

The Relationship between Issuance Spreads and Credit Performance of Structured Finance Securities

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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 corporate credit spreads.² In searching for determinants of corporate spreads, researchers also find that corporate 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, research on bond spreads in the structured finance market has been scant.³ This is largely due to the lack of sound economic models and reliable data 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.

For almost the same reasons, the analysis of structured finance spreads has drawn a huge amount of attention from dealers and investors. At the heart of the analysis is to determine the risk and value of pooling and tranching, based on historical data and projected cash

flow distributions. The analysis is often complicated by the existence and strong interactions of a number of jointly 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 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 impact the spreads on 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 deal cash flow distributions, resulting in additional uncertainty to the transactions.

The objective of this paper 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 performance of structured finance securities.⁵ To the best of our knowledge, this is the first research paper systematically addressing 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?

These questions are answered in two different ways in this paper. For each question, we first describe the basic data and their summary statistics. Some of the results are imme-

diately 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.

Note that 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 within the same broad letter rating category. When constructing the data set to examine whether abnormally wide spreads anticipate future downgrades at the security level, and 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 for a given rating category.

The remainder of this paper 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 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 Moody’s rated U.S. 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 U.S. 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),⁶
 - ABS backed by manufactured housing loans (MH),
 - ABS backed by home equity loans (HELs),⁷

- Prime and alt-A residential mortgage backed securities (RMBS),⁸
- Commercial mortgage backed securities (CMBS),⁹
- Collateralized debt obligations (CDOs) backed by high yield corporate bonds (HYCBOs),
- CDOs backed by high yield loans (HYCLOs),
- CDOs backed by structured finance securities (SFCDO).
- Public or 144A issues, with a public Moody's long term bond rating,
- Not guaranteed by a financial guarantor, a government agency, or GSE (Government Sponsored Enterprises),
- Tranches with initial balances greater than or equal to \$10 million U.S. 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), 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.¹⁰

Exhibit 1 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 split across the Aa, single-A and Baa rating categories. By sector, ABS and RMBS securities account for 76.7% of the total sample.

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 Exhibit 2).

EXHIBIT 1

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)	Aaa	Aa	A	Baa	
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	

In this paper, ABS includes Credit Card, MH, and HEL only. CDOs include HYCBO, HYCLO, and SFCDO only.

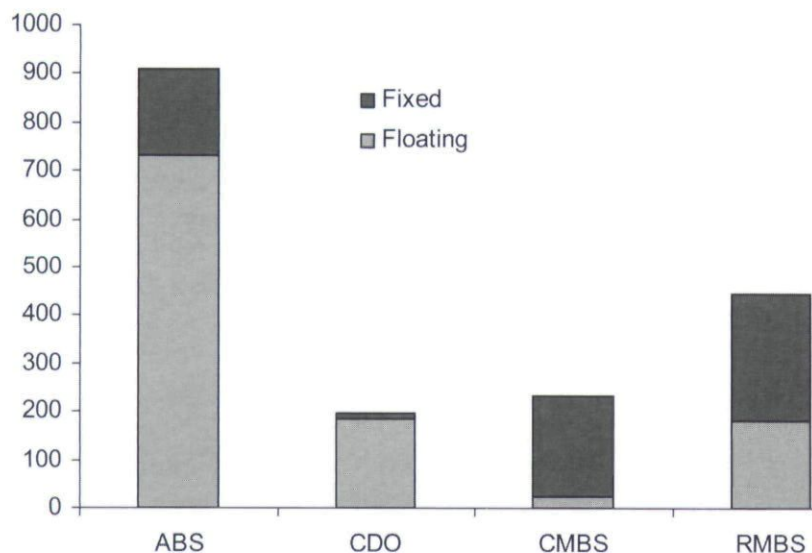
For each security in the sample, we computed a par coupon spread. For each floating rate tranche, a spread is typically given at issuance date. We converted the given spread into a representative spread over the three-month LIBOR rate by first convention the spread into the coupon rate at issuance, and 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.¹¹ 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 their median average lives by rating 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 corporate spreads by rating. The corporate bond spreads used in this paper 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

EXHIBIT 2

Total Dollar Volume at Issuance by Coupon Rate Type and Sector (\$ Billions)



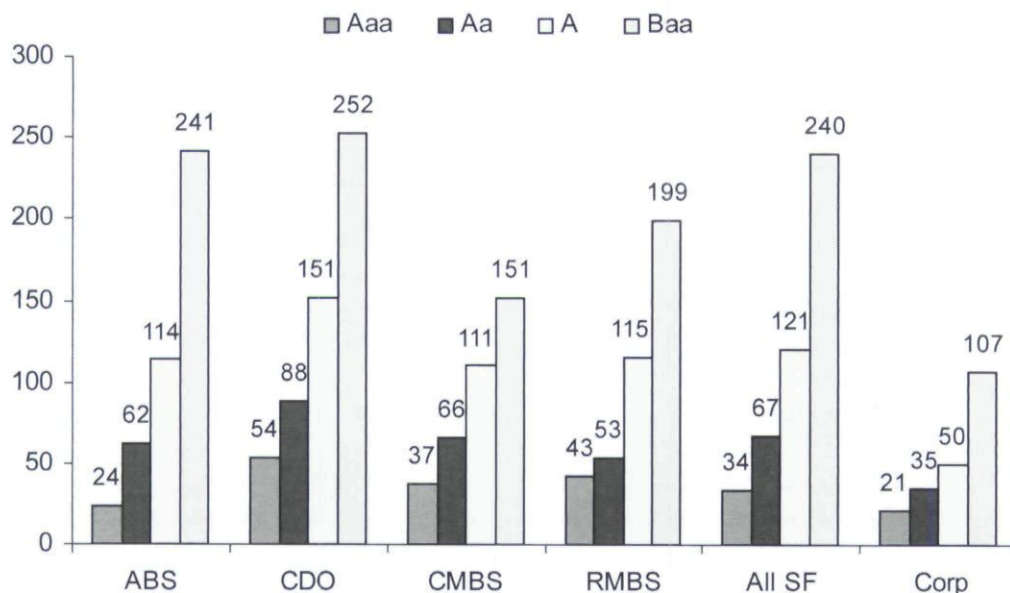
than \$50 million. All yields are yields-to-maturity calculated on a semi-annual basis.¹³

Exhibit 3 depicts the average spreads of floating rate securities by original rating issued during 1998–2004. It shows that the average spreads in a given sector are wider in lower rating categories than in higher rating categories, and the spreads are wider in structured finance than in the corporate sector. In addition, for all sectors, the spreads in the Baa rating category are significantly wider than the spreads in other investment-grade rating categories.

Exhibit 3 also shows 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. The median spreads in CMBS are generally much lower and exhibit less differentiation across rating

EXHIBIT 3

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. The corporate spreads are simple averages of monthly spreads measured over seven-year swap rates.

categories. In the remainder of this paper, 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

Issuance 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 issuance 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 in structured finance and compare them with those in corporate finance.
- Second, 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 both corporate and structured finance.

Spread Dynamics by Rating

Exhibit 4 plots the monthly median spreads and their six-month moving averages for all structured finance securities by rating, and also shows the mean, median, and standard deviation of these monthly median spreads in a summary table. 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 9 bp larger than that in corporate, and it is 13 bp 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 during 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.

Macro Trends in Spreads

In studying the spread dynamics by rating and asset class, we made an observation that there appeared to be a common trend in spreads that rose in 2002 and 2003 and then declined in 2004. This trend coincides 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 is also correlated with changes in interest rates and the slope of the interest rate curve.

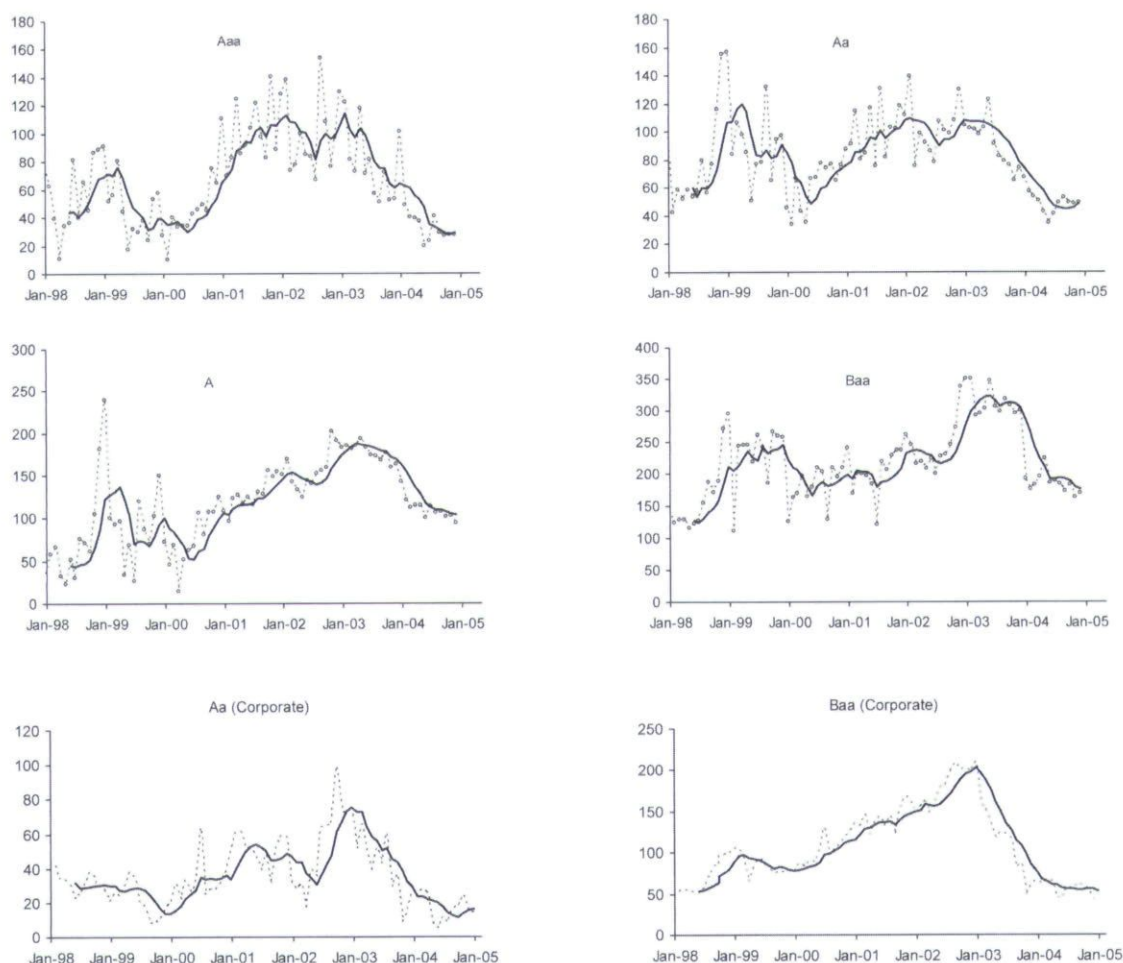
Exhibit 5 shows the relationships between the Aaa spread and Baa–Aaa spread differential and the following four systematic risk factors:

- U.S. structured finance trailing 12-month speculative-grade material impairment rate,¹⁴
- U.S. 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.

Exhibit 5 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

EXHIBIT 4

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 Exhibit 4: 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

Spreads are in basis points.

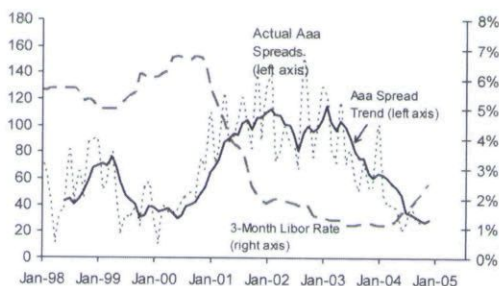
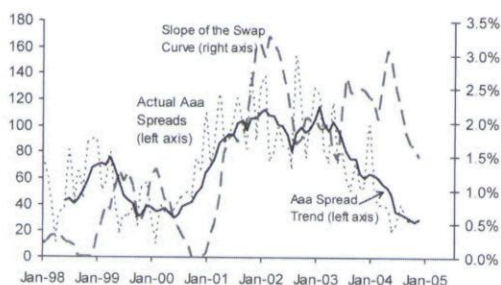
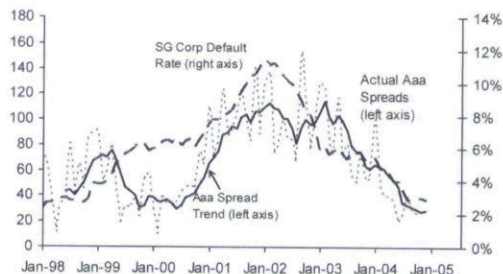
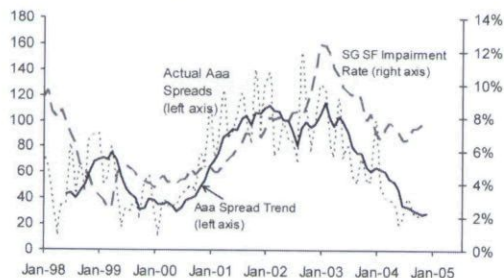
in the slope of the swap curve in 2001 and the flattening of the slope in 2004 were accompanied by an increase and a decline in the Aaa spreads during the respective periods.

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

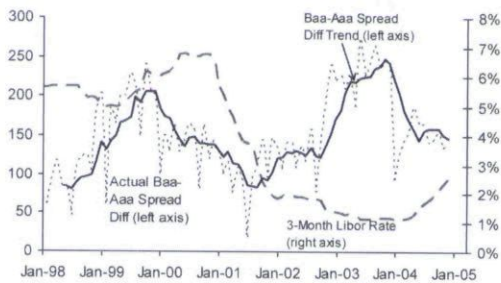
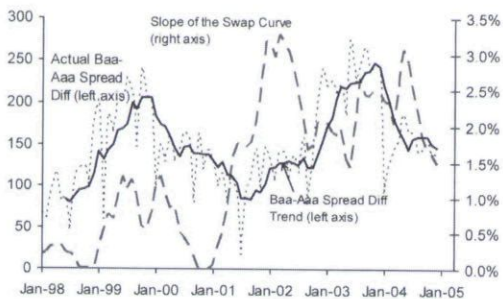
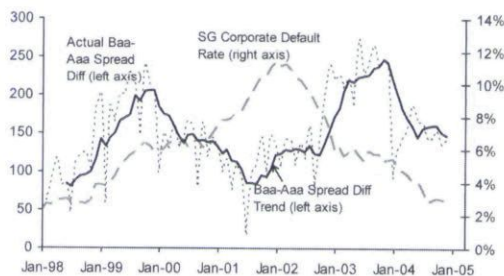
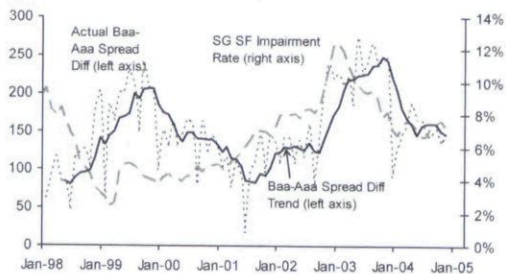
EXHIBIT 5

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



(Continued)

EXHIBIT 5 (Continued)

Summary Table for Exhibit 5: Monthly Time Series Correlations in Exhibit 8, 1998–2004

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

Correlations are calculated using the six-month moving average spread trends shown in the exhibit. 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. 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.

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 with 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. Collectively, these observations suggest that, compared with Aaa spreads themselves, the Baa–Aaa spread differentials contain less systematic risk.¹⁵

Finally, the final row of data in Exhibit 5 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 the structured finance credit performance. This can be attributed to the large number of impairments in the HYCBO and MH sectors, which were highly correlated with the credit performance in the corporate sector. The lagged deterioration of HYCBO and MH credit performance can be the result of built-in credit support that took time to diminish.

To describe these correlations among the spreads and macro variables, we ran a linear regression of 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.

We found that both the macro trend fit the Aaa spread series quite well, with roughly a 50% R-square. For the Baa–Aaa spread differential, however, the macro trend did not describe the series well, as their R-squares were only around 11%.¹⁶

DO SPREADS REACT TO CHANGES IN MARKETS' CREDIT CONDITIONS?

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.

Starting from this section, we move beyond the median spread analysis by rating and asset class, and study two ways in which issuance 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?

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 is in a low downgrade state.¹⁷

We then 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 Exhibit 6. 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.

Using this data sample, Exhibit 7 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 means that spreads strongly react to the past credit conditions in the sector.

For example, the median of Aaa fixed rate spreads was 40 bp higher in a high structured finance impairment state than in a low state, and the median of Baa floating spreads was 44 bp higher in a high state than in a low state. This means that issuance spreads strongly reacted to the past credit conditions in the market.

The comparisons of spreads illustrated in Exhibit 7 were carried out in a bi-variate setting; the presence of correlation among the dynamic variables often 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 market in general, we took Aaa- and Baa-rated securities and ran a security-level regression of their issuance spreads on a number of independent variables, including asset class, coupon rate type and rating category dummies, and three dynamic risk factors such as 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 the three-month LIBOR rate for floating rate securities, and a spread over the five-year swap rate for fixed rate securities.

The independent variables are:

- A combination of asset class, coupon rate type and rating category dummies. For example, we use a dummy 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 U.S. corporate speculative-grade default rate. The coefficient on this variable is allowed to differ by rating as well.¹⁸
 - 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).

Exhibit 8 summarizes the regression results and shows that almost all coefficient estimates are statistically significant (different from zero) at the 95% confidence level. Exhibit 8 also reveals several interesting behaviors.

First, because all dummy variables are significant, there are strong fixed effects in spreads across asset classes, coupon rate types (fixed vs. floating), 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.

EXHIBIT 6

Distribution of the Data Sample for Regression Analysis

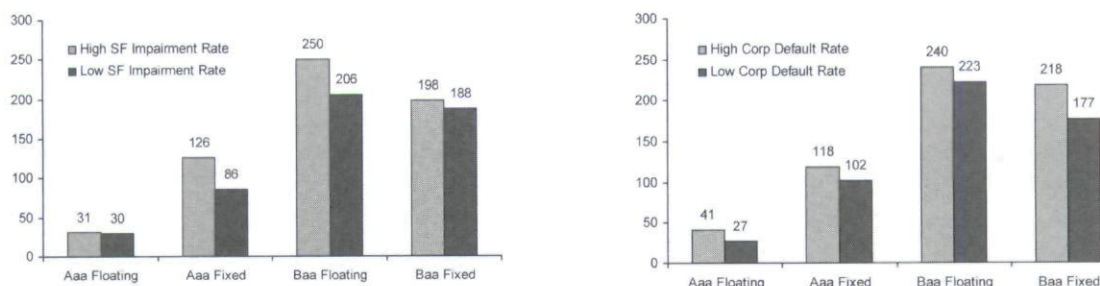
By Number of Securities	Aaa		Baa ^a		Total
Asset Class	Floating	Fixed	Floating	Fixed	
CARD	287	94	97	21	499
MH	41	257	5	85	388
HYCBO	117	24	67	74	282
HYCLO	310	13	177	38	538
SFCDO	316	12	105	33	466
CMBS	58	697	35	323	1,113
HEL	1,880	1,093	783	84	3,840
RMBS	994	4,016	61	3	5,074
Total	4,003	6,206	1,330	661	12,200

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

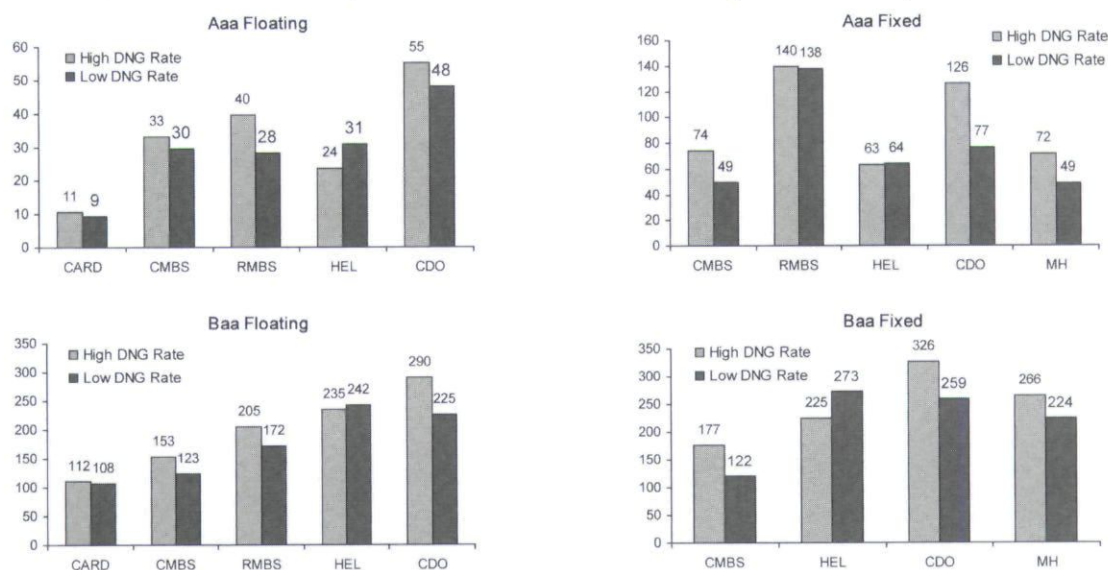
EXHIBIT 7

Comparisons of Median Issuance Spreads across HIGH and LOW Default/ Impairment/Downgrade States.
Note: Spreads are in basis points.

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



These findings support the observations we made in previous sections.

Second, Aaa spreads do not significantly react to the trailing 12-month downgrade rate within a given asset class, but Baa spreads do. 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 4-bp 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 1-bp increase in Aaa spreads and 6-bp increase in Baa spreads in the structured finance market.²⁰

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 changes, so will the fixed rate spreads.

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.²¹

EXHIBIT 8

Regression Results—Spreads React to Past Credit Conditions

Independent Variables		Coefficient Estimates			
		Floating Rate		Fixed Rate	
		Aaa	Baa	Aaa	Baa
Dummy Variables ^a	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)			

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

Spread (bp) is the dependent variable. 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.

^aA dummy variable is defined for each combination of asset class, coupon rate type, and rating category.

DO SPREADS ANTICIPATE FUTURE DOWNGRADES?

Having examined the reaction of spreads to the past credit performance within a given asset class and the corporate market, we turn our attention now 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 use downgrades, instead of material impairments, to measure credit deterioration because very few Aaa-rated securities have become impaired.

We compared the median spreads at issuance for securities that were downgraded and those that were not downgraded within three years after issuance, and found that the spreads are generally higher on securities that were later downgraded. See Exhibit 9.

For example, the spreads on downgraded Aaa MH fixed rate tranches were on average 50 bp higher than those that were not downgraded. The spreads on downgraded

Baa MH fixed rate tranches were more than 90 bp wider.

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.

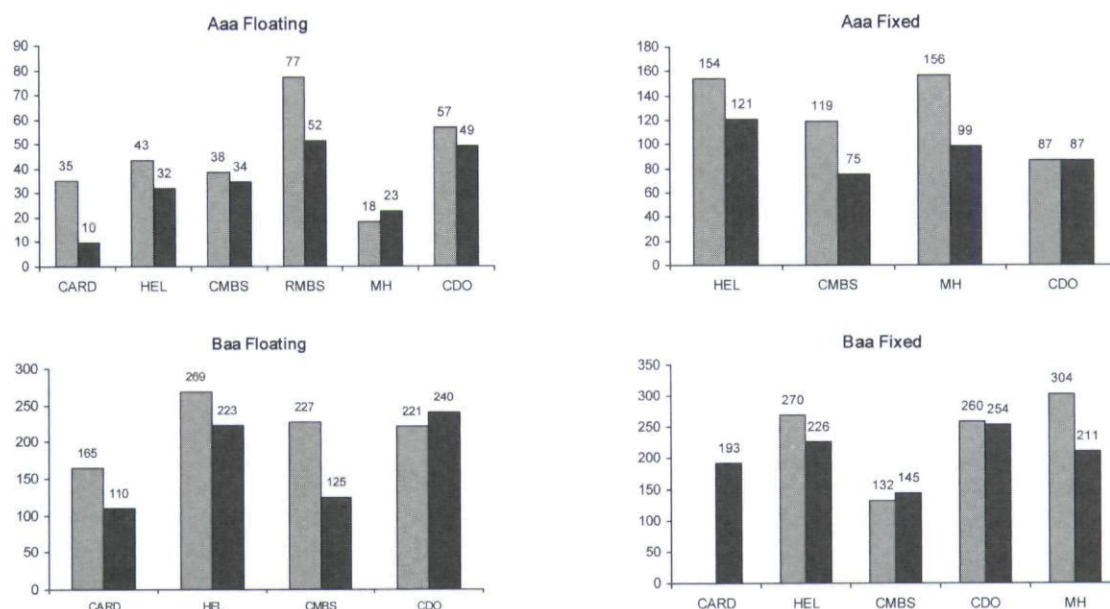
It is worth noting that the Baa broad rating category consists of three refined rating categories: Baa1, Baa2, and Baa3, whose spreads are typically different. Therefore, it is possible that the spread differences in the Baa category shown in Exhibit 9 simply represent the rating distribution differences 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 disaggregated the Baa data sample 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,

EXHIBIT 9

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



Summary Table for Exhibit 9: 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

where the spread differences in Exhibit 9 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 Exhibit 9.

Finally, as shown in Exhibit 9, 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.

The comparisons of spreads in Exhibit 9 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. 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 Exhibit 8, except that a future downgrade dummy variable is added and three dynamic variables are replaced by three time variables.²² 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.

Exhibit 10 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.

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' spreads as independent variables. Because spreads are 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 Exhibit 11, 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.

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.

EXHIBIT 10

Coefficient Estimates on "Future Downgrade" Dummy Variables in Multivariate Regression Models of Issuance Spreads^a

Independent Variable: Future Downgrade Dummy Variable Alternatives	Coefficient Estimates on the Downgrade Variable in Different Subsamples				
	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	2,779	956	499	863	461

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

Spread (bp) is the dependent variable. 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.

In Exhibit 11, the coefficient estimate on spreads is 1.0 per percentage point (100 bp) for Aaa floating rate securities. The first derivative of the logistic function suggests that for every 3 bp of additional spread, the downgrade probability within three years after issuance would increase by roughly 10 bp. In other words, a 10% increase in the spread (because the median Aaa spread of all structured finance is about 30 bp) at issuance increases the downgrade probability by about 3%.

Similarly, for Baa fixed rate securities, a 10% increase in the spread (roughly 20 bp because the median is about 200 bp) would increase the downgrade probability by roughly 8% (or 160 bp).²³

CONCLUDING REMARKS

This paper analyzes the relationship between structured finance issuance spreads, credit ratings, and credit performance and finds that ratings are highly correlated with spreads. We found that structured finance spreads widened significantly when their asset classes experienced high downgrades in the past 12 months before issuance, or when the corporate default rate increased. In addition, securities with higher issuance spreads in a given rating category may imply higher downgrade risk.

Structured finance spreads have also been correlated with Moody's corporate default rate, Moody's structured finance impairment rate, and the slope of the swap curve. This suggests that structured finance spreads contain strong

systematic risk components. Furthermore, we also found that systematic risk components were more significant in Aaa spreads than in Baa spreads.

Some of the spread variations across asset classes appear 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 credit performance.

While this paper addressed some of the basic questions about structured finance spreads and their credit performance, more questions remain unanswered. In particular, there may be non-credit reasons why structured finance spreads have been higher than corporate spreads, and why there are large variations across asset classes within the structured finance sector:

- Structured finance securities are less liquid than corporate bonds as most structured finance investors have adopted a buy-and-hold strategy.
- Structured finance securities are a newer type of securities than corporate bonds. Although the structured finance market started in 1980s, its extraordinary growth was more recent, especially in the last five to ten years. In addition, newer and more complicated structured finance transactions constantly emerge in the structured finance sector. It often takes time for investors to understand a new type of securities and takes even longer to become comfortable with investing in them.
- Some investors are not allowed to invest in certain

EXHIBIT 11

Coefficient Estimates on Spreads in Logistic Regressions of "Future Downgrade" Dummy Variables^a

	Coefficient Estimates on Spreads in Different Subsamples			
	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

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

Spread (%) is the independent variable. 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.

types of structured finance securities either because the risks of these securities are not well-understood, or because there are regulatory or corporate governance constraints that render it costly to invest in such securities.

- Structured finance securities are often more sensitive to interest rate changes and prepayment risk than are corporate bonds. As a result, the spreads on structured securities contain a larger interest rate risk and prepayment risk premium than do corporate bonds.

It is not clear in addition to credit risk, if not all, of the above reasons explain the majority of the spread differences. We leave these questions for future research.

ENDNOTES

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¹Some of the more recent papers include Hull, Predescu, and White [2004], Huang and Huang [2003], Collin-Dufresne, Goldstein, and Martin [2001], Elton et al. [2001], and Duffie and Singleton (1999), Arvanitis, Gregory, and Laurent [1999].

²See, for example, Jarrow, Lando, Turnbull [1997], and Arvanitis, Gregory, and Laurent [1999].

³Ammer 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, b) 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.

⁴The par spreads derived from coupon rates at issuance 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.

⁵For comprehensive historical data on the credit performance of structured finance securities, please visit moodys.com. Also see Hu and Cantor [2003, 2004a, b].

⁶We picked credit card ABS to represent a traditional ABS asset class that had 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.

⁷Excluding high LTV, HELOCs, and NIMs.

⁸Excluding resecuritized RMBS.

⁹Excluding net lease deals.

¹⁰Tranches are generally not collapsed except when we examine whether spreads anticipate future downgrades.

¹¹Ideally, 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 option-adjusted spread (OAS). However, both average lives and OAS are not available all securities.

¹²Moody's provides numerically modified ratings for each broad rating category Aa, A, Baa, Ba, and B with modifiers 1, 2, and 3. Ratings with modifier 1 represent lower credit risk than those with modifiers 2 and 3.

¹³Historical data on Moody's corporate bond yields and yield spreads can be found in the Credit Trends section of Moody's website at moodys.com. Weekly corporate spreads are also published in Moody's Credit Perspectives.

¹⁴Material 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 discussions, please see Hu and Cantor [2004b].

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

¹⁶This 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].

¹⁷We 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.

¹⁸The 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.

¹⁹Because 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.

²⁰Economically, 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. In a regression of Aaa spreads for the all structured finance category as one group on the macro credit variables, 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 9 bp, which is about 30% of the median Aaa spread.

²¹The 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 discussed above.

²²Because 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. The time trend generally mimicked the macro trend very well.

²³We 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 Exhibit 10 in the sense that higher spreads would on average lead to higher downgrade probabilities and even larger number of notches downgraded.

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