	0.0%	0.1%	0.0%	0.6%	24.8%
Aa2	1.1%	3.6%	26.0%	15.7%	10.8%	7.2%	4.5%	2.7%	1.6%	0.9%	0.3%	0.4%	0.2%	0.2%	0.0%	0.0%	0.1%	0.6%	24.1%
Aa3	0.7%	0.7%	5.4%	27.5%	16.5%	10.5%	6.6%	2.9%	1.0%	0.5%	0.4%	0.1%	0.0%	0.3%	0.0%	0.0%	0.1%	0.6%	26.1%
A1	0.4%	0.1%	2.1%	8.3%	33.9%	15.7%	6.7%	3.1%	1.9%	1.2%	0.7%	0.1%	0.5%	0.2%	0.4%	0.1%	0.0%	1.1%	23.5%
A2	0.0%	0.2%	0.1%	2.2%	9.4%	31.3%	14.2%	6.5%	4.1%	2.1%	0.7%	1.1%	0.7%	0.5%	0.0%	0.1%	0.2%	0.9%	25.8%
A3	0.1%	0.1%	0.0%	1.7%	5.0%	14.9%	25.4%	8.7%	6.0%	3.4%	1.6%	0.9%	2.3%	0.8%	0.4%	0.0%	0.1%	0.8%	27.8%
Baa1	0.0%	0.0%	0.1%	0.3%	3.7%	7.3%	13.2%	23.4%	9.3%	5.4%	1.6%	1.3%	0.9%	0.2%	0.9%	0.2%	0.3%	1.9%	30.1%
Baa2	0.0%	0.4%	0.3%	0.3%	1.7%	3.2%	5.8%	11.8%	26.9%	7.6%	2.7%	2.4%	1.4%	1.0%	0.7%	0.3%	0.2%	1.6%	31.7%
Baa3	0.3%	0.0%	0.2%	0.5%	0.6%	2.5%	4.3%	8.1%	14.1%	19.5%	5.1%	3.1%	2.8%	1.7%	1.4%	0.5%	0.4%	3.9%	31.0%
Ba1	0.0%	0.1%	0.0%	0.1%	0.2%	1.4%	1.5%	3.9%	8.1%	6.7%	14.2%	4.9%	4.4%	2.7%	2.9%	0.5%	0.3%	7.9%	40.1%
Ba2	0.3%	0.1%	0.1%	0.0%	0.6%	0.7%	0.9%	1.3%	2.6%	4.5%	7.6%	12.0%	5.3%	3.2%	3.8%	1.8%	0.5%	10.6%	44.3%
Ba3	0.0%	0.0%	0.1%	0.0%	0.2%	0.2%	0.3%	0.4%	0.7%	1.4%	4.0%	5.2%	13.1%	4.8%	5.0%	3.0%	0.5%	18.7%	42.3%
B1	0.1%	0.1%	0.3%	0.0%	0.1%	0.5%	0.8%	0.3%	0.5%	0.9%	1.6%	3.2%	4.5%	12.7%	2.6%	5.2%	0.6%	24.3%	41.7%
B2	0.3%	0.0%	0.0%	0.0%	0.0%	0.4%	0.3%	0.1%	0.3%	0.9%	1.7%	2.8%	3.9%	7.5%	11.7%	5.1%	2.4%	28.3%	34.3%
B3	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.7%	0.7%	0.2%	0.0%	0.4%	1.0%	3.1%	5.2%	1.8%	9.4%	3.5%	32.7%	41.2%
Caa-C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.4%	0.2%	0.0%	2.0%	0.8%	4.7%	1.7%	2.8%	6.8%	40.5%	39.1%

8-Year Average Rating Transition Matrix, 1983-1989

Rating From:	Rating To : Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa-C	Default	WR
Aaa	7.1%	8.3%	7.4%	6.6%	4.3%	2.1%	1.5%	0.4%	0.3%	0.1%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	31.1%
Aa1	4.0%	24.2%	11.0%	12.5%	6.8%	2.3%	3.3%	4.4%	1.9%	1.4%	0.0%	0.0%	0.6%	0.0%	0.0%	0.0%	0.0%	0.6%	26.9%
Aa2	1.1%	3.1%	24.6%	15.0%	10.9%	7.4%	4.8%	2.7%	1.6%	0.9%	0.3%	0.2%	0.2%	0.2%	0.0%	0.0%	0.2%	0.7%	26.2%
Aa3	0.7%	0.5%	5.4%	26.1%	15.9%	10.8%	6.8%	2.9%	0.9%	0.3%	0.4%	0.2%	0.0%	0.2%	0.1%	0.0%	0.1%	0.6%	28.0%
A1	0.3%	0.1%	2.2%	8.2%	31.7%	16.3%	6.6%	2.6%	2.1%	1.2%	0.6%	0.1%	0.5%	0.3%	0.2%	0.0%	0.0%	1.2%	25.7%
A2	0.0%	0.2%	0.1%	2.2%	9.3%	29.8%	14.3%	6.5%	3.9%	2.2%	0.6%	1.0%	0.6%	0.5%	0.1%	0.0%	0.2%	1.1%	27.4%
A3	0.1%	0.1%	0.0%	1.5%	5.0%	14.8%	24.3%	8.1%	6.1%	3.3%	1.7%	1.1%	1.6%	1.0%	0.3%	0.1%	0.2%	0.8%	29.9%
Baa1	0.0%	0.0%	0.1%	0.3%	3.6%	7.2%	12.7%	22.4%	8.8%	5.8%	1.7%	0.9%	0.7%	0.2%	0.7%	0.2%	0.2%	2.4%	32.0%
Baa2	0.0%	0.4%	0.2%	0.4%	1.8%	3.1%	5.5%	11.9%	25.6%	7.2%	2.8%	2.0%	1.4%	1.1%	0.9%	0.2%	0.1%	1.8%	33.7%
Baa3	0.2%	0.0%	0.1%	0.6%	0.6%	2.7%	4.3%	8.3%	13.5%	19.0%	4.6%	3.0%	2.6%	1.4%	1.4%	0.5%	0.4%	4.2%	32.7%
Ba1	0.0%	0.1%	0.0%	0.1%	0.2%	1.4%	1.4%	4.2%	8.1%	6.5%	13.0%	5.1%	4.3%	3.0%	2.3%	0.5%	0.3%	8.4%	41.2%
Ba2	0.3%	0.1%	0.0%	0.0%	0.7%	0.6%	0.6%	1.3%	2.7%	4.7%	7.1%	11.0%	5.2%	3.0%	3.5%	1.5%	0.5%	11.0%	46.1%
Ba3	0.0%	0.0%	0.1%	0.0%	0.3%	0.3%	0.3%	0.4%	0.7%	1.3%	3.9%	5.2%	11.4%	4.6%	4.9%	2.4%	0.5%	20.0%	43.8%
B1	0.1%	0.1%	0.3%	0.0%	0.1%	0.5%	0.8%	0.4%	0.5%	0.8%	1.6%	3.3%	4.1%	10.8%	2.5%	4.4%	0.7%	25.4%	43.6%
B2	0.4%	0.0%	0.0%	0.0%	0.0%	0.5%	0.3%	0.0%	0.5%	0.9%	1.6%	2.9%	3.9%	6.4%	10.3%	4.9%	2.5%	28.7%	36.2%
B3	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.7%	0.8%	0.2%	0.0%	0.3%	0.8%	2.6%	4.7%	1.6%	8.4%	3.3%	33.9%	42.5%
Caa-C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.6%	0.0%	2.0%	0.1%	4.0%	2.4%	2.8%	6.7%	40.5%	39.9%

Exhibit 18—Average Alpha-Numeric Rating Transition Matrices for 2 through 10-Year Time Horizons (cont'd)

9-Year Average Rating Transition Matrix, 1983-1988

Rating From:	Rating To : Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa-C	Default	WR
Aaa	34.7%	7.5%	7.6%	6.8%	4.2%	2.1%	1.8%	0.4%	0.3%	0.1%	0.2%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	33.8%
Aa1	3.7%	23.8%	10.5%	12.6%	6.9%	3.2%	3.7%	3.1%	2.1%	1.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	28.4%
Aa2	1.0%	2.9%	23.6%	14.3%	11.0%	7.7%	4.5%	3.1%	1.3%	1.1%	0.3%	0.1%	0.0%	0.1%	0.0%	0.0%	0.2%	0.7%	28.0%
Aa3	0.7%	0.5%	5.1%	24.8%	15.8%	10.8%	6.8%	3.1%	0.9%	0.4%	0.6%	0.1%	0.0%	0.1%	0.1%	0.0%	0.0%	0.6%	29.5%
A1	0.3%	0.1%	2.4%	8.0%	30.3%	15.5%	6.6%	2.6%	2.5%	1.0%	0.5%	0.2%	0.5%	0.2%	0.2%	0.0%	0.0%	1.2%	27.8%
A2	0.0%	0.3%	0.1%	1.9%	9.3%	29.2%	14.2%	6.3%	3.8%	2.1%	0.7%	1.1%	0.4%	0.4%	0.1%	0.0%	0.1%	1.2%	28.7%
A3	0.1%	0.1%	0.1%	1.3%	5.1%	14.5%	23.3%	8.0%	6.5%	3.4%	1.7%	1.0%	0.9%	1.3%	0.2%	0.2%	0.2%	0.9%	31.4%
Baa1	0.0%	0.0%	0.1%	0.4%	3.4%	7.0%	12.7%	21.2%	8.6%	5.9%	1.6%	0.9%	0.6%	0.2%	0.7%	0.2%	0.2%	2.7%	33.8%
Baa2	0.0%	0.3%	0.2%	0.3%	1.7%	3.5%	5.6%	12.0%	24.2%	6.7%	2.9%	2.1%	1.1%	1.1%	1.1%	0.2%	0.1%	1.9%	35.1%
Baa3	0.1%	0.0%	0.0%	0.7%	0.7%	2.8%	4.8%	8.0%	13.4%	18.5%	4.1%	2.6%	2.7%	1.3%	1.2%	0.5%	0.3%	4.6%	33.6%
Ba1	0.0%	0.1%	0.0%	0.1%	0.3%	1.4%	1.2%	4.7%	7.9%	6.5%	11.9%	5.5%	4.0%	2.9%	2.2%	0.6%	0.2%	8.6%	42.1%
Ba2	0.3%	0.1%	0.0%	0.0%	0.5%	0.5%	0.4%	1.5%	2.8%	4.2%	7.5%	10.3%	5.0%	2.9%	3.6%	1.3%	0.5%	11.2%	47.3%
Ba3	0.0%	0.0%	0.1%	0.0%	0.3%	0.3%	0.2%	0.5%	0.6%	1.4%	3.9%	5.0%	9.8%	4.7%	4.9%	1.8%	0.6%	21.0%	45.1%
B1	0.1%	0.1%	0.4%	0.0%	0.1%	0.5%	0.8%	0.5%	0.6%	0.7%	1.5%	3.4%	4.1%	9.8%	2.4%	3.6%	0.6%	26.1%	44.8%
B2	0.4%	0.0%	0.0%	0.0%	0.0%	0.5%	0.3%	0.0%	0.8%	1.1%	1.4%	1.8%	3.9%	5.2%	8.8%	5.1%	2.9%	29.0%	38.7%
B3	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.7%	0.9%	0.2%	0.0%	0.2%	1.1%	1.5%	4.6%	1.8%	8.0%	3.1%	34.8%	42.9%
Caa-C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.7%	2.0%	0.8%	3.3%	2.4%	2.8%	6.7%	40.5%	40.5%

10-Year Average Rating Transition Matrix, 1983-1987

Rating From:	Rating To : Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa-C	Default	WR
Aaa	29.2%	6.8%	7.9%	7.3%	4.6%	2.3%	1.9%	0.4%	0.0%	0.4%	0.3%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	38.3%
Aa1	3.4%	20.3%	10.9%	12.6%	7.0%	4.2%	4.2%	2.5%	2.2%	0.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.6%	31.6%
Aa2	1.1%	2.4%	19.4%	13.8%	12.0%	8.1%	4.3%	3.8%	0.9%	1.1%	0.2%	0.0%	0.0%	0.1%	0.1%	0.0%	0.1%	0.9%	31.7%
Aa3	0.6%	0.4%	5.0%	21.8%	15.0%	10.9%	7.4%	3.5%	1.0%	0.5%	0.7%	0.2%	0.1%	0.1%	0.1%	0.0%	0.0%	0.6%	32.3%
A1	0.2%	0.1%	2.7%	7.2%	27.8%	15.3%	6.5%	2.9%	2.7%	0.8%	0.5%	0.1%	0.5%	0.3%	0.2%	0.0%	0.0%	1.3%	30.8%
A2	0.0%	0.3%	0.1%	2.0%	8.9%	27.0%	13.9%	6.6%	4.0%	2.2%	0.8%	0.9%	0.4%	0.4%	0.2%	0.0%	0.1%	1.3%	31.1%
A3	0.1%	0.1%	0.1%	0.9%	4.8%	14.0%	21.5%	7.4%	6.6%	3.5%	1.8%	1.3%	0.8%	1.3%	0.0%	0.2%	0.2%	1.1%	34.4%
Baa1	0.0%	0.0%	0.1%	0.4%	3.5%	6.1%	11.7%	18.5%	9.1%	5.7%	1.7%	1.1%	0.5%	0.5%	0.6%	0.2%	0.2%	2.9%	37.3%
Baa2	0.0%	0.2%	0.2%	0.3%	1.7%	3.9%	5.6%	11.7%	20.7%	6.5%	2.9%	2.1%	0.7%	1.1%	1.2%	0.4%	0.1%	2.2%	38.6%
Baa3	0.1%	0.0%	0.0%	0.7%	0.9%	2.5%	5.4%	8.0%	13.0%	16.1%	3.1%	2.9%	2.9%	1.2%	1.1%	0.5%	0.2%	4.8%	36.6%
Ba1	0.0%	0.1%	0.0%	0.0%	0.3%	1.5%	1.2%	4.9%	7.7%	6.0%	9.5%	5.1%	3.5%	2.8%	2.3%	0.8%	0.2%	9.4%	44.8%
Ba2	0.3%	0.1%	0.0%	0.0%	0.5%	0.4%	0.3%	1.2%	2.9%	4.0%	7.0%	8.4%	4.0%	2.8%	3.5%	1.2%	0.6%	12.2%	50.8%
Ba3	0.1%	0.0%	0.1%	0.0%	0.3%	0.4%	0.2%	0.3%	0.7%	1.4%	3.7%	3.7%	7.9%	4.5%	4.4%	1.5%	0.7%	22.8%	47.5%
B1	0.0%	0.0%	0.4%	0.0%	0.1%	0.4%	0.7%	0.7%	0.5%	0.6%	1.4%	2.8%	3.6%	7.8%	2.3%	3.0%	0.5%	28.0%	47.1%
B2	0.4%	0.0%	0.0%	0.0%	0.0%	0.5%	0.4%	0.3%	0.9%	0.9%	2.8%	1.3%	2.7%	3.8%	8.5%	3.9%	3.3%	30.7%	39.6%
B3	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	0.5%	1.1%	0.1%	0.0%	0.2%	1.2%	0.9%	4.5%	1.5%	6.1%	2.5%	36.8%	44.3%
Caa-C	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	3.0%	0.1%	3.6%	2.4%	2.6%	4.9%	42.0%	41.4%

Exhibit 19—Rating Transition Rate Distribution Summary

Each table entry is comprised of the following (5th-percentile, Median, Standard Deviation, 95th-percentile). All numbers in percents.

	Aaa	Aa	A	Baa	Ba	B	Caa-C	Default
Aaa	(78.2,94.1,8.3,100.0)	(5.6,5.6,6.5,6.5)	(0.0,0.0,2.7,2.7)	(0.0,0.0,0.8,0.8)	(0.0,0.0,0.1,0.1)	(0.0,0.0,0.0,0.0)	(0.0,0.0,0.0,0.0)	(0.0,0.0,0.0,0.0)
Aa	(0.0,1.2,1.2,3.4)	(92.2,92.2,7.1,7.1)	(4.8,4.8,5.7,5.7)	(0.0,0.0,1.3,1.3)	(0.0,0.0,0.5,0.5)	(0.0,0.0,0.1,0.1)	(0.0,0.0,0.0,0.0)	(0.0,0.0,0.2,0.2)
A	(0.0,0.0,0.2,0.4)	(1.9,1.9,2.6,2.6)	(94.8,94.8,8.4,8.4)	(3.7,3.7,5.3,5.3)	(0.0,0.0,1.3,1.3)	(0.0,0.0,0.3,0.3)	(0.0,0.0,0.1,0.1)	(0.0,0.0,0.4,0.4)
Baa	(0.0,0.0,0.1,0.3)	(0.0,0.0,0.5,0.5)	(2.7,2.7,4.4,4.4)	(91.2,91.2,10.2,10.2)	(3.2,3.2,6.1,6.1)	(0.2,0.2,1.2,1.2)	(0.0,0.0,0.2,0.2)	(0.0,0.0,0.5,0.5)
Ba	(0.0,0.0,0.1,0.0)	(0.0,0.0,0.2,0.2)	(0.2,0.2,0.6,0.6)	(3.9,3.9,3.9,3.9)	(90.4,90.4,9.9,9.9)	(3.4,3.4,6.4,6.4)	(0.2,0.2,0.8,0.8)	(0.6,0.6,2.0,2.0)
B	(0.0,0.0,0.0,0.0)	(0.0,0.0,0.2,0.2)	(0.0,0.0,0.3,0.3)	(0.0,0.0,1.1,1.1)	(4.7,4.7,5.6,5.6)	(86.7,86.7,10.5,10.5)	(2.3,2.3,4.7,4.7)	(2.4,2.4,4.7,4.7)
Caa-C	(0.0,0.0,0.0,0.0)	(0.0,0.0,0.2,0.2)	(0.0,0.0,0.2,0.2)	(0.0,0.0,2.1,2.1)	(0.0,0.0,3.4,3.4)	(4.5,4.5,6.0,6.0)	(82.5,82.5,20.1,20.1)	(8.3,8.3,18.1,18.1)

Moody's Rating Migration and Credit Quality Correlation, 1920-1966

Special Comment

Report Number
25097