NEW YORK UNIVERSITY
STERN SCHOOL OF BUSINESS
FINANCE DEPARTMENT

Working Paper Series, 1996

Rating Migration of Corporate Bonds: Comparative Results and Investor/Lender Implications

Altman, Edward I.

FIN-96-1

Draft: Not For Quotation or Use in Other Ways Without the Permission of the Author.

Rating Migration of Corporate Bonds: Comparative Results and Investor/Lender Implications

Edward I. Altman*

December 1996

*Dr. Altman is the Max L. Heine Professor of Finance, Stern School of Business, New York University and a consultant to the Global Corporate Research Area of Salomon Brothers Inc. He wishes to thank Jacob Boudoukh of NYU, Lea Carty of Moody's and Paul Narayanan for their thoughtful comments, Betsy Tompkins of Salomon Brothers Inc for data assistance and Jason Seltzer of the NYU Salomon Center for his computational work.

Rating Migration of Corporate Bonds: Comparative Results and Investor/Lender Implications

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 ratings changes (drift) over time as well as the implied impact on the price of the bond and on investment strategies.

Our analysis compares rating changes from the two major agencies, Moody's and S&P, over the period 1970-1995, as well as yield and duration results by rating class from 1985-1996. 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 users as bond investors who concentrate on any or all segments of the corporate bond market, eg., high yield bond and "crossover" investors (those who typically invest in investment grade bonds but who can invest in split-rated issues or the highest grade of non-investment grade bonds), mark-to-market analysts and traders in the new and growing market for credit-spread-derivatives. The latter market enables banks and other institutions to trade and hedge small shifts in a borrower's credit risk as well as the extreme negative migration to default.

Rating Migration of Corporate Bonds: Comparative Results and Investor/Lender Implications

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, agencies perform reviews 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 revolving around 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 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] For example, 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.

This study also assesses the implications of the rating migration experience. In particular, we present a methodology and the relevant data to explore the expected price impact of bonds which experience rating drift, taking into consideration the initial rating "bucket," the resulting credit risk state of the bond over different time horizons and the yield spread and modified-duration associated with different rating classes. These price impacts are analyzed from the standpoint of a number of investment strategies as well as relevant inputs for the credit-risk derivative market.

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 carefully. For example, recently there has been increased interest in the so-called "crossover" investment strategy. Crossover refers primarily to investment grade investors dipping slightly into the lower grade ratings to acquire higher yields, e.g., investing in a 5-B security

---

[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.

(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 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 spread derivatives.

Since we will assess rating migration impact on prices from all initial rating classes, the analysis will complement the default and mortality results reported in previous studies, eg., Altman (1989) and Altman & Kishore (1997). Defaults are, after all, the ultimate, extreme negative migration.

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 the impact on returns, guidelines for credit limitations on particular portfolios, "crossover" strategies, and precise estimates of loan losses. Section 5 explores the characteristics of the credit risk derivative market indicating how rating migration risk can be an important determinant for buyers and sellers. Finally, Section 6 presents concluding remarks and indicates a future extension of this migration work.

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. Soon after, several studies from **Moody's**, including its special reports which were reproduced in Lucas & Lonski (1992) and Carty & Fons (1993). The latter covered that agency's rating changes from 1970-1993. Finally, **S&P** periodically examines rating migration with the latest report (1996) covering rating changes of that agency from 1981-1995. 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 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.[2]

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,[3] respectively. S&P's data start in 1981 and ends in 1995. As one can observe, the relative propensity for an issue to be upgraded or downgraded does vary over time. For instance, 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 more upgrades.

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," which usually is due to a call or some other redemption of the bond, e.g., from an acquisition of the firm, or if there was insufficient information to rate the bond. 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

---

[2]This is also true for both rating agencies' cumulative default analyses, e.g., Moody's (1996) and S&P (1996). Our mortality rate results (Altman & Kishore, 1997) trace the cumulative default/mortality rate of all bonds from initial issuance. This is consistent with the rating migration methods.

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

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. 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" 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

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	WR
AAA (A/K)	94.3	5.5	0.1	0.0	0.0	0.0	0.0	0.0	-
Aaa (M)	89.6	7.2	0.7	0.0	0.0	0.0	0.0	0.0	2.5
AAA (S)	88.7	8.1	0.7	0.1	0.1	0.0	0.0	0.0	2.3
AA (A/K)	0.7	92.6	6.4	0.2	0.1	0.1	0.0	0.0	-
Aa (M)	1.1	88.8	6.9	0.3	0.2	0.0	0.0	0.0	2.8
AA (S)	0.1	88.3	7.6	0.6	0.1	0.1	0.0	0.0	2.6
A (A/K)	0.0	2.6	92.1	4.7	0.3	0.2	0.0	0.0	-
A (M)	0.1	2.5	89.0	5.2	0.6	0.2	0.0	0.0	2.5
A (S)	0.9	2.3	87.7	5.3	0.7	0.3	0.1	0.1	3.6
BBB (A/K)	0.0	0.0	5.5	90.1	2.9	1.1	0.1	0.0	-
Baa (M)	0.0	0.2	5.2	85.3	5.3	0.8	0.1	0.1	3.0
BBB (S)	0.0	0.3	5.6	82.0	5.0	1.1	0.11	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	4.7	80.1	6.9	0.4	1.5	5.8
BB (S)	0.0	0.1	0.6	7.0	73.3	8.0	0.9	1.1	8.9
B (A/K)	0.0	0.0	0.2	1.6	1.7	94.0	1.7	0.9	-
B (M)	0.0	0.1	0.1	0.5	5.5	75.7	2.0	8.2	7.8
B (S)	0.0	0.1	0.2	0.4	5.7	72.9	3.6	5.2	12.0
CCC (A/K)	0.0	0.0	0.0	0.0	0.0	2.8	92.5	4.6	-
Caa (M)	0.0	0.4	0.4	0.8	2.3	5.4	62.1	20.3	8.4
CCC (S)	0.2	0.0	0.2	1.1	2.0	11.3	53.3	19.8	14.1

Sources and Key:

A/K = Altman & Kao (1971-1989) from Altman & Kao (1992) - Newly Issued Bonds
M = Moody's (1970-1993) from Moody's (1993) - Static Pools of Bonds
S = S&P (1981-1995) from S&P (1996) - Static Pools of Bonds
WR = Rating Withdrawn

Note: The symbols across the top are from S&P. Moody's has comparable symbols, e.g., BBB = Baa, except for the CCC≠Caa class. The latter (Moody's) is generally assumed to be closer to default in the Caa category.

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	WR
AAA (A/K)	69.8	23.5	2.9	3.6	0.0	0.0	0.0	0.1	-
Aaa (M)	62.5	21.8	4.9	0.5	0.7	0.2	0.1	0.2	9.1
AAA (S)	53.8	23.4	6.0	1.9	0.6	0.3	0.0	0.2	13.8
AA (A/K)	2.5	67.1	22.8	5.2	1.1	0.3	0.1	-	-
Aa (M)	5.5	52.9	22.3	3.9	1.8	0.5	0.0	0.4	12.7
AA (S)	2.6	53.4	24.3	4.2	1.0	0.9	0.1	0.4	13.1
A (A/K)	0.4	9.2	72.5	15.2	1.9	0.7	0.0	0.1	-
A (M)	0.3	9.9	59.6	15.0	3.9	1.1	0.2	0.6	9.3
A (S)	0.2	7.2	52.2	15.5	3.3	2.0	0.3	0.7	18.7
BBB (A/K)	0.4	1.6	19.6	65.7	7.6	1.7	1.9	1.4	-
Baa (M)	0.2	1.9	18.8	49.7	12.6	3.2	0.3	1.7	11.6
BBB (S)	0.2	1.3	16.0	40.7	9.8	3.6	0.9	2.1	25.5
BB (A/K)	0.0	0.0	7.7	20.4	40.8	16.5	7.8	6.8	-
Ba (M)	0.2	0.5	3.6	13.6	37.4	12.6	0.8	10.1	21.2
BB (S)	0.1	0.4	2.9	13.5	19.4	9.9	1.9	12.5	39.5
B (A/K)	0.4	0.0	2.7	4.5	8.6	59.9	13.4	10.3	-
B (M)	0.1	0.1	0.7	3.1	10.3	31.8	1.7	24.6	27.4
B (S)	0.0	0.1	0.6	2.7	9.2	16.4	2.6	23.2	45.3
CCC (A/K)	0.0	0.0	3.6	3.6	0.0	35.7	28.6	28.5	-
Caa (M)	0.0	0.4	0.6	7.6	5.8	14.0	19.9	35.1	17.0
CCC (S)	0.3	0.0	1.0	2.7	3.0	5.7	5.9	41.3	40.3

Sources and Key:

A/K = Altman & Kao (1971-1989) from Altman & Kao (1992) - Newly Issued Bonds
M = Moody's (1970-1993) from Moody's (1993) - Static Pools of Bonds
S = S&P (1981-1995) from S&P (1996) - Static Pools of Bonds
WR = 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	WR
AAA (A/K)	52.1	35.7	7.1	4.6	0.0	0.4	0.0	0.0	-
Aaa (M)	47.1	31.5	8.8	3.6	1.7	0.2	0.1	1.0	6.0
AAA (S)	32.1	23.5	12.0	7.3	0.2	0.0	0.0	1.2	23.7
AA (A/K)	3.5	46.7	27.6	19.2	2.4	0.2	0.0	0.3	-
Aa (M)	8.4	33.6	30.6	9.6	3.3	0.8	0.2	1.3	12.1
AA (S)	3.1	29.9	30.1	6.4	1.8	0.5	0.3	2.1	25.8
A (A/K)	0.8	17.5	61.5	20.2	3.4	0.9	0.6	0.1	-
A (M)	0.6	14.8	43.0	17.9	5.9	2.5	0.4	1.1	13.9
A (S)	0.5	7.9	32.9	16.3	3.9	1.9	0.3	2.5	33.9
BBB (A/K)	0.0	2.8	36.8	43.3	8.3	4.6	1.9	2.3	-
Baa (M)	0.3	4.7	26.4	29.9	13.2	4.2	0.4	4.0	17.0
BBB (S)	0.2	1.8	14.8	24.0	6.0	1.9	0.2	5.2	45.8
BB (A/K)	0.0	0.0	10.8	27.0	21.6	13.5	18.9	8.1	-
Ba (M)	0.4	1.7	10.0	18.6	19.8	10.4	0.6	13.9	24.6
BB (S)	0.2	0.1	3.7	9.6	6.5	3.9	0.5	21.0	54.6
B (A/K)	0.0	0.0	7.7	9.6	5.7	43.9	9.6	21.5	-
B (M)	0.8	0.0	4.9	6.1	11.6	16.5	0.4	30.2	28.5
B (S)	0.0	0.0	0.7	2.2	4.8	1.8	0.6	28.6	61.2
CCC (A/K)	-	-	-	-	-	-	-	-	-
Caa (M)	0.0	0.7	4.3	14.5	6.8	8.5	8.5	48.7	8.5
CCC (S)	0.0	0.0	0.9	2.7	6.3	2.7	0.0	29.7	57.7

Source and Key:

A/K = Altman & Kao (1971-1989) from Altman & Kao (1992) - Newly Issued Bonds
M = Moody's (1970-1993) from Moody's (1993) - Static Pools of Bonds
S = S&P (1981-1995) from S&P (1996) - Static Pools of Bonds
WR = Rating Withdrawn

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 94.0% of the newly issued bonds are still B rated after one year and 59.9% after five years. Moody's and S&P, however, show that only 75.7% and 72.9% (one year) and 31.8% and 16.4% (five years) retain the same rating. And, while A/K do not specify a withdrawn rating (WR) 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 12.0% of the issuers, respectively, have their bonds' ratings withdrawn after one year and as much as 27.4% and 45.3% 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 and 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 <u>not</u> 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.[4] S&P shows that 88.7% (AAA), 88.3% (AA), 87.7% (A), 82.0% (BBB), 77.3% (BB), -

---

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

- down to 53.5% (CCC).

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 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 65.7%, and the combined no-change and rating-withdrawn (WR) percentages are 61.3% for Moody's and 66.2% 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. With the recent emphasis of marking assets to market, 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 junk 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 has been 2.3% (arithmetic) and about 2.5% (geometric average) per year. But, default is the extreme bond rating migration and other, less extreme changes, will also affect returns.

We have therefore compiled data on average yields, yield spreads, and modified durations to assess the expected change in credit ratings on prices and returns. Crabbe (1995) used historical statistics on rating transition to estimate the return over treasuries for major sectors of the investment-grade bond market. The price impact in our study is derived by multiplying the change in yield spread times the modified duration (the percentage change in price associated with a 100 b.p. move in interest rates) of the bond (based on its initial rating).[5] **Table 4** lists the average yield-to-maturity and option (primarily the

[5]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, eg., 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, we essentially assume no change in rates in our solution. 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.

call option) adjusted spread, by bond rating class, from 1985-1996. The overall 12-year average is also given. For example, the average spread 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. The average modified duration of BBB bonds was slightly above 6.2 years over the same period (**Table 5**). 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.).

To assess the impact of the expected five-year migration of original issue BBB bonds, we might consider all possible levels of migration, including to default. **Figure 1** shows this calculation to be an expected net price change of -218.7 b.p. (-21.87 per $1,000 bond). In Figure 1, we have indicated an expected loss of 4,500 b.p. if the bond migrates to default. This is based on an assumption of a 55% recovery rate on initially issued BBB rated bonds. The entire spectrum of recovery rates by initial bond rating is given in **Table 6**. These rates include defaulted bonds of all seniority levels. Since most investment grade bonds are senior unsecured, as are bank loans, some type of average recovery in the

Table 4

AVERAGE YIELDS AND SPREAD BY RATING CLASS, 1985-1996

	AAA		AA		A		BBB		BB		B		CCC	
Years	Avg YTM Std Dev	b.p. Spread Std Dev	Avg YTM Std Dev	b.p. Spread Std Dev	Avg YTM Std Dev	b.p. Spread Std Dev	Avg YTM Std Dev	b.p. Spread Std Dev	Avg YTM Std Dev	b.p. Spread Std Dev	Avg YTW Std Dev	b.p. Spread Std Dev	Avg YTW Std Dev	b.p. Spread Std Dev
1985	11.09%	21.31	11.54%	33.26	11.81%	52.53	12.45%	122.75	13.91%	303.58	14.71%	400.00	16.58%	570.42
	0.62	7.01	0.57	10.26	0.54	13.27	0.56	13.43	0.83	34.36	0.52	33.03	0.72	45.80
1986	8.81	52.60	9.43	81.75	9.78	113.86	10.55	205.70	11.97	410.33	13.04	530.50	15.65	789.83
	0.52	23.42	0.44	26.71	0.45	29.17	0.41	39.54	0.31	47.38	0.41	40.09	0.83	121.72
1987	8.97	43.99	9.47	63.12	9.71	83.08	10.26	145.41	11.87	345.92	13.21	492.58	16.75	836.08
	0.69	14.14	0.62	14.45	0.57	11.66	0.54	17.93	0.62	44.97	0.83	61.56	0.77	86.14
1988	9.34	47.05	9.69	51.25	9.85	69.66	10.39	118.31	11.89	296.75	13.70	488.08	16.67	789.08
	0.29	13.34	0.25	12.44	0.24	10.29	0.20	20.89	0.23	42.29	0.27	42.00	0.89	70.39
1989	9.35	39.90	9.59	48.65	9.79	72.60	10.30	112.58	11.68	303.50	13.98	543.42	20.77	1,221.42
	0.46	13.00	0.49	14.40	0.45	16.90	0.40	21.26	0.27	40.32	0.53	97.51	3.05	347.42
1990	9.28	67.89	9.52	72.27	9.78	101.90	10.52	163.54	11.91	334.00	16.58	804.50	31.58	2,304.08
	0.23	10.26	0.22	11.54	0.22	18.00	0.31	37.00	0.37	28.70	1.23	117.58	5.01	499.29
1991	8.35	86.41	8.79	72.16	8.98	114.00	9.79	168.96	12.09	484.75	16.09	778.17	22.07	1,668.67
	0.49	9.44	0.34	14.41	0.45	19.67	0.53	40.64	0.79	54.24	2.33	147.81	4.93	363.86
1992	6.82	86.85	7.78	69.71	7.79	104.24	8.58	150.34	9.71	360.58	11.50	546.42	14.10	875.50
	0.44	10.86	0.34	7.55	0.37	9.68	0.35	15.20	0.59	59.28	0.65	62.77	0.91	153.83
1993	5.76	74.03	6.72	75.43	6.75	100.10	7.45	150.64	8.36	307.58	10.08	491.67	12.70	807.75
	0.34	6.41	0.39	3.77	0.37	5.67	0.42	9.28	0.43	25.96	0.46	33.10	0.48	37.03
1994	6.82	51.18	7.54	58.49	7.60	78.10	8.19	123.43	9.21	253.83	10.97	431.42	13.53	699.75
	0.83	3.94	0.69	5.21	0.71	5.55	0.67	7.55	0.87	12.35	0.88	18.97	1.51	87.47
1995	7.01	44.08	7.39	51.69	7.45	69.27	7.93	109.26	9.16	253.83	11.43	484.92	15.54	900.25
	0.66	3.22	0.64	4.32	0.67	5.60	0.67	7.49	0.64	15.24	0.37	39.50	0.38	46.05
1996	6.66	40.06	7.01	44.96	7.05	60.24	7.54	99.87	8.75	245.50	10.85	459.90	14.66	840.90
	0.45	1.76	0.41	1.87	0.43	2.43	0.41	4.17	0.32	23.83	0.18	49.42	0.46	58.13
1985-96														
Average	8.21	54.82	8.73	60.44	8.89	85.31	9.52	139.79	10.91	326.13	13.04	538.73	17.59	1,027.91
Std Dev	1.58	22.22	1.44	18.42	1.53	24.52	1.54	36.81	1.76	76.18	2.20	140.23	5.50	520.48

YTM: yield to maturity (%): average based on 12 (months) observations
YTW: yield to worst (%): average based on 12 (months) observations
Spread: average option adjusted spread over U.S. Treasury Bonds (basis points, b.p.)
1985-96 averages = monthly observations

Source: Salomon Brothers Inc.; Professor Edward I. Altman, New York University Salomon Center

Table 5

AVERAGE MODIFIED DURATION BY RATING CLASS: 1985-1996

Years	AAA Duration Std Dev	AA Duration Std Dev	A Duration Std Dev	BBB Duration Std Dev	BB Duration Std Dev	B Duration Std Dev	CCC Duration Std Dev
1985	5.91 0.20	6.11 0.17	6.18 0.15	5.75 0.14	6.35 0.18	5.87 0.19	5.41 0.11
1986	6.66 0.15	6.85 0.19	6.70 0.13	6.19 0.09	6.51 0.09	5.32 0.22	5.44 0.26
1987	6.30 0.36	6.54 0.33	6.67 0.25	6.27 0.18	6.30 0.23	5.34 0.21	5.28 0.13
1988	5.84 0.19	6.21 0.13	6.27 0.17	6.17 0.09	6.16 0.08	5.40 0.09	5.02 0.12
1989	6.15 0.15	6.01 0.08	6.13 0.10	6.16 0.09	5.48 0.13	4.90 0.10	4.21 0.30
1990	5.56 0.42	5.99 0.10	6.03 0.14	5.95 0.14	5.32 0.13	4.41 0.18	3.39 0.34
1991	4.88 0.19	6.64 0.22	5.86 0.06	5.92 0.10	4.40 0.39	4.60 0.34	3.71 0.14
1992	4.46 0.05	6.85 0.10	6.04 0.07	6.34 0.15	4.47 0.17	3.94 0.28	2.76 0.34
1993	4.50 0.06	6.85 0.11	6.45 0.23	6.67 0.13	4.86 0.27	4.23 0.22	2.94 0.46
1994	4.29 0.16	6.62 0.23	6.25 0.29	6.44 0.20	5.37 0.12	4.94 0.18	4.62 0.37
1995	4.46 0.19	6.57 0.17	6.12 0.15	6.37 0.14	5.37 0.09	4.75 0.10	4.42 0.09
1996	4.75 0.10	6.51 0.25	6.20 0.11	6.43 0.16	5.28 0.06	4.55 0.08	4.48 0.17
1985-96 Average Std Dev	5.32 0.84	6.48 0.36	6.24 0.29	6.22 0.28	5.49 0.71	4.86 0.57	4.30 0.94

Note: 1985-96 averages = monthly observations

Source: Salomon Brothers Inc.; Professor Edward I. Altman, New York University Salomon Center

FIGURE 1
RATING TRANSITION IMPACT - 5 YEARS FROM ISSUANCE

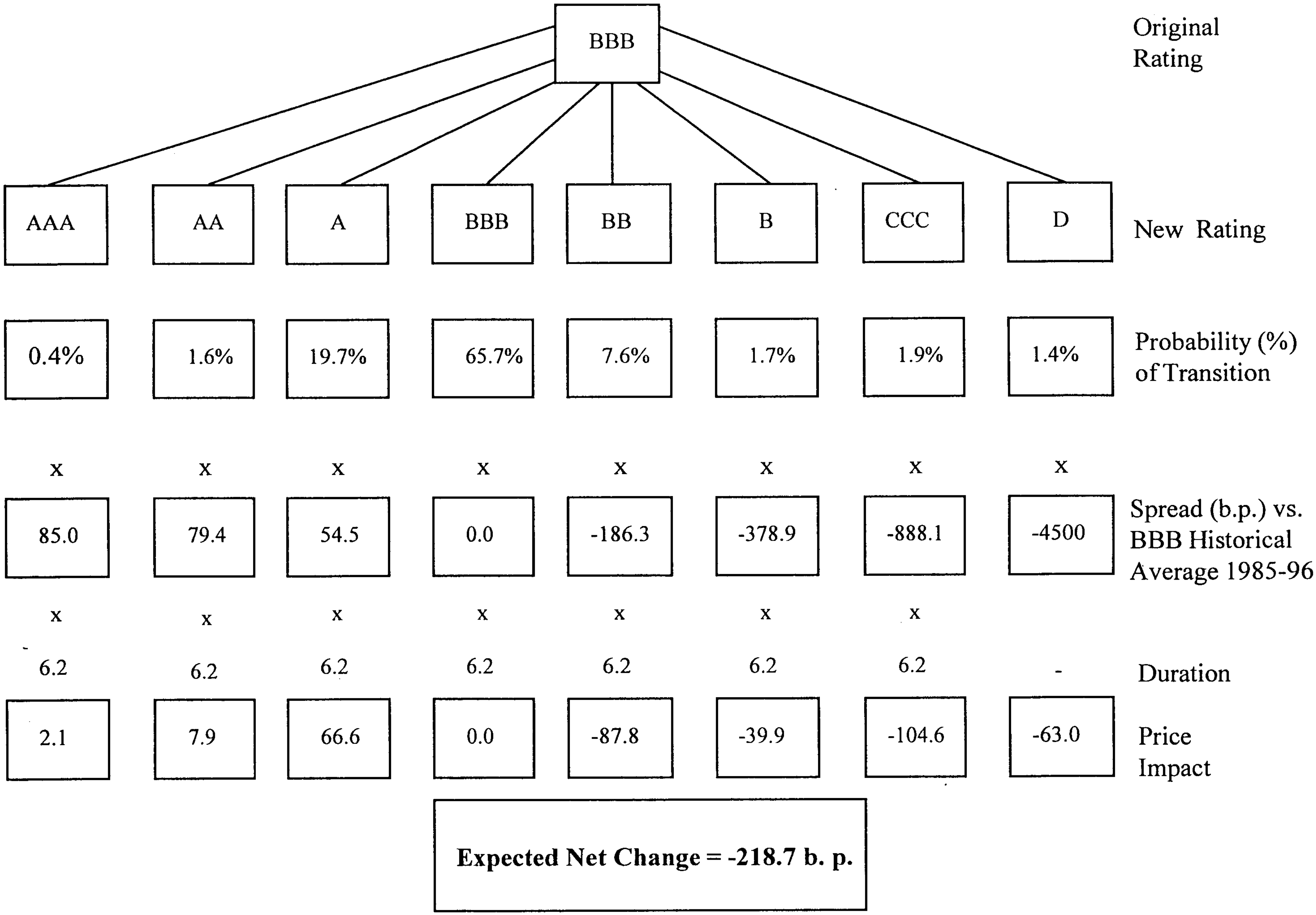


Table 6

AVERAGE PRICE AFTER DEFAULT BY ORIGINAL BOND RATING
(1971 -1996)

Rating	No.of Observations	Average Price	Weighted Average Price	Median Price	Std. Dev.	Minimum Price	Maximum Price
AAA	7	$68.34	$76.99	$71.88	$20.82	$32.00	$97.00
AA	20	$59.59	$76.52	$54.25	$24.59	$17.80	$99.88
A	56	$60.63	$47.59	$61.32	$25.53	$10.50	$100.00
BBB	81	$49.42	$50.27	$50.00	$23.70	$10.00	$103.00
BB	67	$38.76	$39.15	$33.52	$23.38	$ 1.00	$98.75
B	374	$36.59	$35.34	$33.30	$35.34	$ 0.50	$112.00
CCC	115	$37.65	$33.93	$29.61	$33.93	$ 1.00	$103.25
Total	720	$41.35	$39.78	$36.69	$39.78	$ 0.50	$112.00

Source: Compilation by the author from dealer quotes, Moody's and S&P.

vicinity of 55 percent or higher is reasonable and conservative.[6] If the bonds/loans are secured, a 60% estimate from the public bond market, is reasonable. See **Table 7** for the average recovery rate by seniority on defaulted public bonds.

Since the impact of a default is so devastating to the investor, a reasonable strategy would be to sell the bond once it migrates to some unacceptable rating, e.g., B- (B3) or CCC+ (Caa1). The analyst could then change the probability of migration to that lowest level by including that level plus all lower levels in the estimate. For example, if the BBB investor decided to sell once the bond reached the B level, from Table 2 we observe that the probability of that transition by the fifth year would be 5.0% (1.7% + 1.9% + 1.4%) and the expected net impact of all possible migrations would be a loss of 128.7 b.p. or $12.87 per $1000 bond (Figure 2). This assumes, of course, that the bond does reach the lowest tolerance level at some point and the investor can sell at the average yield and spread differential. Finally, we have <u>not</u> considered the possibility that the rating could be withdrawn by the fifth year -- a result that would probably add a 3-5% premium to the investor. We shall include this possibility in our analysis at a later point.

---

[6]Indeed, in a recent study, Carty and Lieberman (1996) found that the average recovery on a 58 issue sample of senior unsecured bank loans was 71% of face value.

Table 7

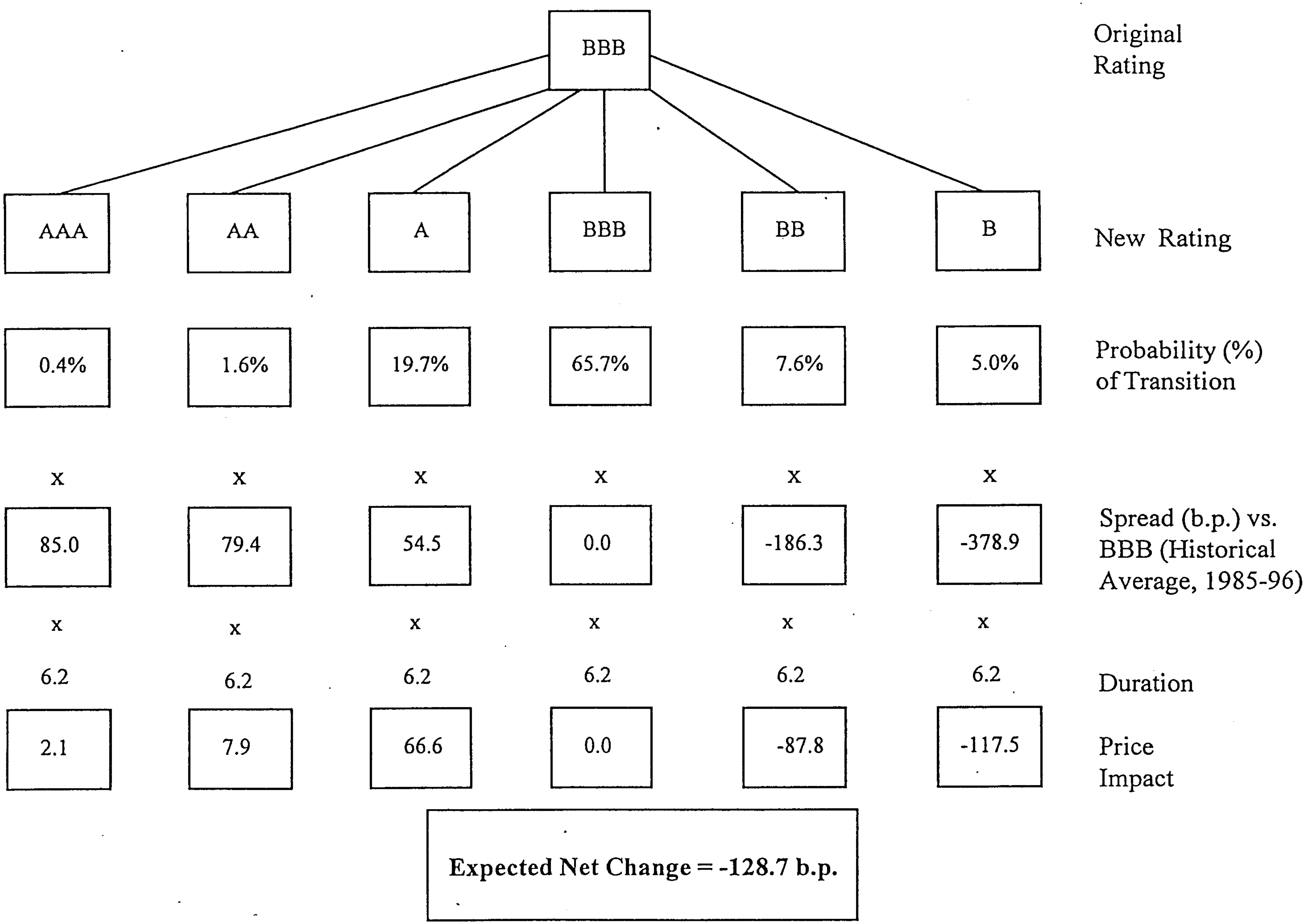
WEIGHTED AVERAGE RECOVERY RATES ON DEFAULTED DEBT BY SENIORITY PER $100 FACE AMOUNT

(1978 - 1996)

Default Year	Senior Secured		Senior Unsecured		Senior Subordinated		Subordinated		Discount and Zero Coupon		All Seniorities	
	No.	$	No.	$	No.	$	No.	$	No.	$	No.	$
1996	4	$59.08	4	$50.11	9	$48.99	4	$44.23	3	$11.99	24	$51.91
1995	5	$44.64	9	$50.50	17	$39.01	1	$20.00	1	$17.50	33	$41.77
1994	5	$48.66	8	$51.14	5	$19.81	3	$37.04	1	$5.00	22	$39.44
1993	2	$55.75	7	$33.38	10	$51.50	9	$28.38	4	$31.75	32	$38.83
1992	15	$59.85	8	$35.61	17	$58.20	22	$49.13	5	$19.82	67	$50.03
1991	4	$44.12	69	$55.84	37	$31.91	38	$24.30	9	$27.89	157	$40.67
1990	12	$32.18	31	$29.02	38	$25.01	24	$18.83	11	$15.63	116	$24.66
1989	9	$82.69	16	$53.70	21	$19.60	30	$23.95	-	-	76	$35.97
1988	13	$67.96	19	$41.99	10	$30.70	20	$35.27	-	-	62	$43.45
1987	4	$90.68	17	$72.02	6	$56.24	4	$35.25	-	-	31	$66.63
1986	8	$48.32	11	$37.72	7	$35.20	30	$33.39	-	-	56	$36.60
1985	2	$74.25	3	$34.81	7	$36.18	15	$41.45	-	-	27	$41.78
1984	4	$53.42	1	$50.50	2	$65.88	7	$44.68	-	-	14	$50.62
1983	1	$71.00	3	$67.72	-	-	4	$41.79	-	-	8	$55.17
1982	-	-	16	$39.31	-	-	4	$32.91	-	-	20	$38.03
1981	1	$72.00	-	-	-	-	-	-	-	-	1	$72.00
1980	-	-	2	$26.71	-	-	2	$16.63	-	-	4	$21.67
1979	-	-	-	-	-	-	1	$31.00	-	-	1	$31.00
1978	-	-	1	$60.00	-	-	-	-	-	-	1	$60.00
Total/Average	89	$57.94	225	$47.70	186	$35.09	218	$31.58	34	$20.81	752	$40.11
Median		$53.42		$41.99		$30.70		$32.91		$17.50	-	$36.69
Std.Dev.		$23.12		$26.60		$25.28		$22.50		$17.76	-	$25.84

Source: Computation by the author from Dealer Quotes, Moody's and S&P.

FIGURE 2
RATING TRANSITION IMPACT - 5 YEARS FROM ISSUANCE



Despite our finding of a negative price impact from BBB migration, we still observed, in other studies, that both the actual return in the 1980's (Altman, 1990) and the expected return, 1971-1996 (Altman & Kishore, 1997) from an investment in BBB bonds was either the best, or second to BB bonds, compared to all other rating classes. No doubt this is based on the total yield spreads of these bonds compared to the actual default losses and also rating migration patterns.

The negative rating migration impact with respect to bonds initially rated BBB is somewhat surprising and indicates the value-added information which considers both the expected rating change and the price impact. For example, if we only observed the rating change experience for BBBs over five years (Table 2), it would appear that upgrades (21.6%) dominate downgrades (12.6%).

4.3 Credit Risk Limitations on Portfolio

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 7.65% 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 (2.7%) and 50% weight of BBB bonds that fall to non-investment grade (12.6%). And, since 3.3% of the BBB initial rated bonds can be expected to fall below B as well as 0.1% 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.

4.4 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 BB.

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. 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, 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.

In order to investigate "Crossover" strategy patterns and expectations, we utilize the only study that analyzes rating migration with intra- rating-notch (1, 2, 3) criteria. This can be found in the Moody's (1993) study. Recall that the Moody's original rating "basket" includes bonds of all ages, not original issue ratings, and this particular data covers the period 1983-1993. For example, from **Table 9**, we observe that the one-year transition probability from Ba1 to Baa3 is 5.7% and 3.0% from Ba1 to Baa2 (positive rating drift). On the negative side, the probability that a Ba1 will fall to Ba2 or Ba3 is 4.2% and 4.3% respectively. Table 9 also lists the two-year rating migration matrix. Recent data on average spread differentials and average durations, separated by notches for triple-B and double-B bonds, is given in **Table 10.**[7] Keep in mind, that the main reason for investing in 5-B or 4-B bonds is to acquire the higher yield from these hybrid investment-non-investment grade bonds compared to the 6-B unambiguous investment grade sector. From Table 10 we can observe that the average spread between BBB- and BB+ bonds was 67 b.p. per year from 1992-1996 and it was 90 b.p. between BB+ and BB.

If we observe the two-year rating migration results from Table 9 for Ba1 and Ba2 bonds, we can estimate the impact of the migration on returns. In this case, Moody's data is particularly appropriate, not only for its notched differentials, but also for including the rating-withdrawn category -- 17.2% for Ba1 and 17.5% for Ba2. Further, we can truncate the possible drift from the initial rating to two notches up and down as well as including the rating-withdrawn category. The crossover investor is assumed to sell when the bond migrates to either an unambiguous investment or non-investment grade status. Hence, all migration above or below two notches is included in the two notch change "cell." For example, the Ba2 migration up to Baa1 or above is 5.5%

[7]Unfortunately, we do not have migration probability data on 5-B bonds, i.e., tracking both types of split rated bonds (Baa3/BB+ and BBB-/Ba1) for new and seasoned issues. And, our migration data that includes rating notches covers the period 1983-1993 -- a predominantly down-rated period, i.e., downgrades outnumbered upgrades in every year. It would be better to have migration data that exactly conforms with our yield, spread and duration data in Table 10.

Table 9

One-Year Rating Transition Matrix

Rating From: \ Rating To:	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	D	WR
Aaa	87.0%	5.7%	2.7%	0.2%	0.2%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.1%
Aa1	0.9%	88.2%	3.1%	3.5%	0.9%	0.2%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%
Aa2	1.0%	2.6%	73.9%	9.3%	6.2%	1.6%	0.9%	0.2%	0.1%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	4.2%
Aa3	0.1%	1.0%	2.3%	77.3%	9.3%	4.1%	1.1%	0.2%	0.2%	0.2%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.1%	3.9%
A1	0.1%	0.2%	0.9%	4.4%	76.8%	7.6%	2.8%	1.1%	0.3%	0.3%	0.4%	0.5%	0.1%	0.2%	0.0%	0.0%	0.0%	0.0%	4.4%
A2	0.0%	0.1%	0.2%	0.8%	5.0%	76.6%	7.3%	3.7%	1.2%	0.4%	0.3%	0.2%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	3.8%
A3	0.0%	0.1%	0.1%	0.3%	1.4%	8.2%	71.0%	6.8%	4.2%	1.7%	0.6%	0.3%	0.4%	0.6%	0.1%	0.0%	0.0%	0.0%	4.4%
Baa1	0.0%	0.1%	0.1%	0.1%	0.2%	2.9%	7.0%	68.4%	9.3%	3.7%	1.1%	0.6%	0.6%	1.0%	0.0%	0.0%	0.1%	0.1%	4.9%
Baa2	0.0%	0.2%	0.2%	0.2%	0.2%	1.0%	3.6%	7.6%	67.3%	8.4%	2.6%	0.5%	1.0%	0.9%	0.3%	0.3%	0.2%	0.0%	5.7%
Baa3	0.0%	0.0%	0.0%	0.0%	0.2%	0.5%	0.4%	4.9%	9.6%	61.5%	7.9%	3.1%	2.4%	1.2%	3.1%	0.1%	0.1%	0.5%	7.2%
Ba1	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.8%	0.7%	3.0%	5.7%	67.4%	4.2%	4.3%	2.4%	0.3%	1.1%	0.2%	1.0%	8.7%
Ba2	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.4%	1.9%	5.8%	66.7%	6.5%	5.3%	0.7%	1.4%	0.3%	0.9%	9.9%
Ba3	0.0%	0.1%	0.1%	0.0%	0.0%	0.1%	0.1%	0.3%	0.1%	0.8%	2.3%	3.0%	70.0%	6.8%	1.0%	3.3%	0.8%	3.0%	8.4%
B1	0.0%	0.0%	0.1%	0.1%	0.1%	0.0%	0.1%	0.0%	0.1%	0.4%	0.2%	2.3%	4.1%	68.4%	1.1%	6.2%	0.9%	6.3%	9.5%
B2	0.0%	0.0%	0.0%	0.0%	0.4%	0.0%	0.0%	0.4%	0.0%	0.0%	0.4%	1.7%	3.0%	6.0%	62.5%	6.9%	5.6%	5.2%	7.8%
B3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.1%	0.3%	0.3%	1.5%	4.1%	1.3%	64.7%	3.9%	15.2%	8.5%
Caa	0.0%	0.0%	0.0%	0.6%	0.6%	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.6%	1.2%	1.2%	1.2%	1.9%	55.9%	21.1%	14.9%

Two-Year Rating Transition Matrix

Rating From: \ Rating To:	Aaa	Aa1	Aa2	Aa3	A1	A2	A3	Baa1	Baa2	Baa3	Ba1	Ba2	Ba3	B1	B2	B3	Caa	D	WR
Aaa	79.8%	8.1%	2.1%	0.8%	0.3%	0.6%	0.0%	0.0%	0.2%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	8.0%
Aa1	2.1%	78.4%	4.7%	3.7%	2.6%	1.1%	0.3%	0.2%	0.2%	0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	6.4%
Aa2	1.8%	6.1%	55.7%	12.8%	9.6%	4.6%	1.2%	0.8%	0.2%	0.0%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.1%	0.0%	6.7%
Aa3	0.3%	1.0%	4.3%	62.0%	12.9%	6.1%	2.4%	1.1%	0.3%	0.4%	0.3%	0.3%	0.5%	0.1%	0.0%	0.0%	0.0%	0.3%	7.6%
A1	0.2%	0.4%	2.1%	8.9%	59.8%	10.9%	4.7%	1.4%	1.0%	0.6%	0.4%	0.8%	0.7%	0.8%	0.1%	0.1%	0.1%	0.1%	7.0%
A2	0.1%	0.2%	0.2%	2.0%	8.3%	59.2%	10.4%	5.3%	2.5%	1.1%	0.9%	0.6%	0.6%	0.6%	0.3%	0.0%	0.1%	0.1%	7.4%
A3	0.0%	0.2%	0.2%	0.9%	3.6%	12.8%	49.5%	9.8%	6.5%	3.9%	1.4%	0.2%	1.5%	0.6%	0.1%	0.2%	0.0%	0.3%	8.2%
Baa1	0.0%	0.1%	0.3%	0.4%	0.8%	6.1%	9.1%	48.4%	12.0%	6.3%	2.5%	0.8%	2.0%	1.5%	0.1%	0.2%	0.1%	0.3%	8.9%
Baa2	0.1%	0.5%	0.2%	0.6%	1.1%	2.4%	7.8%	9.1%	43.8%	10.3%	5.0%	1.1%	1.9%	1.8%	0.7%	0.9%	0.0%	0.3%	12.2%
Baa3	0.0%	0.0%	0.1%	0.0%	0.1%	1.2%	2.1%	9.2%	14.3%	37.7%	8.0%	4.0%	2.6%	2.9%	1.1%	0.4%	0.4%	1.5%	14.3%
Ba1	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	1.5%	1.2%	6.0%	7.8%	43.9%	5.8%	5.9%	3.4%	1.0%	2.0%	0.6%	3.2%	17.2%
Ba2	0.0%	0.0%	0.1%	0.0%	0.0%	0.1%	0.1%	0.5%	1.4%	3.0%	8.8%	43.3%	7.7%	9.2%	0.4%	2.3%	0.7%	4.6%	17.5%
Ba3	0.0%	0.1%	0.1%	0.0%	0.0%	0.1%	0.1%	0.7%	0.1%	0.8%	3.9%	4.2%	50.4%	9.1%	0.8%	5.6%	1.2%	7.9%	14.7%
B1	0.0%	0.0%	0.1%	0.2%	0.2%	0.0%	0.1%	0.2%	0.1%	1.0%	0.5%	2.9%	4.2%	50.0%	1.7%	8.2%	1.3%	13.2%	16.3%
B2	0.0%	0.0%	0.0%	0.0%	0.6%	0.0%	0.0%	0.6%	0.0%	0.0%	0.6%	2.2%	7.2%	5.6%	38.9%	10.6%	6.1%	11.7%	16.1%
B3	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.2%	0.0%	0.1%	1.0%	0.4%	2.8%	6.0%	1.8%	46.0%	4.6%	20.1%	17.1%
Caa	0.0%	0.0%	0.0%	1.0%	1.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.0%	2.1%	2.1%	1.0%	2.1%	35.1%	26.8%	27.8%

Source: Moody's Special Report (1992), p.13

Table 10

Average Yields (Y), Option Adjusted Spreads (O) & Durations (D) For BBB and Below Rated Bonds
(Ratings Separated By Notches: 1992-1996)

Year		BBB+	BBB	BBB-	BB+	BB	BB-	B+	B	B-	CCC
1992	Y(%)	8.4	8.5	8.8	9.2	10.6	10.7	11.0	11.4	12.2	14.1
	O(bp)	126	147	176	311	416	462	487	541	633	876
	D(Yr)	6.4	6.4	6.2	4.5	4.9	4.0	4.3	3.7	3.5	3.4
1993	Y(%)	7.1	7.4	7.8	8.0	8.8	9.2	9.6	9.9	11.6	12.7
	O(bp)	119	139	191	269	343	404	432	483	580	808
	D(Yr)	6.5	6.9	6.6	5.1	4.9	4.2	4.5	4.1	4.0	3.8
1994	Y(%)	7.8	8.2	8.6	8.7	9.6	9.8	10.3	11.2	11.5	13.5
	O(bp)	89	108	168	203	284	326	368	459	479	700
	D(Yr)	6.2	6.8	6.4	5.6	5.7	4.7	5.0	4.9	4.9	4.5
1995	Y(%)	7.6	7.9	8.3	8.6	9.5	9.9	10.8	11.4	12.5	15.5
	O(bp)	81	93	147	190	287	333	417	481	592	900
	D(Yr)	6.2	6.6	6.3	5.8	5.6	4.6	5.0	4.7	4.5	4.3
1996[2]	Y(%)	7.3	7.5	7.8	8.1	9.0	9.4	10.0	10.8	12.2	14.7
	O(bp)	76	91	131	178	270	322	375	452	594	841
	D(Yr)	6.5	6.5	6.3	5.9	5.4	4.4	4.7	4.5	4.4	4.2
1992-1996											
Avg. Y											
Avg. O		98	116	163	230	320	369	416	483	575	825
Avg. D		6.4	6.6	6.4	5.6	5.3	4.4	4.7	4.4	4.3	4.0

[1]Annual Averages based on monthly results.
[2]Through October

Source: Salomon Brothers Inc

and the migration down to B1 or below is 17.2%. For the "rating withdrawn" result, we assume the bond was called at an average price of 103 (3% above par), which is the midpoint between a typical first call of 105 and a last call before par of 101.

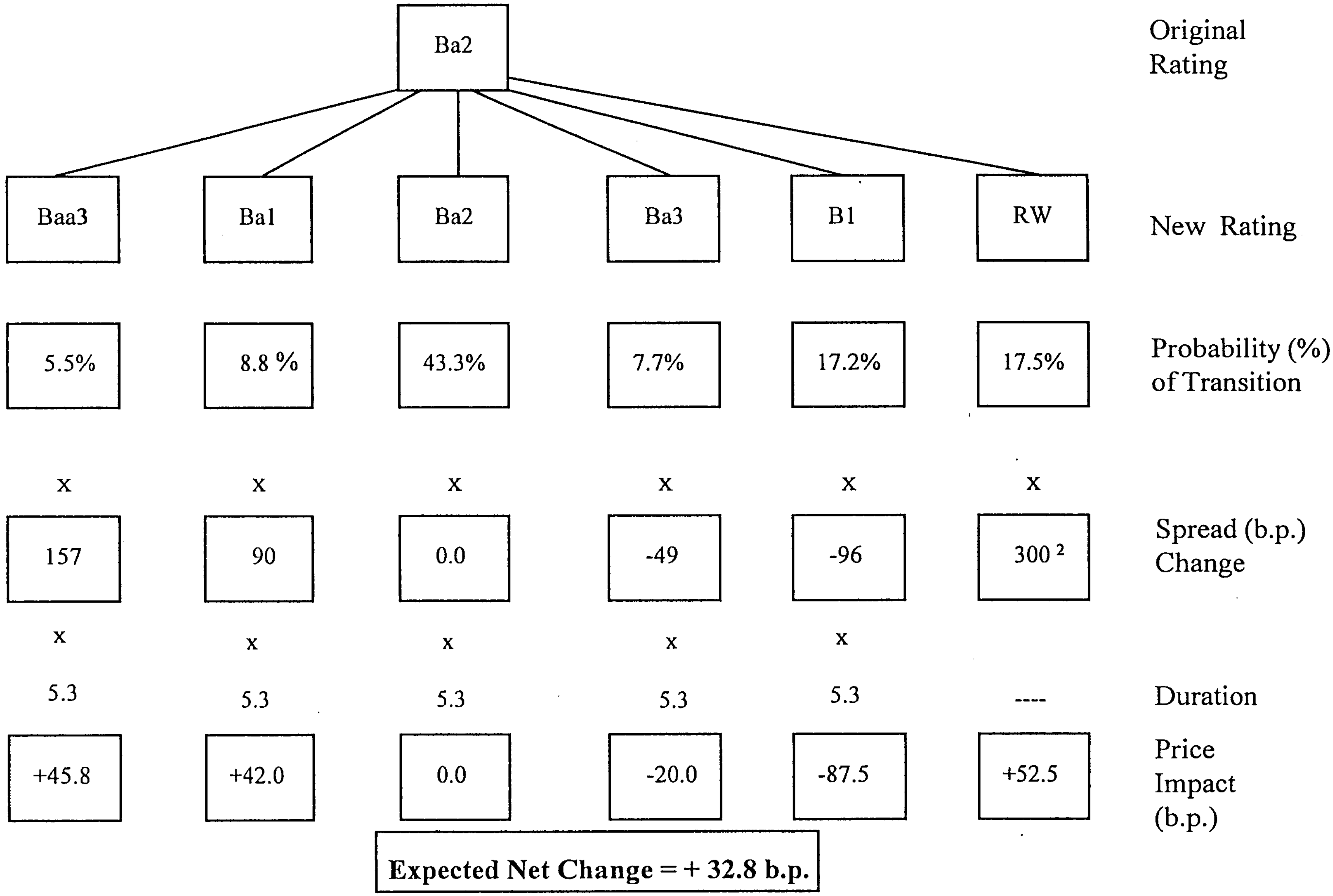
Figure 3 shows that the two-year migration pattern for a Ba2 bond results in an expected net change of +32.8 b.p. For a Ba1 bond, the two-year migration pattern results in an expected net change of -14.3 b.p. This assumes that the investor bought all bonds in the particular initial rating class and experienced the migration pattern typical of the 1983-1993 period. A different, perhaps more optimistic rating transition assumption, would result in even better results. The crossover investor who purchased the Ba2 bonds could therefore enjoy the higher yield and a perhaps a slight bump upward due to rating drift. The most salient point is that even during the negative rating change scenario period of the 1980's, the return impact of expected rating transitions for crossover investors is negligible.

4.5 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 then be calculated. The latter figure relative to the expected price change would then give us the *unexpected* price change for different confidence intervals. For example, while the expected impact of migration on Ba2 rated bonds after two years is +32.8

FIGURE 3

RATING TRANSITION IMPACT - TWO YEAR HORIZON [1]



[1] Maximum two notch transition; [2] indicates 3% call premium

Source: Tables 9 and 10

b.p. (Figure 3), the standard deviation is ±350.0 b.p.. One could then estimate that there is about a 16% chance that the return will drop by more than 317 basis points (3.17%) or rise by more than 383 b.p. in two years due to rating migration (assuming a normal distribution).

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 unexpected *default loss* estimates.

4.6 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 4.5, a final 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 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

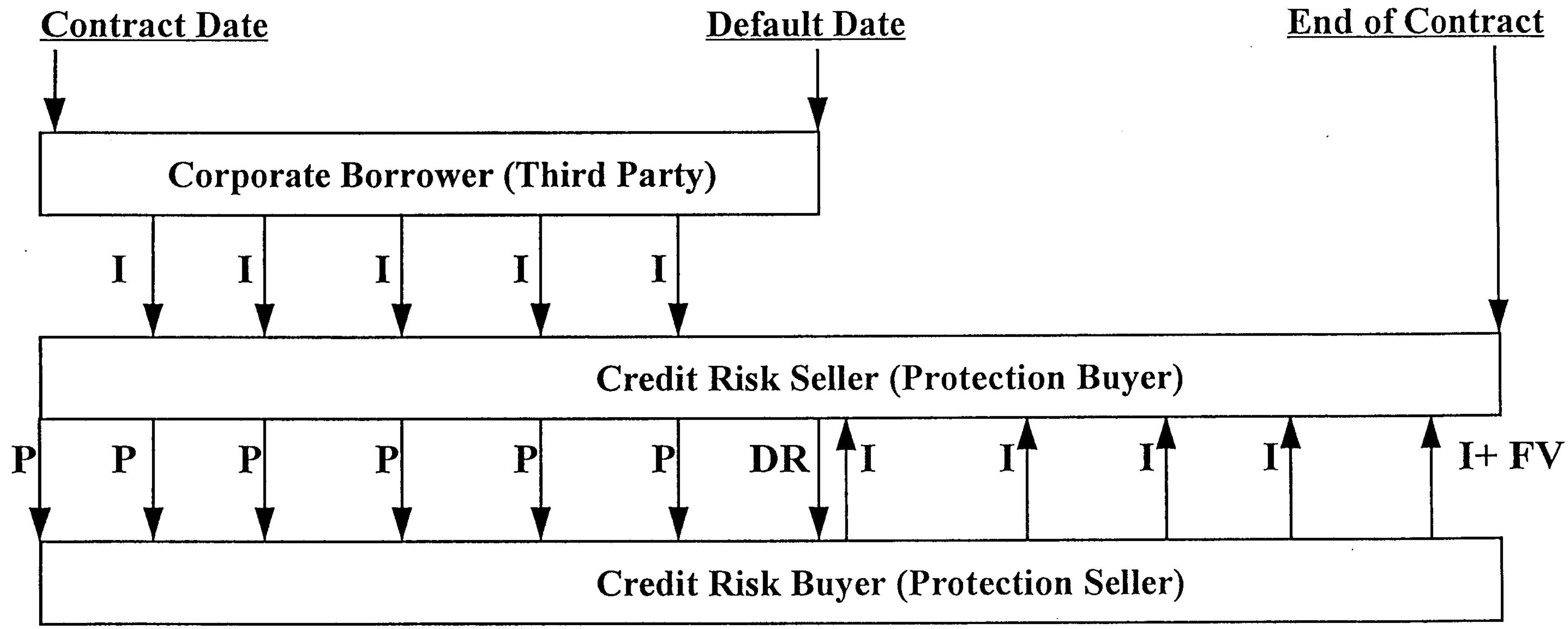
(1996).

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 even-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. **Figure 4a** illustrates a credit derivative where the protection buyer continues to receive the interest payments plus the face value at the time when the underlying loan would have matured. **Figure 4b** illustrates a structure where the contract ends at the time of default, or shortly thereafter, when the security is sold or delivered.

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).

Figure 4a

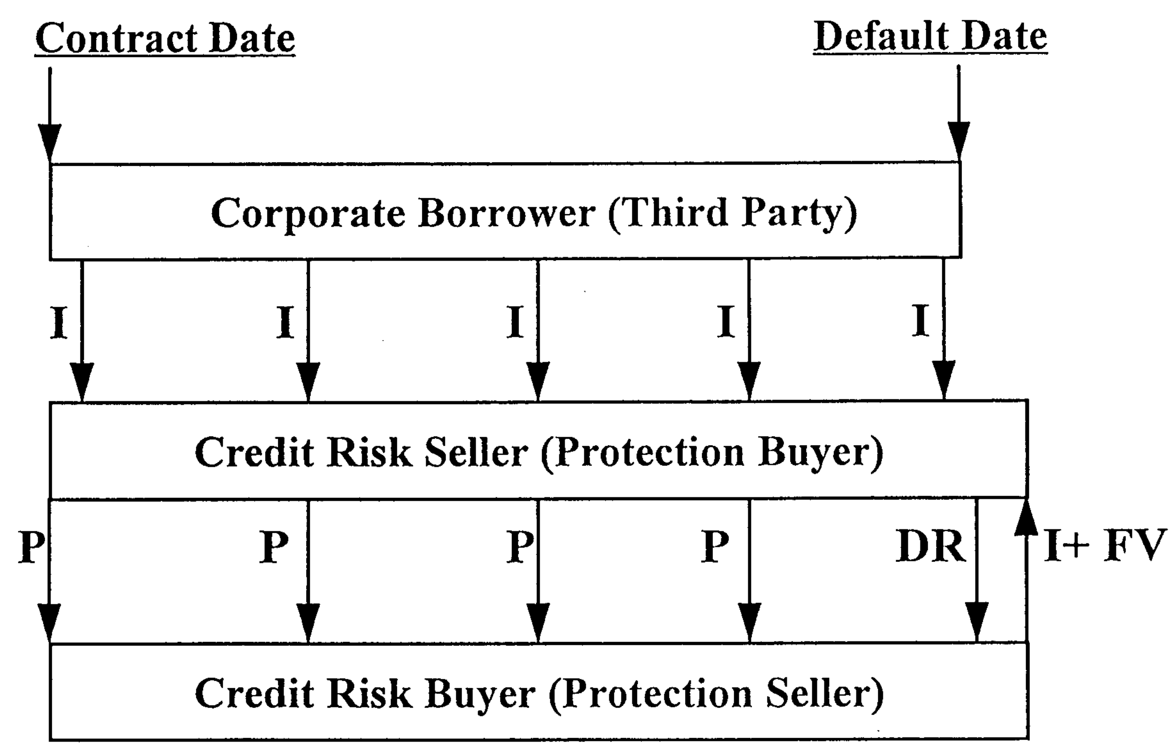
Credit Risk Derivative Contract Time Line



I = Interest (fixed or floating rate) on underlying asset, e.g. bond
P = Premium on credit derivative contract
DR = Default recovery - either sale proceeds or delivery of underlying asset
FV = Face value at maturity of underlying asset

Figure 4b

Credit Risk Derivative Contract Time Line



I = Interest (fixed or floating rate) on underlying asset, e.g. bond
P = Premium on credit derivative contract
DR = Default recovery - either sale proceeds or delivery of underlying asset
FV = Face value at maturity of underlying asset

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.

With specific reference to migration-risk, as opposed to default risk, money managers who want to take higher than normal risk in order to increase yields, 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.

---

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

Figure 5 illustrates a total return structure which is combined with an interest rate swap. In this illustration, the premium for downgrade protection is separated from the LIBOR-plus floating rate. Of course, the protection premium can be included in that rate. Settlement for the change in price may be periodic or at the end of the swap period.

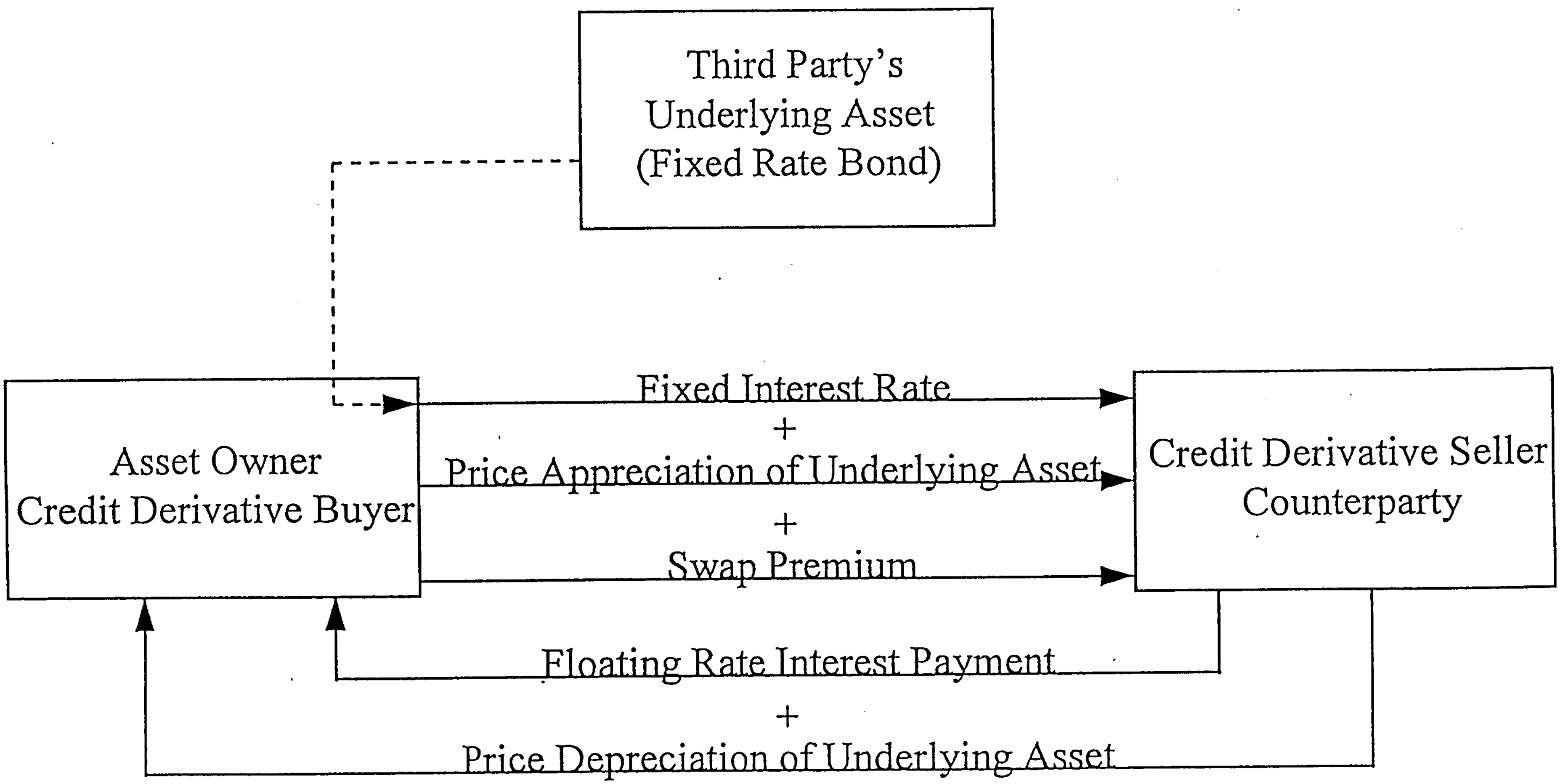
Our report and analysis seeks to provide rating migration expectations and the consequent market-value change patterns as a foundation for knowledge based analysis to make the credit derivative market more efficient and liquid, especially with respect to the total-return-swap-derivative market.

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

Figure 5

Total Return Credit Risk Derivatives (Combined with an Interest Rate Swap)



well as the entire spectrum of rating notch differentials.

In a prior work (Altman, 1989; update in Altman & Kishore, 1997), we have simulated an investment return spread analysis by original bond rating. This analysis included historical patterns of default losses as well as yield spreads for the original investment and subsequent reinvestment of cash flows from interest, redemptions and recoveries on defaults. The missing elements were changes in returns due to interest rate and credit migration change. In a future study, we will attempt to include the missing migration element.

References

Altman, Edward (1989), "Measuring Corporate Bond Mortality and Performance," **Journal of Finance**, September, pp. 909-922.

Altman, Edward, (1990), "How 1989 Changed the Hierarchy of Fixed Income Security Performance," **Financial Analysts Journal**, May/June, pp. 9-20.

Altman, Edward and D.L. Kao, (1991a), **Corporate Bond Rating Drift: An Examination of Rating Agency Credit Quality Changes**, Charlottesville, VA, **AIMR**.

Altman, Edward and D.L. Kao, (1991b), "Appendices to the AIMR Report on An Examination of Rating Agency Drift Over Time," Working Paper No. S-91-40, NYU Salomon Center, New York University, August.

Altman, Edward and D.L. Kao, (1992a), "Rating Drift of High Yield Bonds," **Journal of Fixed Income**, March, pp. 15-20.

Altman, Edward and D.L. Kao, (1992b), "The Implications of Corporate Bond Ratings Drift," **Financial Analysts Journal**, May-June, pp. 64-75.

Altman, Edward and Vellore Kishore, (1996), "Almost Everything You Want to Know About Recoveries on Defaulted Securities," **Financial Analysts Journal**, November/December, pp 57-63.

Altman, Edward and Vellore Kishore, (1997), "Defaults and Returns on High Yield Bonds: Analysis Through 1996," **Special Annual Report, NYU Salomon Center**, Stern School of Business, January 1997.

Austin, Donald, (1992), "Use Migration Analysis to Refine Estimates of Future Loan Losses," **Commercial Lending Review**, Spring, pp. 34-43.

Carty, Lea and Jerome Fons, (1993), **Measuring Changes in Credit Quality, Moody's Special Report, November,** and **Journal of Fixed Income** (1994, June), pp. 27-41.

Carty, Lea and Dana Lieberman, (1996a), "Corporate Bond Defaults and Default Rates, 1938-1995," **Moody's Special Report**, January.

Carty, Lea and Dana Lieberman, (1996b), "Defaulted Bank Loan Recoveries," **Moody's Special Report**, November.

Crabbe, Leland, (1995), "A Framework For Corporate Bond Strategy," **Journal of Fixed Income**, June, pp. 15-25.

Euromoney, (1996), "The Launch of a New Market: Credit Derivatives," March, pp. 28-34.

Lucas, Douglas, (1995), "The Effectiveness of Downgrade Provisions in Reducing Counterparty Risk," **Journal of Fixed Income**, June, pp. 32-41.

Lucas, Douglas and John Lonski, (1992), "Changes in Corporate Credit Quality: 1970-1990," **Journal of Fixed Income**, March, pp. 7-14.

McDermott, Robert, (1997), "The Long Awaited Arrival of Credit Derivatives," **Derivative Strategy**, December 96 - January 97, pp. 19-26.

Standard & Poor's, (1996), **Ratings Performance 1995: Stability and Transition**, Standard & Poor's, NY, May 28.