Analysis of Yield Spreads on Commercial Mortgage-Backed Securities

Brian A. Maris
College of Business Administration
Northern Arizona University
Box 15066
Flagstaff, AZ 86011

William Segal
Office of Policy Development and Research
U.S. Department of Housing and Urban Development
451 7th Street, SW, Room 8212
Washington, DC 20410

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ABSTRACT

Yield spreads on commercial mortgage-backed securities (CMBS) declined dramatically from 1992 until 1997, then increased each of the next two years. The relationship between CMBS yield spreads and other economic variables is estimated in an effort to determine the extent to which recent trends can be explained by other variables. The results indicate that even after controlling for other observable factors, the yield spread on CMBS declined from 1992 until 1997, then increased each of the next two years.

INTRODUCTION

The market for mortgage-backed securities (MBS) has grown rapidly in recent years. This includes MBS backed by residential and non-residential mortgages. Initially, Veterans Administration (VA) and Federal Housing Administration (FHA) single-family mortgages guaranteed or insured against default by the U.S. Government supported most mortgage-backed securities. Only after secondary markets for MBS on FHA and VA loans were well established did the secondary market for MBS supported by conventional residential mortgages develop. In 1970, less than ten percent of single-family mortgages had been securitized; by 1992, nearly half were. (Fabozzi and Jacob, 1997, p. 76.)

Very few commercial mortgages (including multifamily) are insured or guaranteed by the Federal Government. Securitization of commercial mortgages is a relatively recent development. As of the end of 1990, 9.5 percent of multifamily mortgages had been securitized, almost entirely by GNMA, FNMA and FHLMC, and less than one percent of other commercial mortgages had been securitized, all by the private sector. By the end of 1996, 21.4 percent of multifamily mortgages and 8.5 percent of commercial mortgages had been securitized, mostly by private issuers. The growth rate of securitization of commercial mortgages during the 1990s can be compared to the pattern of securitization of residential mortgages in the early 1970s. Of the $3.1 trillion of residential mortgages outstanding in 1992, nearly half were securitized. (Fabozzi and Jacob, 1997, p. 76.)

A decline in CMBS yield spreads (defined as the difference between yields on CMBS and yields on U.S. Treasury securities of comparable maturity) in the mid- 1990s was noted in the trade press. (See, for example, Fathe-Aazam, 1995, Fabozzi and Jacob, 1997, p. 104, and Zuckerman, 1998.) As shown in Table 1, average CMBS yield spreads in 1997 were less than one-half the levels of 1992. Beginning in 1998, however, CMBS yield spreads began increasing, and in 1999 average yield spreads actually exceeded 1993 levels.

[[Insert Table 1 approximately here]]

Yield spreads on a particular class of securities are affected by a variety of factors. The purpose of this study is to estimate the relationship between CMBS yield spreads and other variables in an attempt to determine the extent to which recent trends in CMBS yield spreads can be explained by changes in other observable variables.

DEVELOPMENT OF THE CMBS MARKET

As noted in the introduction, securitization of multifamily and commercial mortgages by the private sector is a recent phenomenon. There are several reasons securitization developed later for commercial mortgages than for residential mortgages. Until recent years, commercial mortgage lending was a local market, dominated by banks, thrifts and insurance companies. Moreover, as was true on the residential side prior to the creation of FHA, commercial mortgages lacked consistent underwriting standards, documentation or agency backing, and as a result, did not easily support securitization. Except for loans securitized by the GSEs, who typically require lenders to conform to their underwriting requirements[1], a tremendous variety of loan characteristics exists among the commercial mortgages that are described in CMBS prospectuses. On the investor side, traditional fixed income investors lacked the historical data and experience to evaluate default risk and other features of commercial mortgages.

[1] The GSEs do purchase loans that do not comply with their underwriting guidelines in "negotiated transactions."

The early 1990s saw several changes that affected commercial mortgage lending. The difficulties of thrifts, which began in the 1980s, continued. In addition, thrifts, commercial banks and insurance companies faced regulatory changes that increased the capital requirements on direct commercial mortgage lending. Even credit-worthy borrowers had difficulty obtaining credit, and sought alternative sources. Interest rates have been relatively low in the 1990s, and investors sought new investment vehicles. At the same time, the Resolution Trust Corporation needed to liquidate billions of dollars in commercial mortgages. Between 1991 and 1995, the RTC securitized nearly $18 billion in performing and non-performing commercial mortgages, with nearly $14 billion of that total occurring in the two years following its first such deal in August 1991. (Fabozzi and Jacob, 1997, p. 77.) Nonagency CMBS issuance increased from approximately $5 billion annually in 1989-90 to approximately $15 billion in 1992, with most of the increase in the form of RTC issues. However, in 1993, when RTC issues dropped dramatically, the increase in private issues more than offset the drop in RTC activity, and total nonagency issues were up for the year. The volume of nonagency CMBS activity dropped slightly in 1995 to less than $20 billion, but recovered in 1996 to exceed the level of 1994. (Fabozzi *et al.*, 1997, p. 325)

GNMA, FNMA and FHLMC have issued multifamily MBS for a number of years. For the six-year period prior 1991, when the RTC first participated in the CMBS market, GNMA, FNMA and FHLMC issued an annual average of $4.9 billion of multifamily MBS. (Fabozzi *et al.*, 1997, p. 326) The activities of GNMA and the two GSEs did not provide the catalyst to the market provided by RTC activity largely because their issues protect investors from default risk. As a result, it was not until the securitization activity of the RTC began that underwriting standards, rating criteria and evaluation techniques were developed that made it easier for nonagency deals to follow.

RESEARCH METHODOLOGY AND DATA DESCRIPTION

Recent research on mortgage valuation uses an option-based approach. Closed-form valuation is generally not possible, due to the complex nature of the options imbedded in a mortgage. As a result, Monte-Carlo and numerical analysis is used to obtain solutions, and even then, for sophisticated models that reflect real-world complexities, valuation is difficult. Rather than attempt to estimate directly the values of the options that are an inherent part of commercial mortgages, this study uses an option adjusted spread method. The yield on CMBS securities is compared to the yield on an appropriate option-free security of similar maturity. The difference in yields is attributed to the value of the options imbedded in the underlying mortgages. The sample includes all CMBS issues for which the necessary information was available for the period from the beginning of 1992 through 1999.[2] The sample includes 1,600 fixed-rate CMBS tranches and 479 variable-rate CMBS tranches.

The method of analysis is similar to that of Rothberg, *et al*. (1989), which identifies various factors that influence the spread between yields on single-family mortgage-backed securities and U.S. Treasury securities. Among the factors they considered are credit (default) risk, prepayment risk, marketability (liquidity), and tax considerations. The relationship between yield spread and the other variables is estimated with linear regression.

The method used by Rothberg *et al*. is appropriate for analyzing commercial mortgage-backed securities, but the differences between single-family and commercial mortgages are sufficient that their empirical results cannot be generalized to the commercial market. In particular, prepayment and refinancing patterns are entirely different. A single-family mortgage can be prepaid at any time without restrictions. Commercial mortgages typically cannot be refinanced without incurring a substantial penalty. Another consideration is that default risk is generally higher for commercial than for single-family mortgages (Corcoran and Kao, 1994), requiring greater care in controlling for default risk. This point will be discussed more fully below.

Linear regression is used to analyze the data, as shown in equation 1:

[2] Most of the data (described below) were obtained from the CMBS Database, 1995 and 1998. Other data were obtained from the Federal Reserve website, the NBER website, and the commerce Department website.

$$SP_i = a + b(ISSAMT) + c(TRAMT) + d(r_{AAA} - r_{10TR}) + e_1(D_{AA}CPDIFF) + e_2(D_ACPDIFF) + e_3(D_{BBB}CPDIFF) + f_1(D_{93}) + \ldots + f_7(D_{99}) + g(SD) + h(TS) + j(XRI) + \varepsilon_I \quad (1)$$

where:

SP_i = yield spread on CMBS tranche "i"

ISSAMT = natural log of total CMBS issue amount (in millions of $)

TRAMT = natural log of tranche amount (in millions of $)

r_{AAA} = yield on AAA-rated corporate bonds

r_{10TR} = yield on 10-year Treasury bonds

D_j = Dummy variable for highest rating on tranche i, or for year of issue

CPDIFF = r_{BBB} - r_{AAA}

r_{BBB} = yield on corporate bonds rated BBB

SD = standard deviation of the 10-year T-bond yield over previous 52 weeks

TS = 10-year Treasury yield – 3 month Treasury yield

XRI = Experimental Recession Index

For each CMBS issue included in the sample, each tranche with a rating from AAA to BBB (investment grade) is entered separately. Equation (1) is estimated separately for fixed-rate and variable-rate CMBS. Because the discussion in the business and trade press has focused on the absolute spread, the relationship is estimated using the absolute spread as the dependent variable. However, as pointed out by Rothberg *et al.*, due to tax effects, it might be preferable to analyze the relative spread. Taxes affect yield spreads because the interest on Treasury securities is exempt from state and local income taxes, while interest on MBS is not. MBS yield spreads are positively related to the level of interest rates due to tax effects. As the overall level of interest rates drops, the MBS yield spread is also expected to drop somewhat. Therefore, equation 1 is also estimated using relative spreads.

The absolute spread is as defined in the CMBS Database, and is typically the yield on a CMBS tranche minus the yield on U.S. Treasury securities of comparable maturity.[3] The relative spread for fixed-rate CMBS is defined as the absolute spread divided by the yield on a 10-year Treasury. For variable-rate CMBS, the relative spread is the absolute spread divided by the yield on 3-month Treasury bills.

As the CMBS market has grown, and the size of individual issues has increased, one would expect liquidity of the issues to also improve. According to John Levy (1997) the trend is to bigger CMBS deals with two or more investment banking firms participating. Investors are attracted because they expect improved liquidity. If liquidity is positively impacted by larger deals, the yield premium associated is expected to decline. In 1992, the average size for CMBS deals included in our sample was $598 million. In 1999, the average size of CMBS deals included in the sample increased to $799 million. However, the average number of tranches per issue also increased over the same period, so the average tranche size remained increased only slightly, from $110 million to $112 million. Individual securities are traded in the secondary market, not the entire MBS deal. As a result, it is not clear that increased deal size has resulted in improved CMBS liquidity. Total deal size and tranche size are both included in the model. To the extent that either is positively related to liquidity, the expectation is that yield spreads will be inversely related to size.

Several variables in the model are included to capture the probability of prepayment. Prepayment risk on MBS arises from two sources: prepayments and default. The value of a mortgage incorporates the borrower's option to prepay (a call option) and the borrower's option to default (a put option). For single-family residential mortgages, prepayment is more common than default, and the call option dominates. An increase in interest rate volatility increases the value of the borrower's option to refinance, and therefore interest rate volatility is positively related to yield spreads on single-family mortgages and the associated MBS. Similarly, according to the expectations theory of the term structure, the yield curve is an indicator of the

[3] In some cases, the benchmark is identified as the "Treasury yield curve," or for some variable-rate issues, the

expected future course of interest rates. If interest rates are expected to be lower in the future, it increases the likelihood that prepayment will be financially beneficial, and should result in larger spreads on single-family mortgages. (See Rothberg *et al*., 1989, p. 303 for further discussion.) The results of Rothberg *et al*. for single-family MBS are consistent with those expectations.

For CMBS, however, the effect of interest rate volatility is somewhat different. Commercial mortgages typically contain prepayment penalties that are frequently equal to the present value of the refinancing benefit. As a result the put option to default on a commercial mortgage dominates the call option to prepay. For CMBS, the losses associated with default are borne by the lower-rated tranches. The effect of default on the senior tranches is to accelerate the repayment of principal and, as shown by Maxam and Fisher (1997), the senior tranches actually benefit from default due to the early return of principal and the resulting reduction of duration. If the cash flows are accelerated, the security holder effectively earns a long-term interest rate on a security that proves to be short lived. Because the yield curve is typically upward sloping, the prices of highly rated fixed-rate CMBS tranches are positively related to the probability of default, and their yield spreads are expected to be negatively related to the probability of default. The steeper the yield curve, the greater the benefit of receiving payment earlier than promised because the difference between long-term and short term interest rates is greater. An increase in the volatility of interest rates increases the volatility of cash flows received by property owners, and therefore increases both the probability of default and the value of the default option. Therefore, it, too, is expected to be negatively related to yield spreads on senior CMBS tranches.

The default risk component of the yield spread reflects investors' perceptions of the default risk. In the early 1990s, when nonagency CMBS issues were first issued in substantial amounts, the U.S. was recovering from a recession that hit commercial property values very hard. Many loans held by the FDIC and RTC were of low or questionable quality and often documentation was lacking. Investors (and raters) were unfamiliar with analyzing commercial

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LIBOR is used.

mortgages and the risks they posed. Lack of familiarity might have caused investors to overestimate the risks, and could explain why yield spreads were high in the early 1990s. As investors gained familiarity, they developed greater confidence in their ability to assess the risks, and required lower risk premiums.

In addition to interest rate volatility, two variables are included in the model that are intended to reflect default risk. The spread between AAA-rated corporate bond yields and 10-year Treasury yields is included as a proxy for the overall credit market's default risk premium.[4] Additionally, the difference between yields on low- and high-rated corporate bonds (CPDIFF) is included, based on the results of Duca and Rosenthal (1989). CPDIFF is entered in the regression through interactive terms created by multiplying CPDIFF times dummy variables representing security ratings (the rationale for the interactive terms is provided below). Several other variables were tried to better represent default risk specifically on commercial mortgages, including the rental vacancy rate, the quarterly change in GDP, the NBER's Experimental Recession Index (XRI), and quarterly change in the NBER's Index of Coincidental Indicators.[5] Of those variables, the Experimental Recession Index, which represents the probability of a recession in six months, was retained.

Dummy variables are included for each year other than 1992. Another set of dummy variables are included for security ratings (other than AAA) because lower rated securities have higher yields to compensate investors for the greater default risk. The base case is therefore an AAA-rated CMBS issued in 1992. As noted above, interactive terms were created by multiplying the rating dummies times CPDIFF. This has the effect of making estimated spreads between AAA, AA, A, and BBB-rated CMBS tranches proportional to changes in the corporate bond yield spread.

EMPIRICAL RESULTS

[4] The authors are indebted to an anonymous referee for this suggestion.
[5] The authors are indebted to an anonymous referee for suggesting these variables.

The results for estimating regression equation (1) for both the absolute spread and the relative spread are shown in Table 2. Results for fixed-rate CMBS, shown on the left-hand side of Table 2 will be discussed first.

[[Insert Table 2 approximately here]]

Because the results for relative spread and absolute spread are so similar, they will be discussed together. The coefficients for tranche size (TRAMT) are negative, although it is significant only for absolute spread. This provides some support for the notion that larger tranches are associated with lower liquidity premia, as expected. On the other hand, the coefficients for total deal size are positive (significant only for the absolute spread, as with tranche size), indicating that larger deals are associated with higher spreads. This result suggests that issue size is a proxy for supply considerations. Larger deals might require larger spreads to attract a sufficient number of investors to place the issue.

The coefficients for the difference between AAA-rated corporate bond yields and Treasury bond yields ($r_{AAA} – r_{10TR}$) are positive, as expected, and statistically significant. A one percent increase in $r_{AAA} – r_{10TR}$ corresponds to a 101 basis point increase in spread between AAA-rated CMBs and Treasuries. The interactive dummy variables formed by multiplying security rating dummies times CPDIFF are each significant, and show spreads that are inversely related to rating, as expected. The coefficients represent average differences between yield spreads during the sample period: AA-rated securities averaged yields 30.4 basis points higher than AAA after controlling for other variables, given an average value for CPDIFF; A-rated issues averaged 66.9 basis points higher than AAA, and BBB-rated issues averaged 160.8 basis points higher than AAA. The year dummy variables indicate that CMBS spreads are increasing from year-to-year, beginning in 1992, until 1998. They then decrease each of the next two years. This is consistent with the average spreads shown in Table 1, but more importantly, indicate that, even after controlling for changes in the other variables, CMBS spreads were still changing from year-to-year. This indicates that CMBS spreads were not

merely reacting to changes in the other variables included in the model, but responding to variables not included.

As discussed in the previous section, higher interest rate volatility (SD) and the Experimental Recession Index (XRI) are both positively associated with greater likelihood of default on the underlying mortgages. According to Maxam and Fisher, (1997) highly rated CMBS benefit from modest default experience, and based on their results, the coefficients for both SD and XRI should be negative. As shown in Table 2, however, the coefficients for both SD and XRI are positive. In the case of the absolute spread, both coefficients are significant, wile for relative spread, the coefficient for XRI only is significant. This indicates that for investment grade CMBS, investors earn a default risk premium within each rating category.

The term structure variable (TS) is positive and significant for the absolute spread, and negative and significant for the relative spread. If a reasonable explanation exists for that result, the authors are unaware of it.

The results for variable rate CMBS (shown on the right-hand side of Table 2) are similar to those for fixed rate CMBS. Although their signs are the same as for fixed rate CMBS, neither of the size variables have coefficients that are significantly different from zero in either the absolute spread or the relative spread cases. The coefficient for interest rate volatility (SD) is positive and significant for the absolute spread, and insignificant for the relative spread (as was the case for fixed rate). The coefficient for the term structure (TS) is positive in both cases, but significant only for the relative spread case. The coefficient for the Experimental Recession Index (XRI) is insignificantly different from zero for both the absolute and the relative spread regressions. There is little evidence in these results that investors in variable rate CMBS receive a default risk premium beyond the differences resulting from rating.

For fixed-rate CMBS, the results in Table 2 clearly indicate that after controlling for credit quality[6] and other factors, yield spreads on fixed-rate CMBS declined each year from 1992 until

[6] A number of studies have concluded that lenders have eased their underwriting standards in recent years. The *1998 Survey of Credit Underwriting Practices* states underwriting standards for commercial loans have eased each of the past four years. The primary reason cited by examiners for easing underwriting standards was competitive pressure.

1997, then recovered somewhat each of the next two years. What these regression results cannot do is indicate why yield spreads changed over time. There is no a priori way of knowing whether yield spreads were at more appropriate levels in 1992 than they were in 1997 or 1999. The CMBS market was new in the early 1990's, and participants were not as familiar with assessing the risks associated with CMBS. An indication of this is the change in the percentage of tranches with "split" ratings: ratings from different raters that are a full rating category apart (AAA by Standard and Poor's, Aa by Moody's, for example). Table 3 shows the percentage of split ratings by year. For the first two years (1992-93) in the sample, more than 21 percent of the tranches received split ratings. For the 1994-99 period, the percentage was less than one-fourth as high, at 4.7 percent. The hypothesis that the two percentages are the same must be rejected (the z-statistic equals 6.8). This indicates a higher degree of uncertainty on the part of security raters about the default risk of individual CMBS in the early 1990's. It is likely that investors were equally uncertain. However, the fact that raters tend to have greater agreement now about the appropriate rating for CMBS does not mean that the current consensus rating accurately reflects default risk or that existing yield spreads adequately compensate investors for that risk. Nor does it explain why percentage of split ratings increased in 1999 or yield spreads have recovered in the last two years of the 1990s.

CONCLUSIONS

Yield spreads on commercial mortgage-backed securities (CMBS) declined dramatically from 1992 to mid-1998. Because commercial mortgages are complex instruments, with imbedded options, yield spreads on CMBS are influenced by a variety of factors, and it is possible that the decline in yield spreads is merely reflecting other changes. However, the results of this study indicate that CMBS yield spreads declined during the sample period, even

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According to the FDIC's *Report on Underwriting Practices* the weakening of underwriting practices is especially noteworthy in commercial real estate lending. A general lowering of underwriting standards by lenders will increase the overall probability of default on commercial mortgages. It is not clear how that should affect yields on CMBS, however. If the standards of security raters have been consistent over time, the default risk on an A-rated CMBS tranche in 1992 should be very similar to the default risk on a CMBS tranche with the same rating in 1998.

after controlling for other factors, including default risk (as measured by rating). Possible explanations for compression of yield spreads in 1997 and early 1998 include “overheating” of the commercial mortgage market associated with the late expansion phase of the credit cycle, or alternatively, that the development of the CMBS market improved the flow of funds into commercial mortgage markets. Further research is needed to evaluate the relative merits of these competing explanations.

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Table 1

CMBS Yield Spreads By Year and Rating

Year	Rating	N	Mean Yield Spread	Mean Annual Spread for All Ratings
1992	AAA	8	165.4	
	AA	16	204.1	
	A	3	301.7	
	BBB	3	320.0	206.1
1993	AAA	25	126.4	
	AA	28	162.3	
	A	13	217.3	
	BBB	14	263.6	177.7
1994	AAA	33	95.7	
	AA	43	114.1	
	A	36	147.2	
	BBB	34	226.8	144.3
1995	AAA	62	92.8	
	AA	46	114.5	
	A	34	143.6	
	BBB	45	207.8	135.0
1996	AAA	85	79.0	
	AA	48	99.8	
	A	42	120.7	
	BBB	66	167.6	114.7
1997	AAA	105	62.6	
	AA	53	76.8	
	A	50	92.1	
	BBB	89	122.4	88.0
1998	AAA	99	97.7	
	AA	48	124.3	
	A	50	143.4	
	BBB	83	212.3	144.4
1999	AAA	119	125.3	
	AA	54	153.1	
	A	81	184.2	
	BBB	85	281.2	182.9

Table 2

Regression Results

CMBS Type:	Fixed Rate		Var. Rate	
Dep. Var.	RelSP	AbsSP	RelSP	AbsSP
Constant	-0.021 -0.58	0.52 0.02	-0.002 -0.026	-18.80 -0.61
ISSAMT	0.007* 2.73	4.98* 3.58	0.005 0.81	3.84 1.48
TRAMT	-0.002 -0.86	-2.40* -2.04	-0.009 -1.58	-4.23 -1.81
$r_{AAA} - r_{10TR}$	0.253* 23.92	101.21* 16.44	0.197* 7.82	56.65* 5.33
D_{AA}CPDIFF	0.062* 8.91	30.45* 7.49	0.083* 5.10	34.81* 5.03
D_{A}CPDIFF	0.123* 16.10	66.92* 15.07	0.213* 11.29	95.08* 11.92
D_{BBB}CPDIFF	0.29* 37.73	160.79* 35.90	0.429* 21.28	192.53* 22.62
D_{93}	-0.076* -5.16	-57.09* -6.65	-0.052 -1.82	-34.96* -2.89
D_{94}	-0.096* -6.54	-71.12* -8.35	-0.142* -5.35	-50.14* -4.48
D_{95}	-0.151* -7.48	-75.87* -6.46	-0.178* -3.95	-49.07* -2.57
D_{96}	-0.147* -8.03	-82.04* -7.69	-0.195* -4.97	-57.09* -3.45
D_{97}	-0.178* -8.73	-98.74* -8.31	-0.216* -4.77	-62.02* -3.24
D_{98}	-0.159* -7.13	-89.35* -6.88	-0.226* -4.14	-69.41* -3.01
D_{99}	-0.161* -8.30	-82.76* -7.31	-0.170* -3.61	-38.30 -1.92
SD	0.028 1.35	38.64* 3.23	0.027 0.57	52.97* 2.64
TS	-0.014* -2.44	9.49* 2.78	0.034* 2.13	12.65 1.89
XRI	0.492* 5.70	413.77* 8.23	-0.058 -0.267	77.42 0.84

Notes for Table 2:

Adj. R^2	.765	.724	.718	.716
F	326.30	262.96	77.18	76.44
N	1,600	1,600	479	479

*Significant at .05 level.

Variable definitions:

AbsSP = Absolute spread
= CMBS yield – Yield on Treasury of comparable maturity (in basis points)

Rel SP = Relative spread
= AbsSP / Yield on 10-year Treasury (fixed rate)
= AbsSP / Yield on 3-month T-bill (variable rate)

ISSAMT = natural log of issue amount in millions of $

TRAMT = natural log of tranche amount in millions of $

r_{AAA} = yield on AAA-rated corporate bonds

r_{10TR} = yield on 10-year Treasury bonds

D_j = Dummy vriable for highest rating on tranche i or for year of issue

CPDIFF = $r_{BBB} - r_{AAA}$

r_{BBB} = yield on corporate bonds rated BBB

SD = standard deviation of the 10-year T-bond yield over previous 52 weeks

TS = 10-year Treasury yield – 3 month Treasury yield

XRI = Experimental Recession Index

Table 3
Percentage of Split Ratings*, by Year

Year	% Split Ratings
1992	34.5
1993	17.1
1994	10.3
1995	5.7
1996	9.4
1997	1.7
1998	1.6
1999	5.8

*A split rating occurs if different raters provide different ratings to the same security.