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The Relationship between Par Coupon Spreads and Credit Ratings in US Structured Finance

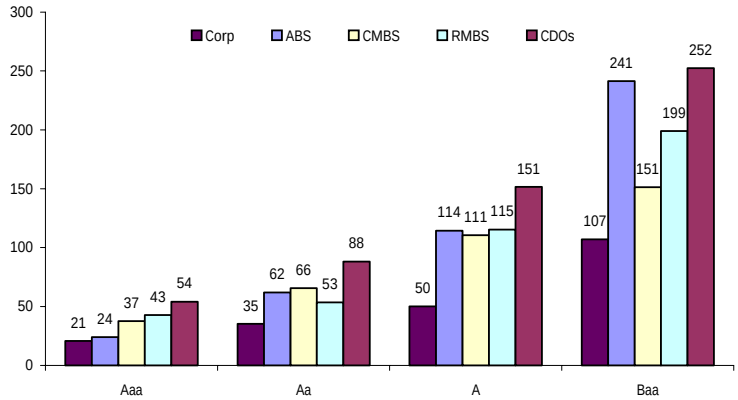
Highlights

This *Special Comment* analyzes the relationship between structured finance par coupon spreads at issuance and the securities' credit ratings. Our data sample covers a seven-year period from 1998 to 2004, and includes floating and fixed rate securities that were rated investment grade (Baa3 or above) at origination.

The major findings are:

- Spreads vary as expected across rating categories, with spreads on lower rated securities considerably higher than spreads on higher rated securities.
- Spreads vary substantially over time and across asset classes; the spreads on structured finance securities are generally wider than those on similarly rated corporate securities.
- Spreads in structured finance are generally positively correlated with those in corporate finance. The correlations appear to vary by rating category and asset class.
- Spreads typically widen when the structured finance one-year speculative-grade impairment rate or corporate one-year speculative-grade default rate rises. Spreads also vary with the three-month LIBOR rate and the slope of the swap rate curve.
- Spreads are backward looking in the sense that new issue spreads widen after downgrade rates rise on outstanding securities within the same asset class.
- Spreads also anticipate future credit performance in the sense that securities with wider spreads at issuance (conditional on sector, rating, and general market conditions) are more likely to experience subsequent rating downgrades than other securities.
- A number of important simplifying assumptions are used to facilitate the analysis. In particular, all fixed rate spreads are measured by comparing each tranche's par coupon rate to the five-year swap rate, regardless of the security's expected average life. Moreover, all floating rate spreads are expressed as spreads over three-month LIBOR rates, by adjusting for the prevailing difference between the security's benchmark interest rate and the three-month rate. We believe that a relaxation of these assumptions would not change any of the conclusions stated above. In future studies, however, we hope to use better spread measures and carefully account for differences in average lives and differences in benchmark interest rates across securities.

Figure 1 - Averages of Monthly Median Floating Rate Spreads by Original Rating and Sector, 1998-2004



Notes: Each structured finance sector is represented by asset classes that are large and have distinct credit performance characteristics. The ABS sector includes securities backed only by credit card receivables, manufactured housing loans, and home equity loans. The CDO sector includes only securities backed by high yield corporate bonds, high yield loans, and structured finance securities. See the data sample section for further details.

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Introduction

The volume of academic literature analyzing corporate bond yield spreads is enormous and growing.[1] Virtually all academic studies have found credit ratings to be one of the most important determinants of spreads. In fact, some bond pricing models directly use rating agencies' rating migration data to estimate credit spreads.[2] In searching for determinants of corporate bond spreads, researchers also find that corporate yield spreads cannot be fully explained by fundamental credit risks represented by historical default and recovery rates. Other factors found to be important include liquidity, systematic risk, incomplete accounting information, and taxes.

Compared with the huge amount of academic interest in corporate bond spreads, academic research on bond spreads in the structured finance market has been scant.[3] This is largely due to the lack of sound economic models for pricing complex and relatively less liquid structured securities. The diversity and innovation in the securitization market also make it hard to standardize the pricing and performance data on these securities, which are essential for academic research.

For almost the same reasons, the analysis of structured finance spreads has drawn a huge amount of attention from practitioners. At the heart of the analysis is the measurement of risk and value of pooling and tranching, based on historical data and projected cash flow distributions. The spread or relative value analysis for structured finance securities is often complicated by the existence and strong interaction of a number of unique risk factors that determine the spread. These risk factors include:

- *Credit risk.* This normally refers to a security's inability to repay all of its principal and interest on time as promised. Any possible breach of such promises, which typically results in shortfalls of interest and losses of principal, is a potential loss to investors. Moody's credit ratings typically address this loss risk.
- *Prepayment or extension risk.* This refers to the acceleration or deceleration of repayment of principal, relative to the expected payment schedule. This risk can be very significant for securities that can prepay (for example, RMBS).
- *Liquidity risk.* This refers to the inability of the investor to sell a security at a fair price as needed. This risk may or may not be correlated with other risks such as the aforementioned credit risk and prepayment risk. For instance, securities could become highly illiquid in a distressed or fragile market environment where demand for such securities becomes restrained even though the fundamental credit risk of the securities remains the same. A security can also be rendered illiquid because of legal or regulatory constraints on the sale and holding of such securities. Finally, securities that are customized for a special group of investors tend to be illiquid.
- *Legal or regulatory risk.* Changes in the legal status or regulatory treatment of certain structured securities could seriously impact the valuation of such securities.
- *Maturity or term risk.* Securities with longer maturities or longer average lives tend to be more risky than securities with shorter maturities or average lives because predictability of future cash flows weakens with horizon. Therefore, investors typically demand higher premium for longer term securities.
- *Maturation and complexity risk.* The structured finance market is constantly evolving as new structures and new asset classes are introduced into the market. Additional premia are often required for new asset classes that investors are unfamiliar with and for complex transactions that are hard to analyze and subject to great model risk.
- *Sponsor and servicer risks.* Although structured transactions employ bankruptcy remote special purpose vehicles, the behavior and financial strength of deal sponsors and servicers can still impact future deal cash flow distributions, resulting in additional uncertainty to the transactions.

The objective of this *Special Comment* is to investigate whether and how the par coupon spreads at issuance contain credit risk signals,[4] and whether and how the spreads are related to credit ratings. This is Moody's first study on structured finance spreads and their relationships with credit performance and credit ratings. There are four essential questions we want to answer:

- How do spreads vary by rating at issuance across structured finance asset classes?
- How do structured finance spreads react to changes in market credit conditions and interest rates?
- Do spreads look in the "rear-view mirror" and react to a sector's past credit conditions?
- Do spreads anticipate securities' future rating downgrades, even after controlling for ratings?

1. *Some of the more recent papers include Hull, Predescu, White (2004), Huang and Huang (2003), Collin-Dufresne, Goldstein, Martin (2001), Elton, Gruber, Agrawal, Mann (2001), and Duffie and Singleton (1999).*
2. *See, for example, Jarrow, Lando, Turnbull (1997), and Arvanitis, Gregory, Laurent (1999).*
3. *Ammer and Clinton (2004) and Gorton and Souleles (2005) are two exceptions. In the first paper, the authors found that a) rating downgrades are accompanied by negative returns and widening spreads, (2) a portion of the negative implications of downgrades are anticipated by price movements ahead of rating actions. The second paper finds that the sponsor's credit rating has an impact on the issuance spread of senior tranches of credit card securitizations.*
4. *The par spreads derived from coupon rates are close to, but not necessary the same as, the primary issuance spread in the market because securities can be sold above or below par at issuance. The par coupon spreads at issuance are also different from the secondary market spreads on traded securities.*

These questions are answered in two different ways in this study. For each question, we first describe the basic data and their summary statistics. Some of the results are immediately observable from these basic analyses. We then conduct regression analyses and place the relationship under study in an appropriate multivariate setting, mostly to control for fixed effects across sectors and credit cycles. We show that most of the findings agree with each other across the two analytical frameworks.

Our data set lacks information on expected average lives and option-adjusted spreads, which are calculated under specific interest rate and prepayment assumptions. When describing the time series behavior of credit spreads in this paper, we report changes over time in the median spread on floating rate securities issued within the same month, within the same sector, and carrying the same broad letter rating. When constructing the data set to examine whether abnormally wide spreads anticipate future downgrades at the security level, and in those cases where more than one tranche was issued with the same rating in the same deal, we included only the tranche with the widest spread and, presumably, the longest expected life.

Other than the questions we address in this report, there are of course other interesting questions with respect to the spreads and ratings in structured finance. For example,

- Why are there persistent spread differences across certain asset classes even though their historical credit performance appear to be similar?
- Why do spreads of certain asset classes vary substantially in periods during which their credit performance has been stable?
- What portion of spreads is attributable to pure credit risk in the presence of liquidity and interest rate risks?
- How do spreads in the secondary market (dealer quoted spreads) behave in relation to the credit performance of structured securities?

We leave these questions for future research. The remainder of this report is organized as follows. We first describe the data sample and methodology. We then discuss the macro and time trends in median floating rate spreads by rating and asset class. Finally, we conduct bivariate and multivariate analyses of spreads at the tranche level to see how spreads react to and anticipate changes in the credit performance of structured finance securities.

Descriptions of Data Sample and Methodology

The data sample of this study contains 16,516 US structured finance securities (from 7,547 transactions), with a total market value of $1.8 trillion at issuance. Securities that met the following criteria were included in the data:

- Denominated in US dollars, and issued in the U.S. market between 1998 and 2004, and carried a long-term investment-grade bond rating (Baa3 or above) at origination,
- In the following eight asset classes:
  - ABS backed by bank credit card receivables (Card),[5]
  - ABS backed by manufactured housing loans (MH),
  - ABS backed by home equity loans (HEL),[6]
  - Prime and alt-A residential mortgage backed securities (RMBS),[7]
  - Commercial mortgage backed securities (CMBS),[8]
  - Collateralized debt obligations (CDOs) backed by high yield corporate bonds (HYCBO),
  - CDOs backed by high yield loans (HYCLO),
  - CDOs backed by structured finance securities (SFCDO).
- Public or 144A issues, with a public Moody's rating,
- Not guaranteed by a financial guarantor, a government agency, or GSE,
- Tranches with initial balances greater than or equal to $10 million US dollars,
- Not a preferred-share security or a CDO combination note,
- Not from deals that link their tranche ratings to the rating of a single credit (a corporate or sovereign rating),
- Tranches classified either as a fixed rate bond with coupon rate information, or a variable rate bond with both spread and index information. For variable rate bonds, only those quoted on the following indices are included: LIBOR, COFI, prime, and federal funds rate. Bonds with additional features such as step-up (or -down) coupons, caps, or floors are included although these specific features are ignored in the initial coupon rate determinations,
- Like-rated tranches within a single deal are maintained as separate observations, so all pari passu tranches are included.[9]

5. *We picked credit card ABS to represent a traditional ABS asset class that has an excellent credit performance record. Manufactured housing loan ABS represents a poorly performing ABS asset class, and HEL represents the largest and fastest growing ABS asset class. We dropped all other ABS asset classes for the convenience of our discussion.*
6. *Excluding high LTV, HELOCs, and NIMs.*
7. *Excluding resecuritized RMBS.*
8. *Excluding net lease deals.*
9. *Tranches are generally not collapsed as we do in rating transition and default studies, except in the last section where we examine whether spreads anticipate future downgrades.*

Figure 2 reports the number of tranches and the median tranche balance at origination by rating and sector. By rating, the data sample includes 10,209 Aaa-rated tranches, or about 61.8% of the total study sample. The rest of the sample is roughly evenly split across the Aa, single-A and Baa rating categories. By sector, ABS and RMBS securities account for 76.7% of the total sample.

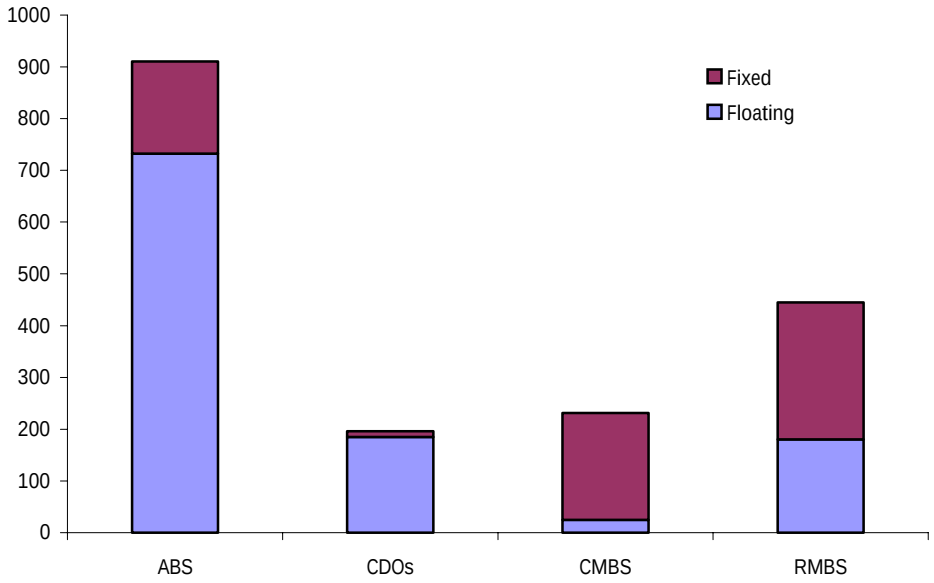
Figure 2: Number of Tranches and Median Tranche Balances at Origination by Original Rating and Sector, 1998-2004

Number of Tranches	Aaa	Aa	A	Baa	Total
ABS	3,652	1,125	1,403	1,075	7,255
CDOs	792	393	360	494	2,039
CMBS	755	329	362	358	1,804
RMBS	5,010	215	129	64	5,418
Total	10,209	2,062	2,254	1,991	16,516
Median Tranche Balance (aggregated by rating category) ($ millions)					
ABS	490.0	37.5	38.1	28.4	
CDOs	266.0	34.0	25.3	21.5	
CMBS	714.4	44.5	42.5	42.2	
RMBS	364.4	16.6	15.8	16.2	

Note: ABS includes Card, MH, and HEL only. CDOs include HYCBO, HYCLO, and SFCDO only.

Our data sample consists of both floating and fixed rate securities, with more floating rate (about 63%) than fixed rate (37%) securities. By sector, most of the ABS and CDO securities are floating rate, while most of the CMBS and RMBS securities are fixed rate (see Figure 3).

Figure 3: Total Dollar Volume at Issuance by Coupon rate type and Sector ($ billions)



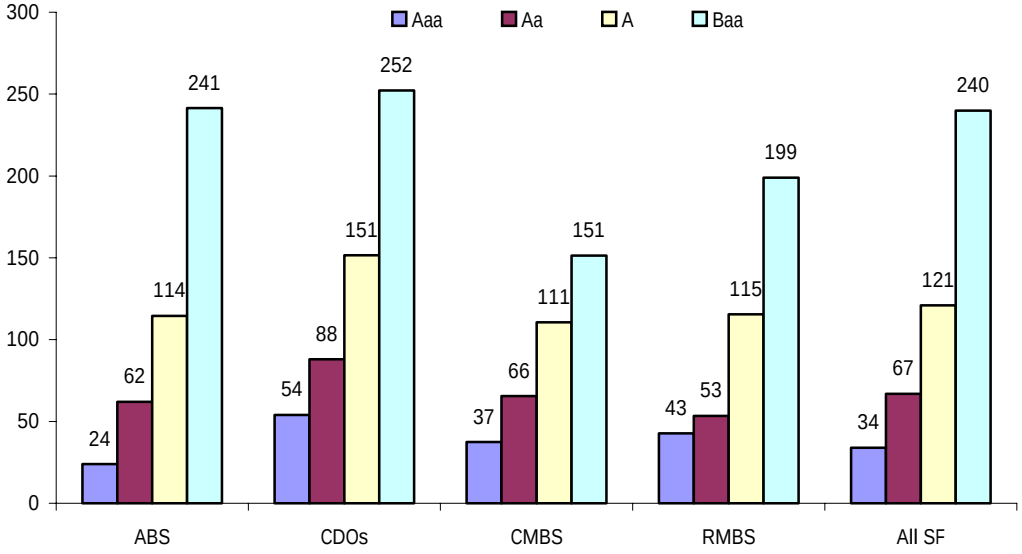
For each security in the sample, we computed a par coupon spread. For each floating rate tranche, a spread is typically given at issuance date. We converted that given spread into a representative spread over a three-month LIBOR rate using the difference of the chosen floating rate index and the three-month LIBOR rate in the month of issuance. In other words, we first convert the spread into a coupon rate at issuance and then subtract the three-month LIBOR rate from it.

To compute the spread for a fixed rate security, we took the security's stated coupon rate at issuance and subtract from it the five-year swap rate in the month of issuance.[10] The five-year tenor is chosen to mimic the median average lives of Aaa securities for most asset classes. Because we do not know the average lives of all structured securities and only roughly know the median average life of the securities within a given rating category and asset class, in the analysis to follow, we describe our findings based on monthly median spreads, and present floating rate spreads if possible.

For comparison, we also obtained Moody's coupon spread indices on corporate bonds. The corporate bond spreads used in this study are the simple median yield spreads over seven-year swap rates of all regular coupon (no zero coupons or floating-rate) seven-year bonds rated by Moody's. To be included in the indices, bonds must have maturities between six and eight years, and have outstanding values of more than $50 million. These are not new issue spreads. The spread in a broad rating category is represented by the spread of its middle refined-rating that carries a numeric modifier 2. All yields are yields-to-maturity calculated on a semi-annual basis.[11]

Figure 4 depicts the average spreads of all floating rate securities by original rating for each broad structured finance sector during 1998-2004. The average spreads for a given sector are wider in lower rating categories than in higher rating categories, and spreads are wider in structured finance than in the corporate sector. Moreover, across all sectors, the spreads in the Baa rating category are significantly wider than the spreads in other investment-grade rating categories.

Figure 4: Averages of Median Floating Rate Spreads (*bps*) over three-month LIBOR Rates by Original Rating and Sector, 1998-2004



Note: ABS includes CARD, MH, and HEL only. CDOs include HYCBO, HYCLO, and SFCDO only. Also see footnote 5. The corporate spreads are simple averages of monthly spreads measured over seven-year swap rates.

In addition, the average spreads vary across sectors within a given rating category. For example, the median spreads among CDOs are higher than those in other sectors for all rating categories. Moreover, the median spreads in CMBS are generally much lower and exhibit less differentiation across rating categories. In the remainder of this study, we will analyze how and why the average spreads by rating vary across asset classes and over time.

Floating Rate Spread Dynamics and Macro Trends

Coupon spreads in structured finance not only vary across rating categories and sectors, but also vary over time. In this section we demonstrate the dynamics of coupon spreads and their macro trends. We organize this section as follows.

First, we group all structured finance securities by their original rating. The purpose is to provide an overview of rating-based spread dynamics at a high level only and compare them with those in corporate finance.

10. *Ideally, the fixed rate spread should be measured against the swap rate at a maturity that is the same as the average life of the security. An even better measure would be the option-adjusted spread (OAS). However, both average lives and OAS are not known for all securities.*
11. *Historical data on Moody's corporate bond yields and yield spreads can be found in the Credit Trends section of Moody's website at www.moodys.com. Weekly corporate spreads are also published in Moody's Credit Perspectives.*

Second, we study the differences in spread dynamics across asset classes after controlling for ratings. The two most interesting rating categories are Aaa and Baa. Aaa is the predominant rating category in structured finance, while Baa is the riskiest rating category in the investment-grade sector.

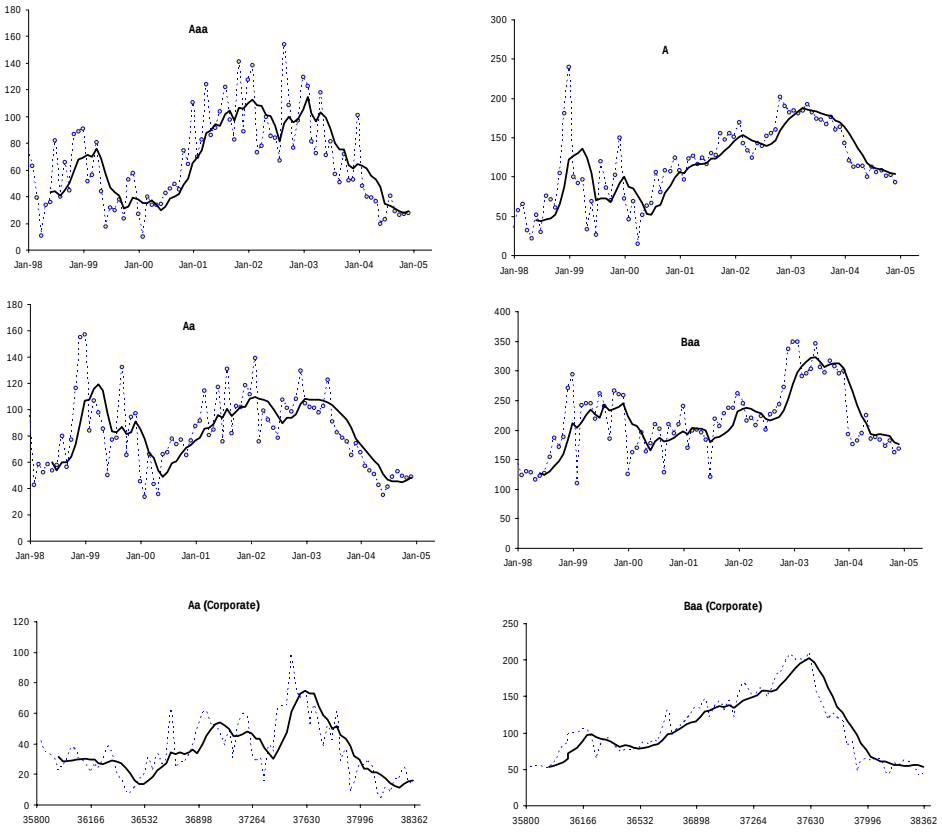
Third, we examine the co-movements of spreads with some systematic risk factors such as interest rates and the speculative-grade default and impairment rates in corporate and structured finance.

Spread Dynamics by Rating

Figure 5 plots the monthly median spreads and their six-month moving averages for all structured finance securities by rating, and shows the mean, median and standard deviation of these monthly median spreads. Several patterns are noteworthy:

- Spreads exhibit different volatility across rating categories. The standard deviations of spreads are higher in the Baa and single-A categories than in the Aaa and Aa categories. But the ratio of the standard deviation over the mean (a measure of relative volatility) is the highest in the Aaa category.
- Spreads have peaked at different times for different rating categories. The median Aaa and Aa spreads peaked in 2002, earlier than did the Baa and single-A spreads, which peaked in 2003. This may suggest that spreads in different rating categories have different determinants. We will discuss this finding later in more detail.
- Spreads are also more volatile in structured finance than in corporate finance within a given rating category. For example, the standard deviation of Aa spreads in structured is nine basis points larger than that in corporate, and it is 13 basis points larger in the Baa category. The relative spread volatility, however, is slightly higher in corporate than in structured for a given rating category.
- A comparison of structured and corporate spreads indicates that they are positively correlated for most of the sample period. The Aa corporate spreads have a 62% correlation with the Aaa structured finance spread, and a 38% correlation with the Aa structured finance spread. Similarly, the Baa corporate spreads have 68% and 56% correlations with the Aaa and Aa structured spreads, respectively. The main exception appears to be from late 1998 to late 1999, when structured finance spreads displayed large swings that were not observed in the Aa or Baa corporate spreads.

Figure 5: Median Floating Rate Spreads by Original Rating for the All Structured Finance Category (*dotted line*) **vs. Their Six-Month Moving-Average Trends** (*solid line*) **and Corporate Spreads**



Summary Table for Figure 5: Floating Rate Spreads by Rating in Structured Finance and Corporate Finance, 1998-2004

	Structured Finance				Corporate Finance	
	Aaa	Aa	A	Baa	Aa	Baa
Mean	66	82	116	216	35	107
Median	64	79	115	209	31	98
Standard Deviation	34	28	49	59	19	46
Standard Deviation / Mean	0.5	0.3	0.4	0.3	0.5	0.4

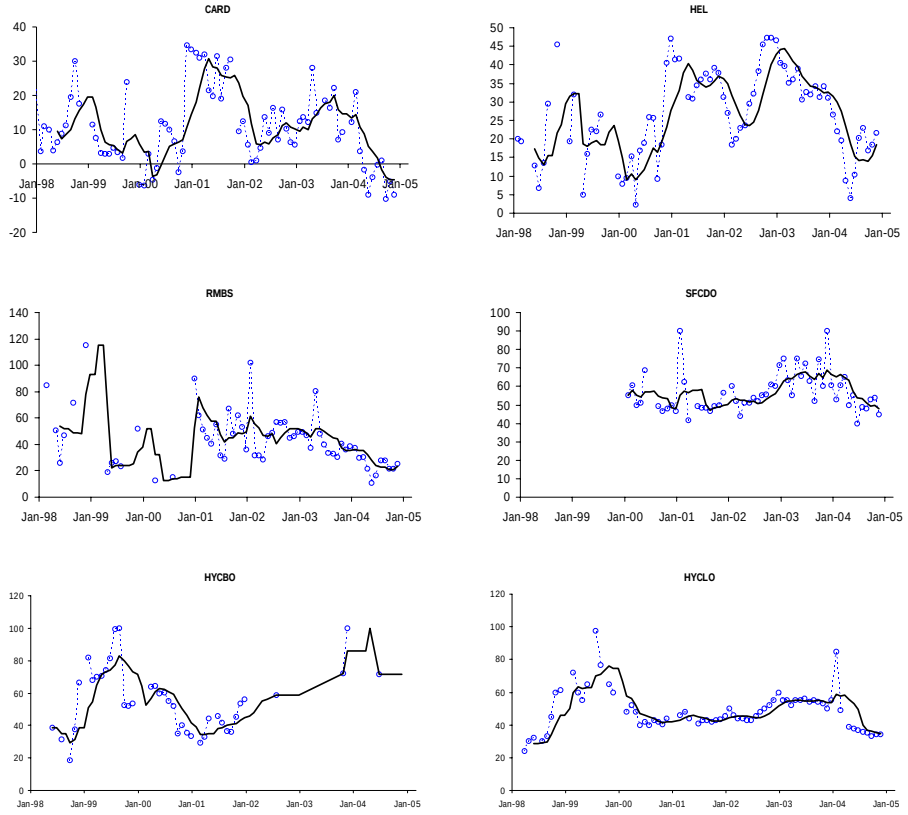
Note: Spreads are in basis points.

Aaa Spread Dynamics by Asset Class

Figure 6 depicts Aaa floating rate coupon spreads by asset class and shows that:

- The relative spread volatility varied substantially across asset class. The contrast is particularly evident between CARD and SFCDO. The monthly median spread averages only about 11 bps for CARD, compared with 57 bps for SFCDO, but their standard deviations are the same at 11 bps. As a result, the ratio of the standard deviation over the mean is 1.1 for CARD, but only 0.2 for SFCDO.
- Spreads exhibited quite distinct average levels and trends by asset class. For example, spreads on average were much higher in SFCDO and HYCBO than in HEL and RMBS. Since 2001, the RMBS spreads have declined while the HYCBO spreads have increased sharply. Meanwhile, after some big swings, the HEL spreads have declined substantially since the beginning of 2003. The SFCDO spreads, however, spiked in late 2003 before declining in the middle of 2004.
- Spreads declined substantially in 2004 across all asset classes (except for HYCBO which had just one deal issued), reflecting the combination of a benign credit environment, low interest rates, strong real estate markets, and strong demand for structured finance securities.[12]

Figure 6: Monthly Median Aaa Floating Rate Spreads by Asset Class (*dotted line*) **and Their Six-Month Moving Average Trends** (*solid line*)



12. *Spreads declined further in the first half of 2005. In particular, part of the spread compression could be the result of strong CDO bids.*

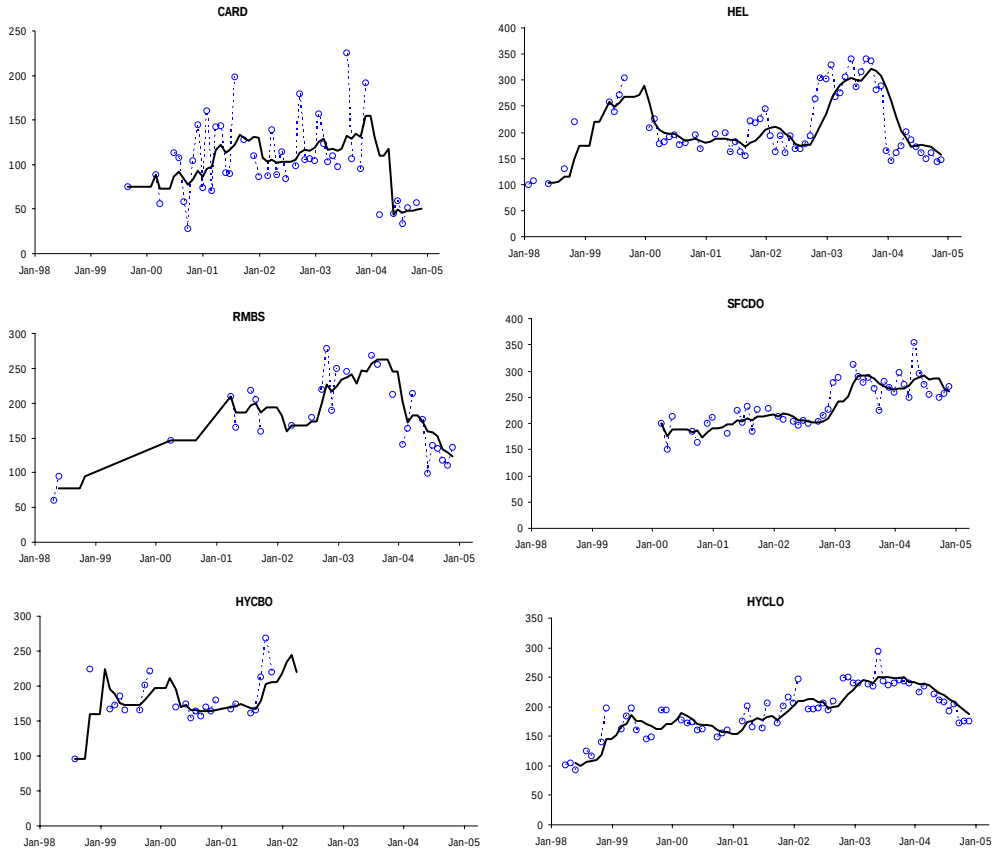
Summary Table for Figure 6: Aaa Floating Rate Spreads Across Structured Finance Sectors						
	CARD	**HEL**	**RMBS**	**SFCD**	**HYCB**	**HYCLO**
Mean	11	27	43	57	56	48
Median	9	27	40	54	54	46
Standard Deviation	11	12	21	11	20	13
Standard Deviation / Mean	1.1	0.4	0.5	0.2	0.4	0.3
Note: Spreads are in basis points. The SFCDO sector did not exist until 2000, and the HYCBO sector had only one or two deals rated each year after 2001. Most of the Aaa median spreads we present in this section are for floating rate securities. Because almost all Aaa CMBS and MH securities are fixed rate, their spreads are not presented here.						

Baa-Aaa Spread Differentials by Asset Class

As shown in Figures 4 and 5, the Baa spreads have on average been much higher than the Aaa spreads. This is not surprising because the Baa-rated tranches are lower in priority in a deal's capital structure than the Aaa tranches, and have been shown to sustain much higher historical default and loss rates than do the Aaa tranches.[13] Also, because most deals have both Aaa and Baa tranches, and the Baa tranches are more susceptible than the Aaa tranches to changes in collateral credit conditions, we expect to see some similarities and some differences between the Baa and Aaa spread series.

Figure 7 provides the time series of spread differential between the median Baa spreads and the median Aaa spreads for each of the eight asset classes studied in the data sample. We examine the Baa spreads' differential over Aaa spreads in order to control for the common trends in both Aaa and Baa spreads.

Figure 7: Baa-Aaa Median Floating Rate Spread Differentials by Asset Class and Their Six-Month Moving Average Trends (*solid line*)



13. "Default & Loss Rates of Structured Finance Securities: 1993-2004," Moody's Special Comment, July 2005.

SUmmary Table for Figure 7: Baa-Aaa Floating Rate Spread Differentials Across Structured Finance Sectors

	CARD	HEL	RMBS	SFCDO	HYCBO	HYCLO	MH (Fixed)	CMBS (Fixed)
Mean	104	210	177	238	180	192	206	94
Median	103	193	172	228	171	196	207	92
Standard Deviation	44	62	56	44	33	42	85	48
Standard Deviation / Mean	0.4	0.3	0.3	0.2	0.2	0.2	0.4	0.5

Note: Spread differentials (bps) are calculated as the differences between the median Baa spreads and the median Aaa spreads each month. Except for MH and CMBS, whose spread differentials are based on fixed rate securities, spreads for all other asset classes are based on floating rate securities.

We make three observations from Figure 7:

- As also evident in Figure 5, the Baa-Aaa spread differential rose and peaked for most asset classes in 2003 before dropping in 2004. Along with the general trend of spread narrowing in 2004, there were also spread compression between Baa and Aaa. This spread compression was not evident, however, for SFCDOs.
- The Baa-Aaa spread differentials in RMBS, HEL, and CARD experienced much steeper declines in 2004 than in other asset classes. This occurred despite the lack of any significant variation in credit performance, which was excellent throughout the period.
- The volatility of Baa-Aaa spread differentials, as measured by their standard deviation, is generally higher than that of Aaa spreads. But the relative volatility, as measured by the ratio of the standard deviation over the mean was generally lower in Baa-Aaa spread differentials than in Aaa spreads. For example, the relative volatility in the CARD sector is 1.1 for Aaa spreads, but 0.4 for Baa-Aaa spread differentials.

Macro Trends in Spreads

In studying the spread dynamics by rating and asset class, we made an observation that there appears to be a common trend in spreads that rose in 2002 and 2003 and then declined in 2004. This trend coincided with a similar pattern in the aggregate material impairment rate in structured finance and the aggregate default rate in corporate finance. This movement in spreads was also correlated with changes in interest rates and the slope of the interest rate curve.

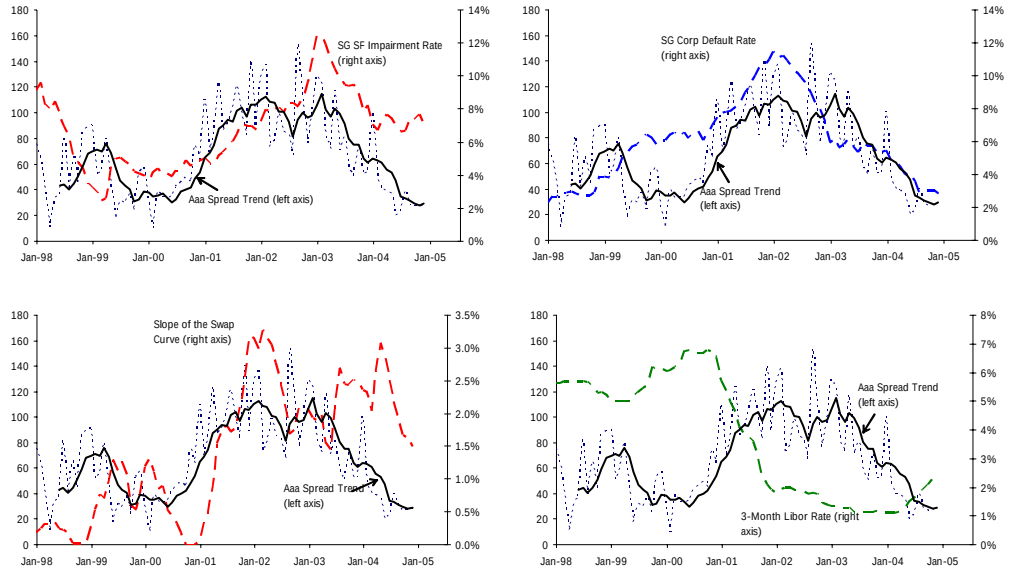
Figure 8 shows the relationships between the Aaa spread and Baa-Aaa spread differential and the following four systematic risk factors:

- US structured finance trailing 12-month speculative-grade material impairment rate[14],
- US corporate trailing 12-month speculative-grade default rate,
- The slope of the swap curve (five-year swap rate minus three-month LIBOR rate), and
- The three-month LIBOR rate.

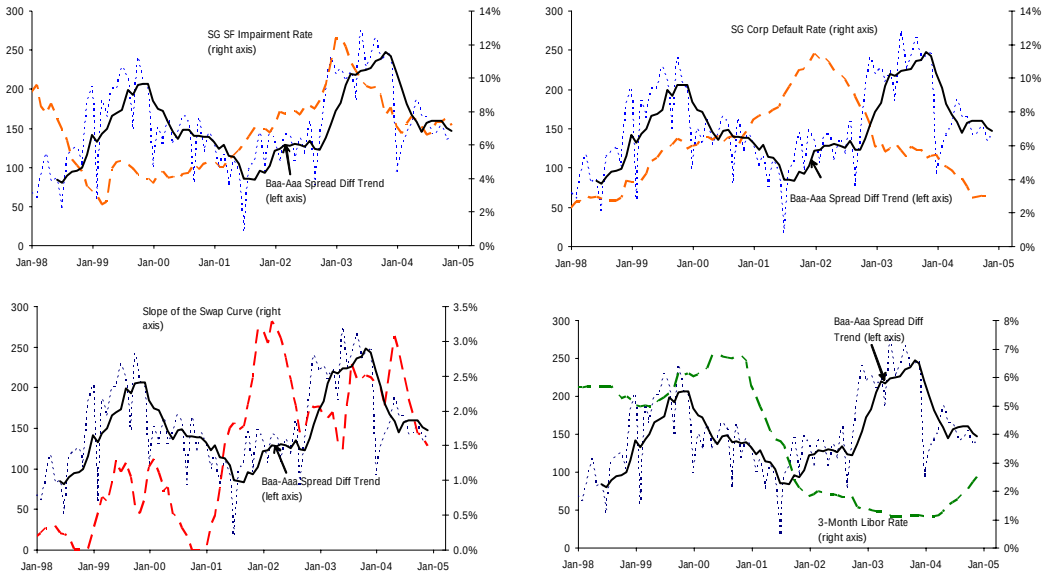
14. Material impairments in structured finance are comprised of uncured payment defaults and all securities downgraded to Ca or C, regardless of whether or not they have entered into payment default. For more details, see Moody's Special Comment, "Payment Defaults and Material Impairments of US Structured Finance Securities: 1993-2002," December 2003.

Figure 8: Median Aaa Floating Rate Spreads and Baa-Aaa Floating Rate Spread Differentials for the All Structured Finance Category (*dotted lines, bps*) **and Various Systematic Risk Factors**

Panel 1: Aaa Spreads



Panel 2: Baa-Aaa Spread Differentials



Summary Table for Figure 8: Monthly Time Series Correlations 1998-2004

	SG SF Impairment Rate	SG Corporate Default Rate	Three-month LIBOR Rates	Swap Curve Slope
Aaa Spreads	54%	65%	-57%	52%
Baa-Aaa Spread Diff	16%	-9%	-35%	32%
Baa-Aaa Spread Diff (1-year lead)	37%	13%	-42%	31%
SG SF Impairment Rate (1-year lead)	41%	87%	-69%	77%

Note: Correlations are calculated using the six-month moving average spread trends shown in the figure. Monthly impairment rates and default rates are trailing 12-month time series observations in the speculative-grade (SG) category. The slope of the swap curve is the difference between five-year swap rates and three-month LIBOR rates. In order to compute correlations with the one-year lead variables, the last year of data observations are dropped. Some of the spread variations over time may be driven by the changes in the distribution of asset classes within the structured finance sector.

Figure 8 reveals that the Aaa spreads moved closely with two credit condition variables: the speculative-grade one-year impairment rate in structured finance and the speculative-grade one-year default rate in corporate finance. Specifically, the Aaa spreads widened as the default and impairment rates increased and narrowed as they decreased. Additionally, the Aaa spreads showed a negative correlation with the short-term interest rates and a positive correlation with the slope of the swap curve during the study period. For example, the Aaa spread was at its peak levels during 2003 when the three-month LIBOR rate was at its bottom. The significant increase in the slope of the swap curve in 2001 and the flattening of the slope in 2004 were accompanied by an increase and a decline in the Aaa spreads during the respective periods.

By comparison, the correlation between the Baa-Aaa spread differential and the two credit condition variables appears to be time dependent. The spread differential is only weakly correlated with the structured finance impairment rate from 1998 to 2002, but strongly correlated with the lagged impairment rates after 2002. In fact, the correlation between the Baa-Aaa spread differential and the impairment rate increased to 37% from 16% after the spread differential was led by one year (for instance, the spread differential began to drop in 2004, about one year after the impairment rate dropped in 2003).

Compared to the Aaa spreads, the Baa-Aaa spread differentials were less correlated with the corporate default rate and two interest rate variables. The Baa-Aaa spread differential did move closely with the corporate default rate during 1998-2000, but then appeared to follow the corporate default rate with a long lag. Collectively, these observations suggest that, compared to Aaa spreads themselves, the Baa-Aaa spread differentials contain less systematic risk.[15]

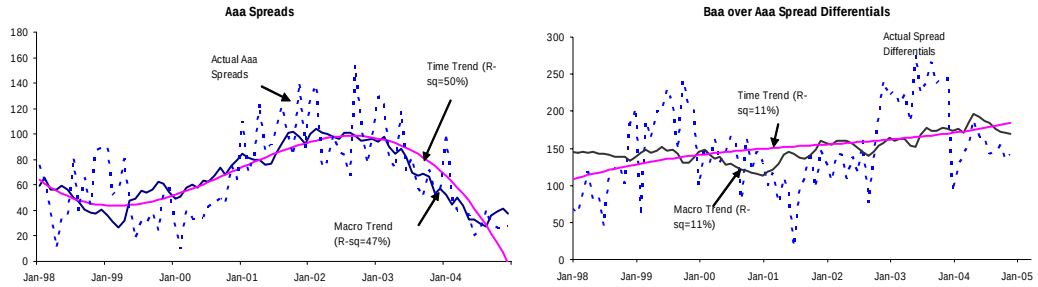
Finally, the final row of data in Figure 8 indicates a particularly strong correlation (87%) between the corporate default rate and the one-year lagged structured finance impairment rate. This suggests that corporate credit conditions had a strong lead impact on structured finance credit performance. In particular, the large number of impairments in the HYCBO and MH sectors, were highly correlated with the credit performance in the corporate sector. The lag in the deterioration of HYCBO and MH credit performance can be the result of the build-in credit support that took time to diminish.

To describe these correlations among the spreads and macro variables, we ran two regressions for the median Aaa spread and the Baa-Aaa spread differential on three macro variables - the corporate default rate, the structured finance impairment rate and the slope of the swap curve. We dropped the LIBOR rate because it has a strong and negative correlation (-87%) with the slope of the swap rate curve during the sample period.

In Figure 9, we compare the model-fitted spreads and spread differentials with the actual observed spreads and spread differentials. There is also a time trend in each chart. The time trend is estimated in a regression of spreads on a cubic polynomial function of time, where time t is the number of months to the observation date from the beginning of the sample period (January 1, 1998).

15. *Note that these observations are made for structured finance as a whole. The lead and lag relationship between spreads and credit variables may vary across asset classes.*

Figure 9: Macro and Time Trends in Structured Finance Aaa Floating Rate Spreads and Baa-Aaa Floating Rate Spread Differentials



Note: Time Trend plots the fitted values of the Aaa spreads or the Baa over Aaa spread differentials in a cubic polynomial regression equation of time t; Macro Trend plots the fitted values of the Aaa spreads or the Baa over Aaa spread differentials in a linear regression of the spread on the slope of the swap curve, the corporate default rate and the structured finance impairment rate.

Figure 9 indicates that both the macro and time trends fit the Aaa spread series quite well, with roughly a 50% R-square. For the Baa-Aaa spread differential, however, neither trend describes the series well, as their R-squares are only around 11%.[16] In both spread series, however, the macro trend and the time trend are pretty much on top of each other, suggesting high correlations between the two.[17]

How Do Spreads React to and Anticipate Credit Performance?

In the previous section, we demonstrated that the Aaa floating rate spreads contain a common trend that is correlated with both the corporate default rate and structured finance impairment rate. By comparison, the Baa-Aaa spread differential is also correlated with the two credit condition variables, but the correlation is weaker and time dependent.

In this section, we move beyond the median spread analysis by rating and asset class, and study two ways in which coupon spreads at the tranche level may be related to credit conditions by asking the following two questions:

- Do spreads look in the "rear-view mirror" and react to the past and ongoing credit conditions in a particular asset class or in the bond market?
- Do the spreads anticipate credit problems such that higher spreads imply higher impairment rates or downgrade rates in the future?

Spreads React to Past Credit Market Conditions

Bivariate Analysis

To see how spreads depend on the past credit conditions in a given asset class or in a sector, we define two credit states: HIGH and LOW. The corporate bond market is in a HIGH default state if the corporate default rate is above its median over the sample period from 1998 to 2004; otherwise it is in a LOW default state.

Similarly, the structured finance market is in a HIGH impairment state if the structured finance material impairment rate is above its median, and otherwise it is in a LOW impairment state. An asset class is in a HIGH downgrade state if its downgrade rate in the past 12-month period is above its median over the sample period, otherwise the asset class in a LOW downgrade state.[18]

We selected a data sample that included both floating and fixed rate securities of all asset classes and were rated either Aaa or Baa (Baa1, Baa2, or Baa3) at origination. The distribution of the data sample by rating, asset class and coupon rate type is shown in Figure 10. Note again that certain asset classes such as CDOs and HEL have more floating rate securities than fixed rate securities in the Aaa rating category, while the opposite is true for CMBS and RMBS.

16. *This further supports the conjecture that the systematic component of the spread is more prominent in Aaa spreads than in Baa spreads. For similar findings in corporate spreads, see Elton et al (2001) and Huang and Huang (2003).*
17. *The coefficient estimates for Aaa spreads are -17.6, -11.3, 6.3, and 9.4 on the constant term, the slope variable, the structured finance impairment rate and corporate default rate variables, respectively. For Baa spreads, the coefficient estimates are 141.1, 17.8, 2.2, and -5.0, respectively.*
18. *We do not study spread differences across HIGH and LOW upgrade states. Ammer and Clinton (2004) showed that upgrade activity had negligible effects on ABS spreads.*

Figure 10 - Distribution of the Data Sample for Regression Analysis

	Aaa		Baa		Total
Asset Class	Floating	Fixed	Floating	Fixed	
CARD	287	94	97	21	499
MH	41	257	5	85	388
HYCBO	117	24	67	74	282
HYCLO	310	13	177	38	538
SFCDO	316	12	105	33	466
CMBS	58	697	35	323	1113
HEL	1880	1093	783	84	3840
RMBS	994	4016	61	3	5074
Total	4003	6206	1330	661	12200

Note: Baa floating rate MH securities and Baa fixed rate RMBS securities are excluded from the regression analysis due to their small sample size.

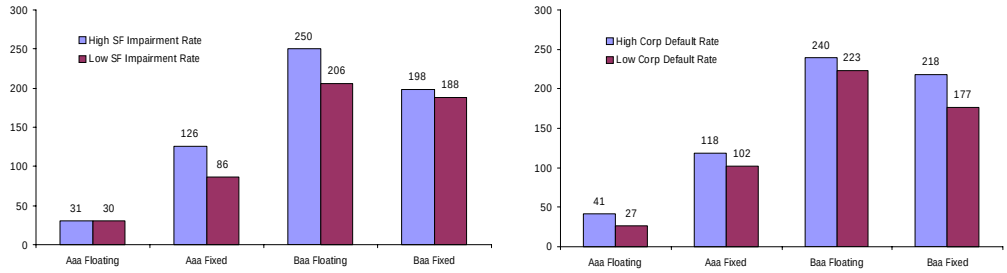
Using this data sample, Figure 11 compares spreads in the HIGH and LOW states of the markets. To compare spreads across the two default states in the corporate and structured finance sectors, we aggregate all securities by rating and coupon rate type. To compare spreads across the two downgrade states, we show the spread differences by asset class, in addition to rating category and coupon rate type.

In almost all categories, the spreads are higher in a HIGH state (with higher impairment or default or downgrade rates in the past twelve months going into the issuance month) than in a LOW state. This suggests that spreads strongly reacted to the past credit conditions in the sector.

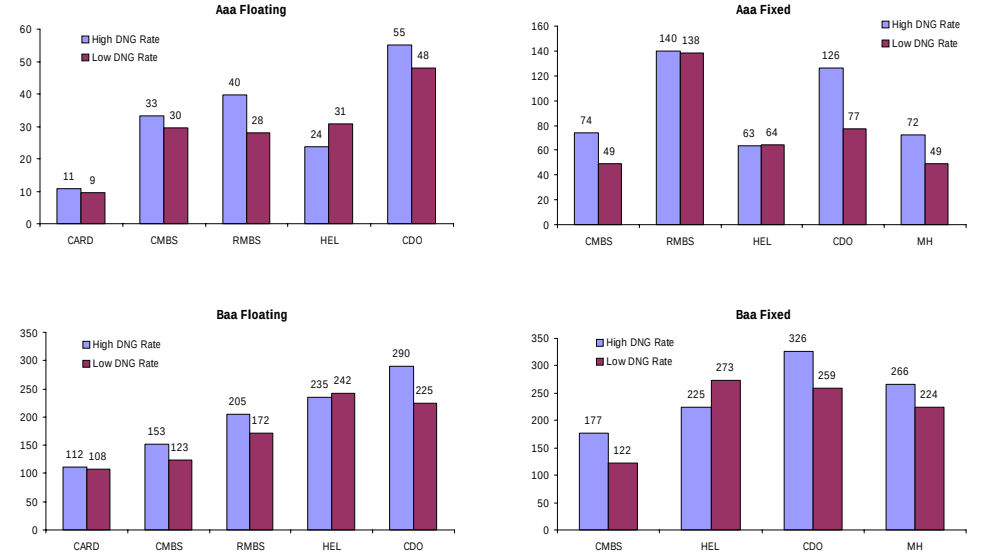
In addition, the median of Aaa fixed rate spreads was 40 basis points higher in a HIGH structured finance impairment state than in a LOW state, and the median of Baa floating rate spreads was 44 basis points higher in a HIGH state than in a LOW state. This suggests that coupon spreads strongly reacted to the past credit conditions in the market.

Figure 11 - Comparisons of Median Issuance Spreads across HIGH and LOW Default/Impairment/Downgrade States

Panel 1: Structured Finance Spreads in HIGH and LOW Default/Impairment States



Panel 2: Structured Finance Spreads in HIGH and LOW Downgrade States by Asset Class



Note: Spreads are in basis points.

Multivariate Analysis

The comparisons of spreads illustrated in Figure 11 were carried out in a bi-variate setting. The presence of correlation among the dynamic variables makes it necessary to test the hypothesis in a multivariate framework. To further test whether and how spreads react to past credit performance in a particular asset class or in the bond market in general, we took Aaa- and Baa-rated securities and ran a security-level regression of their coupon spreads on a number of independent variables, including asset class, coupon rate type and rating category dummies, and three dynamic risk factors, including the past downgrade rate of a given asset class, the corporate default rate, and the slope of the swap curve.

In the regression model, the dependent variable is a spread - a spread over three-month LIBOR rate for floating rate securities, and a spread over five-year swap rate for fixed rate securities.

The independent variables are:

- Dummies for each combination of asset class, coupon rate type and rating categories. For example, we use a dummy variable for Aaa floating rate CARD securities and another dummy for Baa fixed rate CMBS securities.
- Trailing 12-month downgrade rate for each asset class. The coefficient on this variable is allowed to differ by rating in the regression.
- Trailing 12-month US corporate speculative-grade default rate. The coefficient on this variable is allowed to differ by rating as well.[19]

- The slope of the swap curve (the five-year swap rate minus the three-month LIBOR rate). The coefficient on this variable is allowed to vary by coupon rate type (floating vs. fixed).

This regression is different from the regression in the last section in the sense that the regression here is carried out at the tranche level using asset class and rating dummies and including floating and fixed rate securities, whereas the regression in the last section was done on pooled data that aggregated all structured finance securities into two rating categories and included only floating rate securities.[20]

Figure 12 summarizes the regression results and shows that almost all coefficient estimates are statistically significant (different from zero) at the 95% confidence level.

Figure 12: Regression Results - Spreads React to Past Credit Conditions

Model Description:
To regress coupon spreads on a linear combination of asset class, coupon rate type, and rating dummy variables, and three dynamic risk factors listed below.

Dependent Variable: Spread (bps)		**CoefficientEstimates**			
		Floating Rate		**Fixed Rate**	
Independent Variables:		**Aaa**	**Baa**	**Aaa**	**Baa**
Dummy Variables: A dummy variable is defined for each combination of asset class, coupon rate type, and rating category	CARD	8.9 (2.0)	78.0 (9.8)	-23.0 (5.1)	109.2 (22.6)
	HEL	25.2 (2.1)	213.9 (5.9)	37.0 (3.1)	187.7 (11.9)
	RMBS	40.9 (2.9)	167.4 (8.7)	120.9 (2.6)	N/A
	HYCLO	47.5 (2.4)	188.4 (7.8)	77.5 (12.2)	215.6 (19.1)
	HYCBO	56.7 (5.2)	128.6 (13.3)	77.3 (9.4)	159.0 (17.0)
	SFCDO	60.8 (3.3)	237.0 (9.4)	86.7 (27.1)	185.7 (26.0)
	MH	19.3 (5.0)	N/A	58.4 (5.5)	177.8 (14.9)
	CMBS	35.3 (3.5)	112.7 (9.7)	44.0 (2.9)	99.6 (7.2)
Dynamic Variables	Trailing 12-Month Downgrade Rate in Each Asset Class (%)	*Aaa dummy: -0.64 (0.42)* Baa dummy: 4.28 (0.92)			
	Trailing 12-Month Speculative-Grade Corporate Default Rate (%)	Aaa dummy: 0.87 (0.26) Baa dummy: 6.32 (0.81)			
	Slope of the Swap Curve (%)	*Floating dummy: -1.26 (0.90)* Fixed dummy: 6.72 (0.99)			

Note: White standard errors are in parentheses. Numbers in italics are not statistically significant at the 95% confidence level. The model has an R-square of 0.544 with 12,192 observations.

Figure 12 also reveals several interesting findings.

First, because all dummy variables are significant, and these are constant terms for different categories, it means that the projected spreads in the absence of any changes in the dynamic variables are significantly different from each other. In other words, there are strong fixed effects in spreads across asset classes, coupon rate types, and rating categories. As expected, Baa spreads are higher than Aaa spreads and spreads are higher for fixed rate securities than for floating rate securities. These findings support the observations we made in previous sections. The size of these coefficient estimates, however, may differ from the median spreads we reported earlier because the estimates here are generated in a multivariate regression model.

Second, Aaa spreads do not significantly react to the trailing 12-month downgrade rate within a given asset class, but Baa spreads do react strongly. On average, after controlling for the asset-class-level fixed effect, a one percentage point increase in the downgrade rate of a given asset class leads to a four basis point increase in Baa spreads. Though statistically significant, this effect does not appear to be economically significant.

Third, the coefficient estimates on the corporate default rate are significantly different from zero in both Aaa and Baa spread regressions. This demonstrates the effect of corporate credit market conditions on the structured finance market. On average, a one percentage point increase in the speculative-grade corporate default rate leads to a one basis point increase in Aaa spreads and six basis points increase in Baa spreads.[21]

Fourth, the impact on spreads from changes in the swap curve slope is statistically significant for fixed rate securities, but not so for floating rate securities. This finding is not surprising because we did not compute the fixed rate spreads based on tranches' average lives, and when the slope of the yield curve increases, so will the fixed rate spreads.

19. *The one-year speculative-grade structured finance impairment rate variable is not significant in this regression in the presence of this corporate default rate variable; therefore, it is dropped. We do not include the LIBOR rate variable because it is highly (negatively) correlated with the slope of the swap rate curve, which is included.*
20. *Because spreads on fixed rate securities are calculated without regard to their average lives, one needs to be cautious in interpreting the results for fixed rate spreads. The focus of the regression model should be on the coefficient estimates of dynamic variables, which we do not think will vary materially across average lives.*
21. *Economically, these do not appear to be large response values, compared to a one percentage point increase in default rate. However, these are the coefficient estimates on individual securities of all asset classes combined. In a regression of Aaa spreads for the all structured finance category as one group on the macro credit variables (fitted spreads shown in Figure 11), the coefficient estimate on the corporate default rate is 9.4, implying that a one percentage point increase in the corporate default rate would drive up the Aaa spread in the aggregate by about nine basis points, which is about 30% of the median Aaa spread.*

Finally, using just three dynamic variables and the dummy variables for fixed asset-class effects, the regression explains more than 50% of the spread variations among 12,192 securities.[22]

Spreads Anticipate Future Downgrades

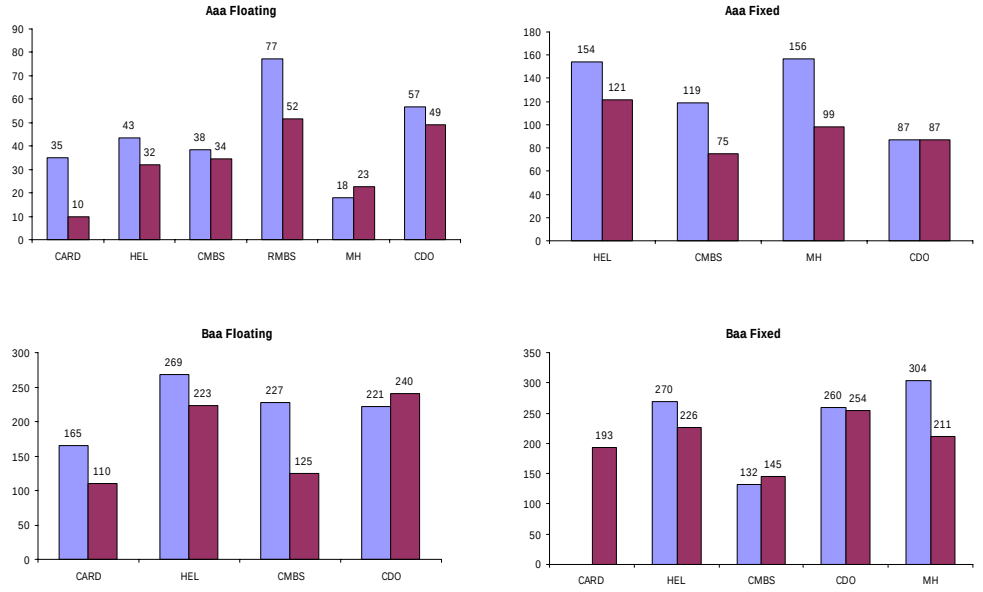
Bivariate Analysis

Having examined the reaction of spreads to the past credit performance within a given asset class and the corporate market, we turn our attention to the ability of spreads to anticipate future credit deterioration at the tranche level. We measure the credit deterioration of a security by whether it is downgraded. We focused on downgrades, instead of material impairments, as the measure of credit deterioration because very few Aaa-rated securities have become impaired.

We compared the median spreads at issuance on securities that were downgraded and those that were not downgraded within three years after issuance, and found that the spreads were generally higher on securities that were later downgraded. See Figure 13.

For example, the spreads on downgraded Aaa MH fixed rate tranches were on average 50 basis points higher than those that were not downgraded. The spreads on downgraded Baa MH fixed rate tranches were more than 90 basis points wider.

Figure 13 - Comparisons of Median Issuance Spreads on Securities that Were Downgraded (*light blue*) and Not-Downgraded (*dark red*) within Three Years after Issuance, 1998-2002



Summary Table for Figure 13: Number of Downgrades within Three Years of Issuance by Asset Class and Rating

	Floating		Fixed	
	Aaa	Baa	Aaa	Baa
CARD	5	4	1	0
HEL	1	10	1	14
CMBS	1	3	1	11
RMBS	1	0	0	N/A
MH	6	N/A	51	54
CDOs	53	75	12	85

22. *The same model was also run on smaller and more homogenous groups of securities separately by asset class and coupon rate type and rating. Other different combinations of systematic risk factors can also be introduced into the regression analyses. The results from these additional regressions are mostly consistent with the main findings from in Figures 12 and are therefore not reported separately.*

To obtain these results, we looked at the difference of a security's ratings over a three-year window after issuance and defined a downgrade dummy variable to be 1 if the security's rating three years after issuance was lower than its original rating and 0 otherwise.

To analyze the ability of Aaa spreads to anticipate downgrades, we needed to control for the fact that a single transaction can issue Aaa tranches with very different average lives. Specifically, for a deal with multiple Aaa tranches, we chose the widest spread to represent the Aaa spread in that deal. Note that tranches carrying the same Aaa rating can command very different spreads when their average lives are different, even though their risks of impairments are almost the same during the periods in which they are all outstanding.

Our dataset includes all securities issued from 1998 through 2002. We exclude those issued in 2003 and 2004 to allow for a long enough time period to measure a three-year or a lifetime downgrade.

To investigate the sensitivity of our results to the time interval over which a downgrade is measured, we also defined a lifetime downgrade dummy variable, which equals 1 if the rating at the end of the sample period (December 31, 2004), regardless of issuance year, is lower than its original rating, and 0 otherwise.

It is worth noting that the Baa broad rating category consists of three refined rating categories: Baa1, Baa2, and Baa3, whose spreads are typically different. Therefore, it is possible that the spread differences in the Baa category shown in Figure 13 simply represent the rating distribution differences within the downgraded and not-downgraded subsectors. For example, if downgraded securities were all rated Baa3, while those not downgraded were rated Baa1, the spread differences would be expected but not meaningful predictors of subsequent downgrade experience beyond what could be inferred from the initial ratings.

To examine the sensitivity of our findings to this additional factor, we braek down the Baa broad category further into their refined rating buckets and again compared spread differences between downgraded and not-downgraded securities. We again found that downgrade securities were issued with wider spreads in all asset classes except HEL, where the spread differences in Figure 13 were possibly driven by the differences in modified rating distributions.

On the other hand, this more refined rating approach revealed that spreads on downgraded fixed-rate Baa2 and Baa3 CMBS securities were higher than those on not-downgraded securities, even though this relationship was not evident at the broad rating level in Figure 13.

Finally, as shown in Figure 13, the downgraded tranches in the regression data sample have been concentrated in the CDO and MH sectors, especially with respect to the Aaa category. Therefore, the association of high spreads and high probabilities of downgrade is mainly attributable to these two sectors. As expected, the more we disaggregate each sector, the more variations of spread differences across the two credit states will be observed.

Multivariate Analysis

The comparisons of spreads in Figure 13 did not control for the changes in the credit or interest rate environment, which had a strong impact on spreads as we discussed in the last section. In order to factor in these two variables and test our hypothesis more rigorously, we set up two multivariate regression models.

The first regression model we used for testing the downgrade-anticipation hypothesis is almost identical to the one used in Figure 12, except that a future downgrade dummy variable is added and three dynamic variables are replaced by three time variables.[23] In this model, we test whether a future downgrade event on a security can explain a wider spread at issuance. Later in this section, we will introduce the second model that uses spreads to explain a future downgrade.

Figure 14 reports the coefficient estimates on two alternatives of future downgrade dummy variables across several different data sub-samples. In all specifications, the coefficient estimates are positive, and in most specifications, the coefficient estimates are significantly positive, suggesting that spreads at issuance are systematically related to subsequent downgrade experience, regardless of their coupon rate type or rating.

23. Because the goal here is to test the ability of spreads to anticipate future downgrades, not how spreads react to past credit conditions at the asset class level or in the economy, as we did in the last subsection, we replaced three dynamic variables with three time variables: time t, t-square, and t-cubic. Note that in the last section, we showed that the time trend generally mimicked the macro trend very well.

Figure 14: Coefficient Estimates on "Future Downgrade" Dummy Variable in A Multivariate Regression Model of Par Coupon Spread

Model Description:
To regress coupon spreads on a future downgrade dummy variable, in addition to a linear combination of asset class, coupon rate type, and rating dummy variables, and a cubic polynomial of time

Dependent Variable: Spread (bps)	**Coefficient Estimates on the Downgrade Variable in Different Sub-Samples**				
Independent Variable: Future Downgrade Dummy Variable Alternatives	All	Floating		Fixed	
		Aaa	Baa	Aaa	Baa
Downgraded with Three Years after Issuance	17.3 (6.7)	9.4 (3.1)	16.5 (8.9)	21.4 (7.4)	*19.5 (16.3)*
Downgraded within Any Time Horizons after Issuance	12.7 (6.1)	8.3 (2.4)	*12.2 (8.0)*	24.2 (7.6)	*28.7 (17.8)*
Number of Observations	2779	956	499	863	461

Note: Only the widest Aaa spread is used if multiple Aaa tranches exist in the same deal. Coefficient estimates on asset class, rating, and coupon rate type dummies and time variables are not reported here. White standard errors are in parentheses. Numbers in italics are not statistically significant at the 95% confidence level.

To further investigate the relationship between spreads and future downgrades, we constructed the second regression model - a logistic regression model - using the future downgrade dummy variable as dependent variable and the securities' spread as independent variable. Because spread is now used as an explanatory variable, we ran our regression analyses for Aaa floating, Aaa fixed, Baa floating, and Baa fixed securities, separately. This enables us to control for spread differences by rating categories and coupon rate types.

As indicated by the results in Figure 15, the coefficient estimates are all positive with respect to downgrades within three years after issuance, and the spreads of floating rate Aaa and fixed rate Baa securities were strongly predictive of future downgrade experiences, although the spreads of floating Baa and fixed Aaa securities were not.

Figure 15: Coefficient Estimates on Spread in A Logistic Regression of "Future Downgrade" Dummy Variable

Model Description:
To run logistic regressions of a future downgrade dummy variable (equals one if downgraded, zero otherwise) on a security's coupon spread (in percent), in addition to a constant term

Independent Variable: Spread (%)	**Coefficient Estimates on Coupon Spread in Different Sub-Samples**			
	Floating		Fixed	
Dependent Variable: Future Downgrade Dummy Variable Alternatives	Aaa	Baa	Aaa	Baa
Downgraded within Three Years after Issuance	1.0 (0.5)	*0.08 (0.2)*	*0.3 (0.2)*	0.5 (0.1)
Downgraded within Any Time Horizons after Issuance	1.4 (0.4)	*-0.12 (0.16)*	*-0.02 (0.2)*	0.5 (0.1)
Number of Observations	956	499	863	461

Note: For deals with multiple Aaa tranches, the tranche with the widest Aaa spread in the deal is used.
White standard errors are in parentheses. Numbers in italics indicate statistical insignificance at the 95% confidence level.

Note that the coefficient estimates are not the marginal effects we are generally accustomed to analyzing. Because the logistic function is not linear, the marginal effect of a spread change on the probability of downgrade is the first derivative of the downgrade probability with respect to the spread.

In Figure 15, the coefficient estimate on spread is 1.0 per percentage point (100 bps) for Aaa floating rate securities. The first derivative of the logistic function suggests that for every three basis points of additional spread, the downgrade probability within three years after issuance would increase by roughly 10 bps. In other words, a 10% increase in the spread (because the median Aaa spread of all structured finance is about 30 bps) at issuance increases the downgrade probability by about 3%.

Similarly, for Baa fixed rate securities, a 10% increase in the spread (roughly 20 bps because the median is about 200 bps) would increase the downgrade probability by roughly 8% (or 160 bps).[24]

24. We also tested the spreads' abilities to predict the number of notches changed over a three-year horizon or over its lifetime to date. The results from these additional regression models supported the findings in Figure 15 in the sense that higher spreads would on average lead to higher downgrade probabilities and even larger number of notches downgraded.

Concluding Remarks

This *Special Comment* analyzes the relationship between structured finance par coupon spreads and Moody's credit ratings at issuance, and finds that ratings are highly correlated with spreads. We found that structured finance spreads widened significantly when their asset classes experienced credit deterioration in the past 12 months before issuance, or when the corporate default rate increased. In addition, securities with higher coupon spreads in a given rating category may imply higher downgrade risk.

Spreads in structured finance have been strongly correlated with macroeconomic variables such as Moody's corporate default rate, structured finance impairment rate, and the slope of the swap curve. This suggests that structured finance spreads contain strong systematic risk components. Furthermore, the systematic risk components were found to be more significant in Aaa spreads than in Baa spreads.

Some of the variation of spreads across asset classes appears to reflect the differences in sector-specific characteristics that are not directly credit-risk related. But other spread variations are clearly related to the differences in structured securities' credit performance.

While this study addressed some of the basic questions about structured finance spreads and ratings, more questions remain unanswered. One of them is how to decompose structured finance spreads into different components and see how they vary over time. The presence of strong liquidity risk, prepayment risk, credit risk, and their mutual dependence make it hard to model and quantify these components and draw inferences accordingly. We leave these questions for future research.

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