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The Importance and Subtlety of Credit Rating Migration

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September 1997

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The Importance and Subtlety of Credit Rating Migration

Bond ratings are usually first assigned by rating agencies to public debt at the time of issuance and are periodically reviewed by the rating companies. If deemed warranted, changes in ratings are assigned after the review. A change in a rating reflects the agency's assessment that the company's credit quality has improved (upgrade) or deteriorated (downgrade). A coincident effect, in some proximity to the date of the rating change, is a change in the price of the issue. This article reports on an in-depth investigation of the expected ratings changes (drift) over time.

Our analysis compares rating changes from the two major agencies, Moody's and S&P, over the period 1970-1996. For the first time, results from several studies which have documented and analyzed these data patterns are contrasted. Depending upon which study one uses, the results and implications can be very different. We expect that the findings will have implications for such diverse practitioners as bond investors who concentrate on any or all segments of the corporate bond market, eg., high yield bond and "crossover" investors, mark-to-market analysts, and traders in the new and growing market for credit-risk-derivatives and for the many analysts who properly view that credit quality assessment involves the entire spectrum of possible outcomes, not just default.

A follow-up study will analyze, in greater depth, two critical characteristics of the rating drift phenomenon. These are unexpected, as well as expected, rating migration patterns and also the implied impact on the price of the fixed income instrument.

The Importance and Subtlety of Credit Rating Migration

1.0 Introduction and Purpose

One of the most important indicators of a corporation's credit quality is the bond rating assigned to its outstanding, publicly traded indebtedness by independent rating agencies. After issuance and the assignment of the initial bond rating, these agencies perform reviews of the underlying issues, although it is not clear if these are periodic or based on market events -- probably both. If deemed warranted, these reviews result in a change, or drift, in the rating signifying improved (upgrade) or deteriorated (downgrade) in the issuers credit worthiness.

Using both Moody's and Standard & Poor's (S&P) bond ratings, this study explores a number of related issues of the rating drift phenomena. In particular, the study assesses the rating change experience of corporate bonds from two different initial states; (1) from the time of issuance to up to ten years post-issuance and (2) from a static-pool of issuers of a given rating, regardless of the bonds' ages, to up to ten years after the pool is formed. The original issuance analysis is drawn from several studies by Altman and Kao and the latter static-pool studies from Moody's and S&P. One of the main objectives of this study is to contrast these different sources by comparing their methodologies, sample periods and results. These comparisons can serve as an important reference for a number of different market practitioners.[1]

We will explore the impact of rating change on fixed income portfolio compositions of investors, particularly those which are restricted as to their credit quality. In addition, particular strategies of investing will be analyzed. For example, recently there has been increased interest in the so-called "crossover" investment strategy. Crossover refers primarily to investment grade investors dipping into the lower grade ratings to acquire higher yields, e.g., investing in a 5-B security (BBB/Baa from one agency and BB/Ba from another). A key question is therefore the likelihood that this 5-B bond will become 6-B or better, or 4-B or worse, over a relatively short term horizon. Finally, we will mention the possible implications of our results on the new and growing market for credit risk derivatives. The reader may find these comparisons and their implications somewhat technical, but they should be of interest if a direct application of these rating drift probabilities is being contemplated.

In addition to the aforementioned applications in the public, fixed income bond market, rating migration is now seen to play an integral part in the more generic topic of credit risk management. Indeed, the recently publicized *CreditMetrics*? methodology utilizes credit migration analysis as one of its centerpieces.[2]

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[1]We will not attempt to "model" the rating migration process and its experience over time. The reader is referred to Altman & Kao (1991a) for a discussion of the use of, and results from, several Markov-Chain models of the rating change phenomenon.

[2]J.P. Morgan, April 2, 1997. This report emphasizes that upgrades and downgrades cause market pricing reactions that result in immediate gains and

The potential user of this comprehensive credit risk measurement framework is left to himself, however, to determine which, if any, of the published data series is the appropriate one to utilize. This is also true for the ultimate negative migration result -- default. As such, this study complements the default and mortality studies published by Altman (1989), Altman & Kishore (1997), Moody's (1997) and S&P (1997).

Section 2 of this study compares different rating migration methods and Section 3 contrasts the empirical results of the three major empirical studies in this area. In Section 4, we explore a number of implications of the received rating migration patterns. These include specification of several methods to estimate the impact on returns, guidelines for credit limitations on particular portfolios, "crossover" strategies, and precise estimates of loan losses. Section 5 briefly explores the characteristics of the credit risk derivative market indicating how rating migration risk can be one of the important determinants for buyers and sellers. Finally, Section 6 presents concluding remarks and indicates a future extension of this migration work. A follow-up study, to this one, will go further into the assessment of the impact on returns. In addition, we intend to explore *unexpected* rating migration patterns as well as the expected patterns discussed in this report.

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losses in a mark-to-market accounting environment. Failure to recognize the impact of these events on both individual security and portfolio values will miss

2.0 Comparing Rating Migration Methods

There have been three sets of studies published on the rating migration phenomenon. The first was a series of articles by Altman & Kao [A/K] (1991 [a&b] and 1992 [a&b]) which utilized data from all S&P rating changes over the period 1971-1989. Several special studies from **Moody's**, reproduced in Lucas & Lonski (1992) and Carty & Fons (1993), are considered. The latter covered that agency's rating changes from 1970-1993. Finally, **S&P** periodically examines rating migration with the latest report (1997) covering rating changes of that agency from 1981-1996. In addition, A/K report on migration patterns of industrials, finance companies and public utilities (A/K, 1991b) and also examine the question of rating change auto-correlation, (A/K, 1992b), i.e., after observing a rating change, can one expect subsequent credit quality changes of the same issuer and whether the change will be in the same direction (upgrade or downgrade) or not.

There are some basic differences between these three sets of studies. While all look at the rating migration of credit quality for up to ten years (and more) from some initial level, the initial age of the security differs between A/K's analysis and the two agencies studies. A/K assess the changes from the initial bond rating, usually at issuance, up to ten years post-issuance. Moody's and S&P assess rating changes of issuers from some initial period, regardless of the age of the bonds which comprise the initial rating class. Hence, the Moody's and S&P static-pool type

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a significant component of risk.

analysis includes newly issued bonds of issuers as well as seasoned bonds of all ages into the static pool as of some date (e.g., 1981) and then follows that pool as to its rating up to 15 years after the initial period.[3]

This distinction is important since we detect an aging effect in the early years after issuance but one which does not persist by the fourth or fifth year from the initial rating bucket. Older bonds appear to have a greater short-term tendency to be up or down- graded than do newly issued bonds.

Another difference between the two rating agency's transition studies and A/K is that the former assess the senior bond equivalent of each **issuer**, regardless of the issue's size or the number of issues per issuer. The Altman/Kao method is issue-based. Finally, as noted earlier, the time period covered in the various studies is somewhat different. Moody's and A/K include the 1970's in their analyses and end at mid-1989 and November 1993,[4] respectively. S&P's data start in 1981 and ends in 1996. The relative propensity for an issue to be upgraded or downgraded varies vary over time. For instance, for all rating classes, the decade of the 1970's was typified by more upgrades than downgrades while from 1981 to 1995, downgrades outnumbered upgrades in every single year (S&P, 1996, Table 6). Interestingly, 1996 showed a reversal toward slightly more upgrades than downgrades. For high

[3]This is also true for both rating agencies' cumulative default analyses, e.g., Moody's (1997) and S&P (1997). Our mortality rate results (Altman & Kishore, 1997) trace the cumulative default/mortality rate of all bonds from initial issuance. This is consistent with their rating migration method.

yield debt, however, the trend toward more upgrades started in 1992, with the ratio of up vs. downgrades greatest in 1993 and about equal to 1.0 in the last three years, 1994-1996 (S&P, 1997 Chart 12).

One final difference between the rating agency methodology and that of A/K is that the two former studies include the category of "rating withdrawn." This usually occurs due to a call or some other early redemption of the bond, e.g., from an acquisition of the firm, if there was insufficient information to rate the bond, or from the redemption at maturity. This is quite an important distinction since, as we will show, the rating withdrawn category can involve anywhere from 2-3% after one year to as much as 25-40% of the number of issuers after five years, depending upon the rating class. Since most redemptions result in a 100% (or more) return of principal to the bondholder, one might choose to include the withdrawn-rating proportion in the same rating class as it was in the initial period. When calculating the impact on returns, the "rating withdrawn" category should reflect the average price at redemption which is typically 1-5% above par value.

3.0 Comparing and Contrasting Rating Migration Results

Tables 1, 2 and 3 compare the one-year, five-year and ten-year transition matrices of the three studies noted above. The A/K results are adjusted somewhat for more complete default statistics.

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[4]Moody's is scheduled to update their results by mid-1997.

There are some striking differences between the A/K vs. the two rating agencies' results. And, the primary causes for the differences would appear to be the "aging effect" of the bonds that comprise the bond rating buckets in the two types of studies as well as the "rating withdrawn" (RW) category. As indicated earlier, both Moody's and S&P have a type of static-pool analysis which follows issuers of bonds of a certain rating class, regardless of the age of the bond, for the periods under investigation -- in this case one, five and ten years. The one and five-year horizons are more suitable for bank loan or seasoned bond analysis, while the ten year horizon is appropriate for newly issued bonds or private placements.

3.1 Aging and Withdrawn-Rating Effects

The dilemma in our analysis of rating migration revolves around which reference point(s) to use for bonds/loans of different ages. A new or very young loan or bond is probably associated more with the A/K results,since their reference point is newly issued bonds. That assumes, of course, that there is an aging effect with respect to the probability of movement from one credit rating class to another -- a phenomenon that, despite no comprehensive documentation, appears to be realistic (see discussion below). If, however, one is analyzing an existing, or seasoned portfolio, then the appropriate reference point is less clear. The more seasoned the issue, the less likely that A/K is the relevant reference. While Moody's and S&P would probably be better references for more seasoned bonds, it is not clear which is better and how far off you might be since the average age of the bonds in their buckets is not specified. What would be ideal is a study which combines bonds of the same age into the various ratings and tracks them for a number of years after the initial pooling. For example, all two-year old BB's are tracked for 1, 5, 10 years, etc.

To illustrate the difference in results that emerge from comparisons between the three sources of rating migration, we refer you again to Tables 1 and 2. The one-year B rated bond migration from A/K show that 93.7% of the newly issued bonds are still B rated after one year and 53.3% after five years. Moody's and S&P, however, show that only 75.7% and 72.8% (one year) and 31.8% and 16.6% (five years) retain the same rating. And, while A/K do not specify a withdrawn rating (RW) category, it is not likely that many of their bonds will be called after one year. Moody's and S&P, on the other hand, indicate that 7.8% and 12.2% of the issuers, respectively, have their bonds' ratings withdrawn after one year and as much as 27.4% and 45.4% after five years. It is obvious, in these cases, that the initial baskets of bond issuers were comprised of seasoned bonds since most issues have at least a 3-year or 5-year "no-call" provision. These comparisons are fairly strong evidence of an aging-effect with respect to rating drift -- similar to the documented aging effect of defaults, (Altman 1989) and Altman & Kishore (1997).

Why we observe such a difference between Moody's vs. S&P's

results after five years is not completely clear. More than likely the different study periods have impacted their results, i.e., Moody's only includes the early-1990's but does include the 1970's; the mid-1990's had enormous call frequencies. One could also make the case that the two agencies had different criteria for rating issuers and this contributes to the observed differences in rating changes.

The difference between A/K and the other two sources manifest for all rating classes. In all cases, the proportion of bonds that do not migrate is greater in the A/K sample and the differences between the two sets of studies appear to be greater, in most cases, as we move down the credit rating quality chain. For example, A/K find that 94.3% of (AAA), 92.6% (AA), 92.1% (A), 90.1% (BBB), 86.1% (BB) retain their ratings after one year.[5] S&P shows that 88.5% (AAA), 88.3% (AA), 87.6% (A), 82.5% (BBB), 73.8% (BB), -- down to 53.1% (CCC) retain their rating.

The reason for the lower migration pattern for A/K is probably a function of the rating process itself, the rating-withdrawn category, and the aging effect. With respect to the latter, a company with a newly issued bond/loan has received the face value of the issuance (in most cases) and has the liquidity to do many things, including debt service. While it is not likely that there will be a default in the earlier years after issuance, the credit quality could change. But the rating agencies, and bank loan

[5]The correlation between credit quality and rating retention does not hold for A/K's B and CCC categories, however.

review groups, usually do not review most bonds/loans for at least one year and, I would argue that, the change in the credit quality of the issuer would have to be substantial to motivate a change in the early years. On the other hand, a seasoned bond could have been deteriorating slowly and finally, after several years, the raters decide to lower the rating (or to upgrade for an enhanced credit profile). Of course, a massive change in credit quality, e.g., a highly leveraged transaction, could motivate a rating change regardless of the age of the bond. This was a commonly observed phenomenon in the 1980's when the number of leveraged buyouts and leveraged recapitalizations increased dramatically.

A final aspect of the above comparisons is related to both the aging effect and the rating-withdrawn occurrence. If we simply add the "rating withdrawn" percentage to the no-change-in-rating group, the A/K results become much closer to that of Moody's and S&P. For example, the five-year (Table 2) Triple-B category shows no change in rating from A/K of 65.4%, and the combined no-change and rating-withdrawn (RW) percentages are 61.3% for Moody's and 67.2% for S&P. While those bonds which are eventually called, or are redeemed at maturity, could have changed in credit quality prior to redemption, there is no *apriori* assumption as to whether the change is up or down. As for the impact on returns to bondholders, the redemption will probably be quite positive. Hence, the aging effect that we observed for the one-year horizon (Table 1) does not seem to persist for the five year horizon (Table 2).

3.2 Marginal Migration Rates

A by-product of the several data sources on migration patterns is to impute the marginal, e.g., one-year, transition ratios from the published cumulative rates. For example, Moody's (1993) reports that the one-year Baa migration to A is 5.2% and the two-year cumulative rate is 9.8%. Therefore, one could infer that the relevant marginal migration from year 1 to year 2 was something like 4.6%. Of course, some of the issuers that moved to A within one year may have returned to Baa and others migrated from Baa to A, etc. We will not pursue these marginal patterns in this paper.

4.0 Implications of Rating Migration

4.1 Impact on Returns

The primary implication of rating migration involves the assessment of the expected impact of the migration on fixed income security values. Changes in price and asset values are a function of credit quality changes as well as interest rate and duration changes. Most of the literature on relevant credit quality change has focused on the impact of the severity of defaults on investor returns, e.g., Altman & Kishore (1997) and Carty & Lieberman (1996a,b). For example, the average *default loss* on defaulting non-investment grade bonds has been about 2.4% per year over the period 1978-1996. With a promised yield spread of about 4.4% per year, high yield bonds might be expected to return about 2.0% per year above the default risk-free rate (assuming no change in interest rates). Indeed, the historical return spread of high yield bonds over 10-year U.S. Treasuries during this 19 year period has been 2.3% (arithmetic) and about 2.5% (geometric average) per year. But, default is the most extreme bond rating migration and other, less extreme changes, will also affect returns.

One method for determining the price impact of a rating change is derived by multiplying the change in yield spread between the initial rating state and the new rating times the modified duration (the percentage change in price associated with a 100 b.p. move in interest rates) of the bond. One problem with this method is that the duration of the bond changes (decreases) as the bond matures and the precise price impact based on cumulative migration patterns is not always clear.

This methodology utilizes either the average yield-to-maturity or the option (primarily call option) adjusted spread, by bond rating class. For example, the average spread compared to U.S. Treasury bonds for AAA's was 54.8 basis points (b.p.), AA was 60.4 b.p., A was 85.3 b.p., BBB was 139.8 b.p., BB was 326.1 b.p., B was 538.7 b.p., and CCC was 1027.9 b.p. Therefore, if a bond's rating changed from BBB to A, the average spread decline would have been 54.5 b.p. (139.8-85.3). The average modified duration of BBB bonds was slightly above 6.2 years over the same period. If the bond had a duration of 6.2 years when it was upgraded, the average price change could then be calculated to be about 338 b.p. ($33.80 per bond). We also observed that the probability of a bond migrating up from BBB to A within five years of issuance was 19.6% (Table 2 -

A/K). The resulting *expected* impact of such a change is therefore 66 b.p. or $6.60 per bond (0.196 x 54.5 x 6.2 = 66 b.p.). If, instead of a 6.2 year duration, the duration drops to 3.0 years when the upgrade occurs, the price change is more modest at 32 b.p. or $3.20 per bond. An alternative method to calculate the impact of rating migration on a bond's value is to estimate the possible rating change for the next period, e.g., one year, and then discount the remaining cash flows from that period to maturity using the forward zero coupon curve for bonds in the new rating class. Rather than trying to estimate the forward interest rate curves, the first method (above) assumes no change in rates. If, however, we are simultaneously estimating the impact of all possible rating migration patterns on a portfolio of many securities, then a type of forward-yield-curve-simulation analysis would appear to be a reasonable approach. A third method to analyze the impact of a rating change on the security's price is to directly observe the price changes of a large sample of bonds of different rating classes. The main problem with this technique is to determine the correct date to measure the price change. It is obviously too late to measure the change at the exact time of the rating change since most, if not all, of the change has already occurred. An alternative date is when the rating agency first places the bond on its "watch-list" and publishes this "event" (e.g., in S&P's **Credit Week**). The price changes over time will not always be the same since market conditions are constantly changing.

This event-study analysis is an illusive methodology.

A final approach that we will consider is to decompose the observed market spreads of bonds in various rating classes so that we can isolate the impact of expected rating drift. Combined with historical rating drift patterns, these observed spreads can reveal the expected economic consequence of a change in rating.

4.2 Portfolio Credit Risk Limitations

Another implication of rating migration involves the financial institution's policy on tolerance for credit quality changes in the underlying fixed income portfolio. Bankers may have a policy with respect to their rating or scoring system that "permits" the bank to have a certain proportion of low quality loans. For example, 5% of the portfolio can be below level five in a nine point system, e.g., below a Double-B rating equivalent. Or, investment grade bond mutual funds can continue to hold 5% of their portfolio that falls below investment grade but also must sell when the rating falls below some extreme level, e.g., below B. Hence, an initial portfolio comprised of newly issued investment grade bonds of 50% A and 50% BBB bonds can be expected to have 8.15% of the portfolio fall below investment grade in five years (A/K results from Table 2) -- 50% weight of A bonds which fall below BBB (3.3%) and 50% weight of BBB bonds that fall to non-investment grade (13.0%). And, since 3.7% of the BBB initial rated bonds can be expected to fall below B as well as 0.7% of the A bonds, and they must be sold, the actual proportion of remaining junk bonds would be about 6.0% -- still somewhat above the 5% tolerance rate.

4.3 Implications for "Crossover Investing"

One of the popular corporate bond investment strategies that has developed recently as yield spreads on all corporate debt have narrowed and shrunk, is the so-called "crossover" or 5-B, or even 4-B, strategy. This typically involves high-grade investors who are permitted and desire to own bonds which are rated investment grade by one of the rating agencies and non-investment grade by another (Baa3/BB+ or BBB-/Ba1). Or, they sometimes can own the highest of the non-investment grade class -- double B or Ba.

One argument for the cross-over strategy is that while the credit risk of the bond is still acceptable, there is a significantly greater yield available compared to bonds that are 6-B (investment grade from both agencies) or even 5-B. And, if the rating agency that is presently rating the bond as non-investment grade eventually upgrades their assessment, even just one-notch, the spread will narrow considerably resulting in a significant increase in price.[6] Also, these bonds seem to have significant call potential from either high cash flows available to payoff the existing bondholders or mergers and acquisitions.

The underlying assumption for most crossover investors is that they will be able to choose the "5-B" or "4-B" bonds that have a good chance for an upgrade and little chance of downgrade. So,

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[6]See the Salomon Brothers Inc report "Bond Market Roundup: Strategy," September 13, 1996 and October 18, 1996. These reports document the strong

either no change in rating (higher yield) or an upgrade (higher yield plus price appreciation) is an acceptable result. The downgrade to unambiguous "junk" status is definitely undesirable although the impact on total return has never been assessed rigorously.

If one were interested in analyzing "crossover" strategy patterns with intra-rating notch criteria (e.g., Ba1, Ba2, Ba3) a relevant study was published in Moody's (1993). Recall that Moody's rating "basket" includes bonds of all ages, not only the original rating, and their data covered the period 1983-1993 (soon to be updated through 1996). For example, we can observe from Moody's that the one-year transition probability from Ba1 to Baa3 (one notch upgrade) is 5.7% and from Ba1 to Baa2 (two notch upgrade) is 3.0%. On the negative side, the probability that a Ba1 will fall to Ba2 or Ba3 is 4.2% and 4.3% respectively. Working through a strategy that includes selling any bond that falls from Ba2 to B1, including specific assumptions as to the impact of a withdrawn rating result, would leave the investor with a +33.8 b.p. expected benefit.[7]

4.4 Unexpected Rating Migration Impact on Returns

The above discussion centered on the *expected* impact of rating migration on prices and returns. A matrix of all the possible outcomes given every migration pattern could be derived in the same manner and the standard deviation around the expected value could

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relative performance of double B's and split-rated Triple-B's.

[7]This is derived based on the method that utilizes yield spread differences

then be calculated. The latter figure relative to the expected price change would then give us the *unexpected* price change for different confidence intervals.

Unexpected gains and losses due to credit risk migration patterns are additional inputs for estimating losses when the loan (or bond) portfolio is subject to mark-to-market disclosure and investor strategy. A buy and hold strategy typically considers only *expected default loss* estimates. We will pursue this line of research in a follow-up report to this one.

4.5 Credit Risk Migration and Loan Losses

A fair amount has been written about estimating both the expected and unexpected losses from bank loan portfolios (see Altman and Saunders (1997) for a summary of a number of studies). With the increased importance of mark-to-market price disclosure, gains and losses due to deteriorating credit risk patterns must now be included. The impact of these changes, first discussed by Austin (1992), can now be quantified more precisely by our expected price change methodology. As noted in Section 4.4, an important component in the loan loss estimation is the unexpected rating migration and its consequent impact. We leave this analysis to a future discussion.

5. Credit Derivatives

As noted earlier, a fast growing segment of the derivative securities market is the trading of options on credit risk changes which allows banks and others to trade small shifts in a borrower's

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between ratings, average durations and transition probabilities.

or counterparty's credit risk. Combined with default risk options and hedges, which are also relatively new and growing, credit risk changes of the underlying corporate, bank, or sovereign counterparty are relevant and important. Estimates of the size of the total credit risk derivative market traded in 1996 was $40 billion, or more (McDermott, 1997).

It is increasingly common for interest rate or currency swaps, which enable the owner to hedge against market fluctuations, to be accompanied by credit risk hedges. One fairly obvious area that is likely to see increased application of credit derivatives is the emerging market debt sector, both sovereign and also, but less so, in the corporate bond markets. In addition, changing markets, such as sovereign debt in the European Monetary Union, may also be a fertile area for such hedging vehicles as currency fluctuation risk becomes less important. And, the traditional commercial bank domestic loan market, where credit risk derivatives started in 1991, will likely grow impressively as banks become more comfortable with this balance sheet risk shifting strategy.

In the past, only default risk hedges seemed relevant for the counterparties. More recent emphasis on total return credit swaps and on mark-to-market disclosure and reporting to owners of fixed income securities and funds, especially where the value of the fund is dependent upon realistic market values, has catapulted credit rating migration analysis to a new and loftier status. For a discussion of the overall credit derivative market, see Euromoney

(1996).

The basic structure of a credit-risk derivative is for the holder of a particular underlying credit (ie., the protection buyer) to pay a "fee," or premium, to a counterparty (protection seller) who agrees to make an event-contingent payment. The trigger event may be a default or downgrade or any event which negatively impacts the market value of the underlying credit's paper. In essence, a credit risk derivative is an insurance product, although potentially more flexible than traditional bond insurance mechanisms. The form of payment when the trigger event occurs is a contractual matter and usually depends on the drop in market value of the security, eg., the notional-face value minus the recovery rate on the defaulted underlying paper.

For pricing purposes, when the contract is written, the recovery amount can be estimated in advance based on historical results or some more specific estimate based on the particular attributes of the security. In the event of a default, the recovery rate is based on the market price at some time shortly after the default, which may vary from one day to several months (see Altman and Kishore (1996) for estimates of recovery rates).

Buyers of credit derivatives typically are banks who either wish to eliminate the default risk of their exposures or simply to reduce exposure in certain sectors or locations. This will free-up its lines of credit in the relevant sector. Other major purchasers include large investment banks who seek to hedge their enormous bond and other derivative portfolios, manufacturers who seek to reduce their losses in the event of a single major customer's default and equity investors who want to hedge all or part of their investment which was "guaranteed" by a questionable third party, eg., emerging market sovereign. Finally, taxes may play an important role in a counterparty's considerations, eg., by disentangling credit risk gain/loss from interest rate gain/loss.

As mentioned earlier in our cross-over investment strategy discussion, money managers may want to take higher than normal risk in order to increase yields. These investors may also desire to hedge against credit changes in the underlying asset by paying a relatively small annual premium. The increasingly common total-return-credit-swap derivative involves a premium to hedge against swings in market values of the underlying asset. Any positive change in value due to reduced risk is paid by the premium-payer-buyer to the credit risk-holder-counterparty and any negative change is paid by the default-risk holder to the hedging premium-payer.[8] This, in essence, transfers the economic value of the underlying asset, eg., fixed rate bond, from the buyer to the new credit risk-holder.

Our report and analysis seeks to provide rating migration expectations and the consequent market-value change patterns as a foundation for knowledge based analysis to make the credit derivative market more efficient and liquid, especially with

[8] For a discussion of the effectiveness of providing for downgrades in reducing counterparty risk, see Lucas (1995).

respect to the total-return-swap-derivative market.

6. Concluding Comments on This Study and Future Work

This study has brought together the several published reports on credit rating migration patterns and attempted to analyze their information similarities and differences. We have highlighted some rather great differences between the various published reports on rating migration. These differences are based on different sample methodologies, rating systems and periods of observation. We have also explored a number of direct applications for this data including expected returns for various types of investors and data to assist traders in credit risk derivative transactions. As banks, bond investors and other purchasers of credit-risk derivatives exploit this market to hedge their portfolios, the ultimate result will be lower costs of credit. We encourage even more in-depth studies with comprehensive and consistent data on rating migration patterns covering all relevant time periods as well as the entire spectrum of rating notch differentials.

In a subsequent study, we plan to go into greater depth in several areas noted in this paper. Specifically, we will explore the price impact behavior and unexpected rating drift patterns to afford a more complete analysis of the credit risk migration phenomenon.

Table 1

Rating Transition Matrix - One-Year Horizon
(All Numbers are %)

	Aaa **AAA**	**Aa** **AA**	**A** **A**	**Baa** **BBB**	**Ba** **BB**	**B** **B**	**Caa** **CCC**	**Def.** **C/D**		**RW**
AAA (A/K)	94.3	5.5	0.1	0.0	0.0		0.0	0.0	0.0	
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Aaa (M)	88.3	6.2	1.0	0.2	0.0		0.0	0.0	0.0	
4.3										
AAA (S&P)	88.5	8.1	0.7	0.1	0.1	0.0	0.0	0.0		2.6
AA (A/K)	0.7	92.6	6.4	0.2	0.1		0.1	0.0	0.0	
-										
Aa (M)		1.2	86.8	5.8	0.7	0.2		0.0	0.0	0.0
5.4										
AA (S&P)	0.6	88.5	7.6	0.6	0.1		0.1	0.0		0.0
2.4										
A (A/K)	0.0	2.6	92.1	4.7	0.3		0.2	0.0	0.0	
-										
A (M)	0.7	2.3	86.1	4.7	0.6		0.1	0.0	0.0	
6.0										
A (S&P)	0.1	2.3	87.6	5.0	0.7		0.2	0.0	0.4	
3.6										
BBB (A/K)	0.0	0.0	5.5	90.0	2.8		1.0	0.1	0.3	
-										
Baa (M)	0.0	0.3	3.9	82.5	4.7		0.6	0.1	0.3	
7.7										
BBB (S&P)	0.0	0.3	5.5	82.5	4.7		1.0	0.1	0.2	
5.7										
BB (A/K)	0.0	0.0	0.0	6.8	86.1		6.3	0.9	0.0	
-										
Ba (M)		0.0	0.1	0.4	4.6	79.0		5.0	0.4	1.1
9.4										
BB (S&P)	0.0	0.1	0.6	7.0	73.8		7.6	0.9	1.0	
8.9										
B (A/K)	0.0	0.0	0.2	1.6	1.7		93.7	1.7	1.1	
-										
B (M)	0.0	0.0	0.1	0.6	5.8		3.1	3.5	10.5	
7.8										
B (S&P)	0.0	0.1	0.2	0.4	6.0		72.8	3.4	4.9	
12.2										
CCC (A/K)	0.0	0.0	0.0	0.0	0.0		2.8	92.5	4.6	
-										
Caa (M)	0.0	0.0	0.0	0.3	1.3		5.3	71.9	12.4	
8.8										
CCC (S&P)	0.2	0.0	0.3	1.0	2.2		9.6	53.1	19.3	
14.2										

Sources and Key:

A/K = Altman & Kao (1971-1989) from Altman & Kao (1992) - Newly Issued Bonds
M = Moody's (1920-1996) from Moody's (1997) - Static Pools of Bonds
S&P = Standard & Poor's (1981-1996) from S&P (1997) - Static Pools of Bonds
RW = Rating Withdrawn

Table 2

Rating Transition Matrix - Five-Year Horizon
(All Numbers are %)

	Aaa AAA	Aa AA	A A	Baa BBB	Ba BB	B B	Caa CCC	Def. C/D	RW
AAA (A/K)	69.8	23.5	2.9	3.6	0.1	0.0	0.1	0.1	-
Aaa (M)	60.8	15.2	4.3	1.0	0.5	0.1	0.0	0.2	18.0
AAA (S&P)	54.0	23.5	6.0	1.7	0.5	0.2	0.0	0.2	13.8
AA (A/K)	2.4	67.1	22.5	5.0	1.0	0.3	0.1	1.7	-
Aa (M)	3.4	54.1	15.9	3.4	1.2	0.2	0.0	0.6	21.1
AA (S&P)	2.4	53.4	24.4	4.0	0.9	0.8	0.1	0.4	13.7
A (A/K)	0.4	9.2	72.0	15.1	1.9	0.7	0.0	0.7	-
A (M)	0.3	5.9	55.7	10.3	2.6	0.7	0.1	0.6	23.4
A (S&P)	0.2	7.0	53.4	14.9	3.0	1.8	0.3	0.7	18.7
BBB (A/K)	0.4	1.6	19.6	65.4	7.6	1.7	1.9	1.8	-
Baa (M)	0.1	0.9	10.0	47.1	8.0	2.0	0.3	2.3	29.3
BBB (S&P)	0.2	1.3	15.5	41.5	9.6	3.4	0.8	2.0	25.7
BB (A/K)	0.0	0.0	7.7	20.4	40.8	16.5	7.8	6.8	-
Ba (M)	0.1	0.3	1.9	10.4	36.5	8.1	1.3	5.9	35.6
BB (S&P)	0.1	0.4	2.9	13.4	19.9	9.6	1.7	11.4	40.2
B (A/K)	0.1	0.0	2.3	4.0	7.7	53.3	11.8	20.8	-
B (M)	0.0	0.1	0.5	2.4	10.3	32.2	3.5	12.9	38.2
B (S&P)	0.0	0.1	0.6	2.8	9.5	16.6	2.5	22.5	45.4
CCC (A/K)	0.0	0.0	2.6	3.6	2.6	30.7	26.5	34.0	-
Caa (M)	0.0	0.0	0.0	1.6	4.0	7.8	29.6	28.0	

29.0								
CCC (S&P)	0.2	0.0	0.9	2.4	3.5	6.1	5.4	42.0
39.5								

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Sources and Key:

A/K = Altman & Kao (1971-1989) from Altman & Kao (1992) - Newly Issued Bonds
M = Moody's (1920-1992) from Moody's (1997) - Static Pools of Bonds
S&P = Standard & Poor's (1981-1996) from S&P (1997) - Static Pools of Bonds
RW = Rating Withdrawn

Table 3

Rating Transition Matrix - Ten-Year Horizon
(All Numbers are %)

	Aaa AAA	Aa AA	A A	Baa BBB	Ba BB	B B	Caa CCC	Def. C/D		RW
AAA (A/K)	52.1	35.6		7.1	4.6	0.0		0.4	0.0	0.2
-										
Aaa (M)	41.6	19.0		6.1	2.1	0.8		0.2	0.0	0.6
29.6										
AAA (S&P)	30.7	24.7		12.0	6.5	0.5		0.0	0.0	1.1
24.6										
AA (A/K)	3.5	45.7	27.1	19.0	2.4		0.2	0.0	2.1	
-										
Aa (M)		4.5	33.4	19.8	4.9		2.2		0.6	0.1
1.5	33.1									
AA (S&P)	3.1	30.3	29.2	6.4		1.5		0.4	0.2	1.8
27.1										
A (A/K)	0.8	17.3	60.9	20.0	3.4		0.9	0.6	1.1	
-										
A (M)	0.3	6.5	38.6	11.1	3.3		1.1	0.2	2.2	
36.7										
A (S&P)	0.5	7.5		33.5	15.8	3.9		1.7	0.2	2.4
34.5										
BBB (A/K)	0.0	2.8	36.1	42.3	8.2		4.6	1.9	4.1	
-										
Baa (M)	0.8	1.3	11.7	30.0	6.4	2.1	0.3	4.1		43.8
BBB (S&P)	0.3	1.7	14.6	24.5	6.1		1.9	0.1	5.2	
45.7										
BB (A/K)	0.0	0.0	10.3	25.5	20.6		12.5	17.2	13.9	
-										
Ba (M)		0.1	0.3	3.0	10.1	17.1		6.1	1.3	9.9
		52.1								
BB (S&P)	0.1	0.1	3.7	10.3	6.6		3.8	0.5		20.0
	54.8									
B (A/K)	0.0	0.0	5.7	8.6	6.7		40.9	6.6	31.5	
-										
B (M)	0.0	0.1	0.8	2.7	7.8		13.8	2.1	18.6	
54.1										
B (S&P)	0.0	0.1	0.7	2.9	4.7		2.2	0.6	28.6	
61.2										
CCC (A/K)	-	-		-		-		-	-	-
	-		-							

Caa (M)	0.0	0.0	0.0	2.1	3.2	5.1	13.5	36.9	39.2
CCC (S&P)	0.0	0.0	0.6	2.3	4.6	2.9	0.0	36.2	53.5

Source and Key:

A/K = Altman & Kao (1971-1989) from Altman & Kao (1992) - Newly Issued Bonds
M = Moody's (1920-1997) from Moody's (1997) - Static Pools of Bonds
S&P = Standard & Poor's (1981-1996) from S&P (1997) - Static Pools of Bonds
RW = Rating Withdrawn

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