WHAT'S IN A RATING? AGENCY APPROACHES TO ANALYZING MBS

AVI GOLDSTEIN

Rating agency classifications play a key role in the structuring and pricing of mortgage-backed securities (MBS). Given the long history and enormous size of the MBS market, one might assume uniform industrywide standards would be developed for rating MBS transactions. Instead, divergent philosophies among the rating agencies as to what a rating should mean have resulted in different analytical approaches to the rating of MBS. The differences among these approaches have significant implications for the structuring and pricing of MBS transactions.

This article presents the different methods by which Moody's Investors Service (Moody's), Standard & Poor's Ratings Group Co. (S&P), Duff & Phelps Credit Rating Co. (D&P), and Fitch Investors Service, Inc. (Fitch) assign rating categories to multiclass MBS. While Moody's defines its ratings as a measure of the expected rate of return of the security, S&P and Fitch define their ratings as a measure of the likelihood that a security will not default, and D&P defines its ratings in a manner that accounts in part for the security's likelihood of default and in part for the security's expected rate of return.

In other words, Moody's defines its ratings so that two identically Moody's-rated MBS will have the same expected rate of return, notwithstanding the fact that one of the securities may be more likely to default than the other; S&P and Fitch define their ratings so that two identically S&P- or Fitch-rated MBS will both have the same likelihood of default, notwithstanding the fact that the expected rate of return of one of the securities may be higher than the other; and D&P defines its ratings so that any two identically rated MBS will not necessarily have the same expected return nor

AVI GOLDSTEIN was an associate at the firm of Cleary, Gottlieb, Steen & Hamilton in New York at the time this article was written.

the same likelihood of default but will satisfy a formula that takes both these measures into account.

The differences between the expected return of two securities having the same likelihood of default are attributable to the severity of losses that would result upon the security's default. As the article illustrates, major conceptual differences among rating agencies may be attributed to the divergent approaches with which each accounts for the effects of loss concentration in subordinated classes of MBS. While Moody's and D&P each include, to varying degrees, the potential severity of losses with respect to the particular class of securities being rated, S&P and Fitch focus solely on the likelihood that a loss (of whatever size) will occur with respect to that class.

The article discusses the rating, structuring, and pricing implications that result from these divergent approaches, and concludes by analyzing the consequences for both MBS investors and securities firms securitizing mortgage loan portfolios.

I. WHAT DOES AN MBS RATING MEAN?

The rating category assigned to a specific mortgage-backed security can be thought of as indicating the ability of the rated security to withstand a particular level of economic stress. Qualitatively, an AAA rating indicates that even in the event of an economic depression the security will remain current. Similarly, an AA rating indicates that the security would be able to withstand a severe economic recession, but in the event of a depression would no longer be able to make all scheduled payments of interest and principal.

In order to ensure that a class of securities can withstand the level of economic stress mandated by a particular rating, the rating agencies require that the issuer of the MBS provide for some form of credit enhancement so as to protect the investor against that level of economic stress. Such credit enhancement can be external to the assets, i.e., through the provision of insurance, a third-party guarantee, or the establishment of a reserve fund against losses, or can be built in internally through the use of a senior/subordinate multiclass structure.

For each rating agency, the levels of economic stress that are associated with any particular rating category are based on historical case studies regarding the performance of loan portfolios. In addition, certain rating agencies also incorporate into their ratings economic projections regarding the future performance of the economy in which the properties securing the mortgage loans are located.

For example, to model the economic stress an AAA security must be able to withstand, S&P uses data from the 1930s' Depression,[1] while D&P and Fitch use data from the economic depression in Houston during 1982–1988.[2] As a result of the differences between the case studies and/or the economic projections used by each rating agency to define the level of stress a security must be able to withstand, each rating agency may require a different level of credit enhancement for a given security to attain the same rating category.

II. RATING MULTICLASS MBS: POOL RISK VERSUS CLASS RISK

The rating of any class of securities in a given MBS transaction can be divided into two parts:

1. The risks associated with the performance of the underlying assets (pool risk), and

2. The risks associated with the performance of the particular class of securities being rated (class risk).

All the rating agencies generally share a common conceptual approach in their analysis of pool risk, but they differ sharply in their definitions and assessment of class risk.

Pool Risk

Rating agencies analyze pool risk by comparing the characteristics of the rated pool against those of a benchmark pool of mortgage loans upon which their case studies defining a particular rating are based. Typically, these characteristics include: loan-to-value (LTV) ratios, type of secured properties, purpose of the loans, payment and loan characteristics, geographic dispersion of mortgages, mortgage seasoning, pool size, loan size, servicer reputation, and other factors relating to the potential performance of the underlying loans being securitized. Thus, a pool with a higher LTV ratio than that of the relevant benchmark pool will be riskier, and, unless this risk is otherwise compensated for, will be assigned a lower rating than the benchmark pool.

The respective criteria that a rating agency uses in analyzing each of the factors that constitute the pool

risk, and the weight each rating agency gives each factor, may differ. For example, different rating agencies may disagree as to 1) the quality of the servicer, and 2) the weight that the quality of the servicer should be given in assessing the overall pool risk. Notwithstanding these differences, all the rating agencies follow a similar conceptual approach — they define, and therefore strive to assess, the pool risk of each pool of loans in terms of its risk relative to a respective benchmark pool.

Class Risk

The predominant method of providing the credit enhancement required to attain a desired rating category is to adopt a senior/subordinate multiclass structure in which all payments of interest and principal to each of the junior classes are subordinated to the payment of interest and principal to the more senior classes. The adoption of a senior/subordinate multiclass structure has the effect of increasing both the frequency that the subordinate class of securities will default and the severity of the losses for subordinated classes of securities in the event that such a default occurs.

When they analyze *pool risk*, all the rating agencies attach as much weight to the frequency of default on the underlying mortgage loans as they do to the severity of losses on the underlying mortgage loans upon the occurrence of such a default. When they analyze *class risk*, however, the rating agency methodologies differ in a general manner:

1. S&P and Fitch focus exclusively on the frequency with which the rated class will default but *do not attribute any weight* to the severity of loss upon such default.

2. D&P considers the severity of the resulting loss, but attributes *less weight* to it than to the frequency with which the rated class is expected to default.

3. Moody's attributes the *same weight* to the severity of loss as it does to the frequency of loss.

III. THE S&P AND FITCH "FREQUENCY-DRIVEN" RATING METHODOLOGIES

The S&P and Fitch rating methods are similar in that both use frequency-driven methodologies that account for the likelihood or frequency of default of any given class of MBS, but do not account for the expected losses that will ensue upon such a default. Under the S&P and Fitch methods, the requisite level of economic stress that a mortgage-backed security is required to withstand to attain a particular rating is expressed in terms of the maximum amount of losses that can be incurred by the underlying mortgage loans without causing the security to default (the loss coverage ratio). The loss coverage ratio can be defined as a fraction equal to the product of 1) the frequency with which a "similar" pool of mortgage loans (i.e., a pool of loans having the same pool risk) in the relevant historical case study were foreclosed upon following default multiplied by 2) the weighted-average severity of losses resulting from the foreclosure of those loans:

$$\text{Loss Coverage} = \text{Foreclosure Frequency} \times \text{Loss Severity} \quad (1)$$

For example, on the basis of its analysis of a nationally dispersed prime-quality pool of single-family mortgage loans with an LTV of 80% and certain other defining characteristics, S&P concluded that in the 1930s' Great Depression 15% of such loans were foreclosed upon, and the average weighted loss due to such foreclosures was 43%. Since the Depression is the economic scenario S&P uses to define an AAA rating, to attain an AAA rating, S&P requires that a mortgage-backed security representing an economic interest in a similar pool of mortgage loans must have a loss coverage ratio of 15% × 43%, which equals 6.5%. Given its historical case studies that define each rating category, for the particular benchmark pool of mortgage loans previously described, S&P has developed the credit scale of loss coverage criteria in Exhibit 1.

To achieve an AAA rating, an issuer of MBS could adopt a multiclass senior/subordinate structure in which one or more classes of securities in a principal amount equal to 6.5% of the overall principal amount of the underlying mortgage loans would be subordinated to the remaining 93.5% of the securities, which would thereby be assigned an AAA rating. Thus, for a $100 million pool of benchmark loans, a subordination level of $6.5 million would be required so that the remaining $93.5 million of securities be AAA-rated. This is intended to ensure that if a depression identical to the 1930s' Depression occurs, the entire pool will have losses limited to 6.5% or $6.5 million, which will be absorbed in their entirety by the

EXHIBIT 1 ■ S&P Loss Coverage Criteria for a Benchmark Prime-Quality Pool

Rating	Foreclosure Frequency (%)	Loss Severity (%)	Loss Coverage (%)
AAA	15	43	6.5
AA	10	40	4.0
A	8	35	2.8
BBB	6	34	2.0
BB	3	33	1.0
B	1.5	33	0.5

Source: "Residential Mortgages" [1993, p. 20].

EXHIBIT 2 ■ Structure A: The Optimal "Top-Down" Structure in an S&P- or Fitch-Rated Transaction with Loss Coverage Ratios Equal to those in Exhibit 1

Size (%)	Class	Fitch/S&P Rating
93.5	A-1	AAA
2.5	A-2	AA
1.2	A-3	A
0.8	A-4	BBB
1.0	A-5	BB
0.5	A-6	B
0.5	A-7	Unrated

Comparison assumes all rating agencies use the S&P loss coverage ratios prescribed in Exhibit 1.

subordinated classes, with no loss incurred by the most senior AAA-rated class.

In an S&P- or Fitch-rated MBS transaction, the derivation of the loss coverage ratios required by a given class of MBS to attain a particular rating is exclusively a function of S&P's or Fitch's analysis of the underlying pool risk. If two securities representing economic interests in the same pool of mortgage loans have an identical amount of credit support from below, they will each be assigned an identical rating, irrespective of the degree to which each of these securities is or is not subordinated to other more senior classes in any given structure. Consequently, in an S&P- or Fitch-rated transaction, to determine the structure in which the highest amount of securities, in descending or top-down order, would be assigned the highest possible ratings (generally referred to as the optimal structure), it is necessary simply to divide the classes of securities in a manner that corresponds to the required loss coverage ratios.

For example, for a pool of mortgage loans whose loss coverage ratios are equivalent to the benchmark pool of prime-quality loans specified in Exhibit 1, the optimal top-down structure in an S&P- or Fitch-rated transaction would be Structure A, as in Exhibit 2.

In essence, the S&P and Fitch ratings are a measure of the likelihood that the rated security will or will not default. The S&P and Fitch ratings do not consider or analyze the amount of expected losses that would result if the security were to default. Consequently, in an S&P- or Fitch-rated transaction, the rating of any given security will neither suffer nor be improved by the fact that, upon a default, its expected losses will be more or less severe than those of another security with an equal likelihood of default. To see this point, consider Structure B in Exhibit 3, which represents a two-class MBS structure for the same pool of mortgage loans as Structure A.

S&P or Fitch would assign the entire class of B-1 securities a B rating, which is equal to the rating previously assigned to the A-6 securities on the basis that the level of credit enhancement for both of these classes is only 0.5%. In other words, in the event of an economic stress greater than 0.5%, both the B-1 and A-6 securities will default. Note, however, that since the size of the B-1 class is 199 times (99.5/0.5) the size of the A-6 class, the severity of losses that the holder of an A-6 security will incur upon a default are 199 times more severe than those that will be incurred by a holder of the B-1 security.

For example, if the underlying mortgage loans experience an economic stress of 1.0%, each B-1 securityholder would incur a 0.53% loss in value, while an A-6 securityholder would suffer a 100% loss and would be wiped out completely.

IV. THE DUFF & PHELPS METHODOLOGY

Much as for S&P and Fitch, the starting point

EXHIBIT 3 ■ Structure B

Size (%)	Class	Fitch/S&P Rating
99.5	B–1	B
0.5	B–2	Unrated

for D&P is an analysis of the amount of credit enhancement necessary to support a particular rating category. In the absence of publicly available data on the actual loss coverage ratios required by D&P for an identical prime pool of mortgage loans as those on which Exhibit 1 is based, we assume that D&P would use the credit enhancement levels contained in Exhibit 1 as a benchmark of the loss coverage ratios it would require for an unsubordinated mortgage-backed security to attain a particular rating category. To the extent that D&P's actual loss coverage ratios are more/less severe, the ratings assigned to any given class of MBS would be less/more favorable than those indicated here.

Assuming the ratios prescribed in Exhibit 1, D&P would, like S&P and Fitch, assign a B rating to the B-1 securities. Unlike S&P and Fitch, however, D&P would not rate the A-6 security or would assign a lower rating to it. This is because the concentration of losses in the A-6 class is 199 times greater than in the B-1 class.

Thus, in contrast to S&P and Fitch, D&P requires that, in order to attain a particular rating, a subordinated security must have more credit enhancement than a non-subordinated security. This increased requirement for credit enhancement is designed to reduce the likelihood of default on a subordinated class further in order to compensate for the greater severity of loss that a subordinated class would suffer upon a default as compared to a non-subordinated class.

D&P defines the extent to which losses are concentrated in any given class as a fraction equal to the degree to which losses are leveraged into a subordinate class relative to an unsubordinated class representing an economic interest in the same pool of mortgage loans. Mathematically this can be expressed as follows:

$$CR_X = \frac{S_X + S_{SX}}{S_X} \quad (2)$$

where CR_X = concentration ratio of class X,
S_X = size of class X, and
S_{SX} = size of classes that are senior to class X.

Upon a default, the severity of losses with respect to a subordinated X class will be CR_X times more severe than the severity of losses that would have ensued if the X class were unsubordinated. Therefore, in order to attain a particular rating category, a subordinated class X must have a loss coverage ratio equal to the product of 1) the amount of loss coverage that would have been required by an unsubordinated security representing economic interests in the same pool of mortgage loans in order to attain the identical rating category as class X multiplied by 2) the relevant D&P concentration multiplier. The D&P concentration multipliers for particular rating categories and for different concentration ratios are set forth in Exhibit 4.

Exhibit 4 illustrates that as the concentration ratios increase, so do the relevant D&P concentration multipliers. To compensate for the increased loss severity that will occur upon a default, D&P requires that an amount of additional credit enhancement be provided to a subordinated class so that a default of that class be 75% times the concentration ratio less likely to occur.[3] Following our first example, as the concentration ratio of the A-6 class is 199, D&P requires that the likelihood of default with respect to the A-6 securities be 75% × 199, which equals 149.25 times more remote than the likelihood of default for the B-1 class that is unsubordinated. The choice of the 75% factor (as opposed to 100%) reflects a business judgment on the part of D&P that investors are concerned more with whether a default will occur than with the extent of losses that will result if such a default occurs.

Exhibit 4, which sets forth the correlation between different levels of credit enhancement and the corresponding likelihood of default, is based on D&P's macroeconomic analysis of historical levels of economic stress.

V. COMPARISON OF D&P VERSUS S&P AND FITCH METHODOLOGIES

S&P and Fitch have similar methodologies in

EXHIBIT 4 ■ D&P Concentration Multipliers

Rating	Concentration Ratio				
Category	25X	50X	100X	200X	400X
AAA	1.01	1.02	1.04	1.08	1.15
AA	1.03	1.06	1.11	1.23	1.45
A	1.05	1.09	1.19	1.38	1.75
BBB	1.08	1.15	1.30	1.60	2.20
BB	1.12	1.24	1.49	1.98	2.95
B	1.15	1.30	1.60	2.20	3.40
CCC	1.19	1.38	1.75	2.50	4.00

Source: "Concentration of Losses" [1994, p. 4].

EXHIBIT 5 ■ Comparison of S&P/Fitch and D&P Ratings of the Structure A Classes

Structure A		S&P/Fitch Ratings	D&P Rating
93.5%	A-1	AAA	AAA
2.5%	A-2	AA	A
1.2%	A-3	A	BBB
0.8%	A-4	BBB	BB
1.0%	A-5	BB	B
0.5%	A-6	B	CCC/Unrated
0.5%	A-7	Unrated	Unrated

Comparison assumes all rating agencies use the S&P loss coverage ratios prescribed in Exhibit 1.

that both define their rating categories in terms of the securities' likelihood of default. Thus, to attain a particular rating category, S&P and Fitch both require a given level of credit enhancement protection for each class of MBS, irrespective of the degree, if any, to which that class is subordinated to other more senior classes in the given structure. Conversely, the amount of credit enhancement that D&P requires of any MBS class in order to attain a particular rating category is dependent on the extent to which that class is subordinated to other classes.

To conduct a comparative analysis of the rating categories that would be assigned by each rating agency to any given class of MBS within a given structure of MBS, it is necessary to know the prescribed loss coverage ratios that each rating agency, after evaluating the particular pool of mortgage loans, would require for each rating category. The loss coverage ratios may differ and are not necessarily publicly available. In the absence of such data, Exhibits 5 and 6 present the hypothetical case that all the rating agencies prescribe the same loss coverage ratios for unsubordinated securities and that those ratios are identical to the ratios contained in Exhibit 1.

As Exhibit 5 illustrates, if all the rating agencies use the loss coverage ratios prescribed by Exhibit 1, D&P would rate the Structure A securities less favorably due to the additional credit enhancement required by D&P for subordinated classes.

For example, the A-2 class has a concentration ratio of (2.5 + 93.5)/2.5 = 38.4. Thus, to attain an AA rating, the A-2 class would require a credit enhancement level of 1.06 (the relevant D&P concentration

EXHIBIT 6 ■ Comparison of S&P/Fitch and D&P Optimal Structures

Structure A		S&P/Fitch Rating	Structure C		D&P Rating
93.5%	A-1	AAA	93.50%	C-1	AAA
2.5%	A-2	AA	2.26%	C-2	AA
1.2%	A-3	A	0.91%	C-3	A
0.8%	A-4	BBB	0.73%	C-4	BBB
1.0%	A-5	BB	0.62%	C-5	BB
0.5%	A-6	B	0.28%	C-6	B
0.5%	A-7	Unrated	1.70%	C-7	Unrated

D&P Derivation of Required Subordination Levels for Structure C

Security	Concentration Ratio	Exhibit 4 Concentration Multiplier	Exhibit 1 Loss Coverage Ratio	Required Subordination
C-1	93.50/93.5 = 1	1.00	6.5%	1.00 × 6.5% = 6.50%
C-2	95.76/2.26 = 43	1.06	4.0%	1.06 × 4.0% = 4.24%
C-3	96.67/0.91 = 106	1.19	2.8%	1.19 × 2.8% = 3.33%
C-4	97.40/0.73 = 133	1.30	2.0%	1.30 × 2.0% = 2.60%
C-5	98.02/0.60 = 158	1.98	1.0%	1.98 × 1.0% = 1.98%
C-6	98.30/0.28 = 351	3.40	0.5%	3.40 × 0.5% = 1.70%

Comparison assumes all rating agencies use the S&P loss coverage ratios prescribed in Exhibit 1.

multiplier from Exhibit 4) × 4.0% (the assumed loss coverage ratio for the AA class given in Exhibit 1) = 4.24%.[4] Because the A-2 class has only 4.0% of credit enhancement, however, the A-2 class would be assigned an A rating. (Note that for a 38.4 concentration ratio the D&P A rating category requires credit enhancement of 1.09 × 2.8 = 3.05, which is satisfied by the A-2 class.)

As Exhibit 5 illustrates, Structure A would not be an "optimal" structure in a D&P-rated transaction. Exhibit 6 presents Structure C, which, assuming the loss coverage ratios prescribed in Exhibit 1, would be the D&P optimal structure.

If any of the rating agencies impose more or less severe loss coverage ratios for unsubordinated securities than those shown in Exhibit 1, the ratings assigned by the agency will be correspondingly less or more favorable than those described here. For example, although Exhibits 3, 5, and 6 show S&P and Fitch assigning identical ratings to each class of MBS, if S&P and Fitch use different loss coverage ratios, the rating categories they would assign to the Structure A securities would be different. Similarly, if D&P uses more or less severe loss coverage ratios than those in Exhibit 1, the differences between the D&P and S&P/Fitch ratings and credit support requirements would be smaller or larger than those in Exhibits 5 and 6.

If D&P and S&P, or D&P and Fitch, rate any given class of subordinated MBS identically, the implication is that D&P's unsubordinated loss coverage ratios are weaker than those of S&P or Fitch, as the case may be. Exhibit 7 describes the D&P loss coverage ratios in the hypothetical case that S&P and Fitch use the loss coverage ratios in Exhibit 1 and that all the rating agencies assign identical ratings to the Structure A securities.

If D&P actual loss coverage ratios are more severe than those shown in Exhibit 7, D&P would rate the Structure A securities more severely than S&P and Fitch. Conversely, to the extent the D&P loss coverage ratios are more lenient than those contained in Exhibit 7, D&P would, notwithstanding the added credit enhancement it requires for subordinated securities, rate the Structure A securities more favorably than S&P and Fitch. If D&P uses the loss coverage ratios in Exhibit 7, it would rate the Structure A securities identically to S&P and Fitch; however, it would rate certain unsubordinated classes of MBS more favorably than S&P and Fitch.

For example, as Exhibit 8 illustrates, if D&P were to use the loss coverage ratios in Exhibit 7, and S&P and Fitch the loss coverage ratios in Exhibit 1, S&P and Fitch would assign the D-1 securities a B rating, while D&P would assign them a BB rating.

All these hypothetical cases illustrate that, irrespective of the actual unsubordinated loss coverage ratios that any rating agency requires, D&P requires more credit enhancement for subordinated classes of

EXHIBIT 7 ■ D&P Unsubordinated Loss Coverage Equivalencies*

Rating Category	S&P/Fitch Loss Coverage (%)	D&P Loss Coverage (%)
AAA	6.5	6.5
AA	4.0	3.8
A	2.8	2.3
BBB	2.0	1.5
BB	1.0	0.7
B	0.5	0.2

Derivation of D&P Unsubordinated Loss Coverage Equivalencies

Class	Rating	Loss Coverage (%)	Exhibit 2 Concentration Multipliers	Unsubordinated Loss Coverage Ratios (%)
A-1	AAA	6.5	1.00	6.5/1.00 = 6.5
A-2	AA	4.0	1.06	4.0/1.06 = 3.8
A-3	A	2.8	1.19	2.8/1.19 = 2.3
A-4	BBB	2.0	1.30	2.0/1.30 = 1.5
A-5	BB	1.0	1.49	1.0/1.49 = 0.7
A-6	B	0.5	2.20	0.5/2.20 = 0.2

*Assumes D&P rates the Structure A securities identically to the ratings that would be assigned by S&P and Fitch, assuming they use the S&P loss coverage ratios in Exhibit 1.

EXHIBIT 8 ■ Comparison of S&P/Fitch and D&P Rating of Unsubordinated Securities*

Size	Class	Fitch/S&P Rating	D&P Rating
99.3%	D-1	B	BB
0.7%	D-2	Unrated	Unrated

*Assumes S&P and Fitch use the S&P loss coverage ratios in Exhibit 1, and D&P uses unsubordinated loss coverage ratios in Exhibit 7.

MBS than for unsubordinated classes of MBS, while S&P and Fitch require the same credit enhancement for both subordinated and unsubordinated classes of MBS.

VI. THE MOODY'S METHODOLOGY

Moody's approach to rating MBS differs from that of the other rating agencies in that it measures the economic stress that a security is required to withstand as a function of the expected deviation in the security's internal rate of return. For Moody's, the six economic scenarios associated with Aaa, Aa, A, Baa, Ba, and B (Moody's equivalent of the AAA, AA, A, BBB, BB, and B rating categories) represent six out of the infinite number of future economic scenarios. Given its current long-term economic projections for the period during which a particular security will be in existence, Moody's assigns a probability to many different possible economic scenarios.

Using a Monte Carlo simulation, Moody's randomly selects outcomes from the assumed probability distribution. The results of thousands of Monte Carlo simulations are then used to calculate the expected, or average, result.

On the basis of the average results of the Monte Carlo simulations, Moody's computes an internal rate of return, r_{AVG}, for the particular class of securities being rated, assuming an initial investment equal to the principal amount of the security. r_{AVG} is then subtracted from r_{IDEAL}, the internal rate of return that an investor would realize, assuming that the security is purchased for its principal amount and that no defaults occur with respect to the underlying pool of mortgage loans. Because certain of the economic projections in Moody's probability distribution include scenarios in which losses will be realized on the underlying mortgage loans, r_{AVG} is likely to be smaller than r_{IDEAL}.

The difference between r_{IDEAL} and r_{AVG}, CIRR, is used as a basis for determining the particular rating for the class of securities being rated. The smaller the CIRR, the better the rating of the security. Moody's rating scale is based on the CIRR of historical portfolios of corporate bonds.

For example, the estimated historical CIRR for portfolios of Aa-rated corporate bonds is 1 to 3 bp, for A- rated bonds 5 to 15 bp, and for Baa-rated bonds 20 to 50 bp. Because Moody's intends that MBS ratings be consistent with corporate bond ratings, these same criteria are used in the MBS context.[5]

Under the Moody's methodology, CIRR is calculated for each class of securities. Consequently, the measurement of the expected severity of loss with respect to each class of securities is automatically built in.

To illustrate how Moody's accounts for the concentration of losses in subordinated classes, Exhibit 9 applies Moody's methodology to compare CIRR for the C-6 class, the second most subordinate class in Structure C (the D&P optimal structure), and the E-1 class in Structure E, an unsubordinated class that is equal in size to the six most senior classes in Structure C. Exhibit 10 shows the respective sizes of the Structure C and E classes.

As Exhibit 9 illustrates, the CIRR of the E-1 securities is 0.02%, or 2 basis points, which, given the historical performance of corporate bonds with which Moody's rating of MBS is intended to be consistent, would qualify the E-1 securities for an Aa rating. Conversely, the CIRR of the C-6 securities is 5.89%, or 589 basis points, which in comparison to the E-1 securities would make the class unrated or qualify it for a significantly lower rating. As Exhibit 9 illustrates, the dramatic difference in CIRR and hence the dramatic difference in Moody's rating of the C-6 and E-1 securities is due to the higher concentration of losses in the C-6 class.

VII. COMPARISON OF MOODY'S WITH OTHER METHODOLOGIES

Assuming that S&P, Fitch, and D&P were to use the S&P loss coverage ratios prescribed in Exhibit 1, S&P and Fitch would assign both the E-1 and C-6 securities an equivalent rating, while D&P would assign the E-1 securities a relatively higher rating than the C-6 securities. Moody's and D&P's approaches are similar insofar as both would rate the C-6 securities more severely because of their higher loss concentration ratio.

Although Moody's defines the economic stress associated with each rating category in terms of expected deviations from the internal rate of return, D&P defines it in terms of expected losses. Notwithstanding this difference, given the relevant data, it is possible to create a mathematical equivalency between these two measurements.

Assuming that both Moody's and D&P use the identical credit scale of loss coverage ratios for unsubordinated securities, i.e., Exhibit 1, and assuming that they both make identical projections regarding the probability with which different economic stresses would occur, it could be shown that Moody's rates subordinated class-

EXHIBIT 9 ■ Calculation of CIRR for E-1 and C-6 Securities

Assumptions:

- Total principal amount of $100,000,000.
- Each security has a principal amount of $1,000.
- Each security pays interest annually at a rate of 10.00% and has a five-year bullet maturity.
- Losses due to the non-payment of interest and principal are spread in a proportionate manner throughout the life of each security.
- Macroeconomic projections:
  - — 70% likelihood that the pool will experience an economic stress of less than 1.70%.
  - — 10% likelihood that the pool will experience an economic stress of 1.80%.
  - — 10% likelihood that the pool will experience an economic stress of 1.90%.
  - — 10% likelihood that the pool will experience an economic stress of 2.00%.

Note: These projections are chosen to be illustrative and are unrelated to the loss coverage ratios in Exhibit 1 or to any other empirical data.

Monte Carlo Simulated Cash Flows for E-1 and C-6 Securities						
Scenario	Class	Year 1	Year 2	Year 3	Year 4	Year 5
I	E-1	$100.0	$100.0	$100.0	$100.0	$1,100.0
	C-6	$100.0	$100.0	$100.0	$100.0	$1,100.0
II	E-1	$99.9	$99.9	$99.9	$99.9	$1,098.9
	C-6	$64.3	$64.3	$64.3	$64.3	$707.1
III	E-1	$99.8	$99.8	$99.8	$99.8	$1,097.7
	C-6	$28.6	$28.6	$28.6	$28.6	$314.3
IV	E-1	$99.7	$99.7	$99.7	$99.7	$1,096.6
	C-6	$0.0	$0.0	$0.0	$0.0	$0.0
Weighted Average	E-1	$99.94	$99.94	$99.94	$99.94	$1,099.3
	C-6	$79.29	$79.29	$79.29	$79.29	$872.1

es of MBS more severely than D&P. This happens because the derivation of the concentration multipliers in Exhibit 4 accounts for only 75% of the loss severity. Under the Moody's approach to measuring the expected losses on which r_{AVG} is based, 100% of the loss severity is accounted for, as equal weight is given to both 1) the likelihood of each economic scenario, and 2) the potential loss severity in a subordinated class.

Conversely, to the extent that both Moody's and D&P assign an equivalent rating to any subordinated class of MBS, it can be shown that D&P uses a credit scale that in the case of an unsubordinated MBS requires relatively more credit enhancement than Moody's does.

VIII. STRUCTURING AND PRICING IMPLICATIONS

The MBS market consists of different types of investors, and the degree to which each investor relies in its pricing of MBS upon the rating categories assigned by rating agencies varies. For the purposes of analysis, consider two investors, X and Y. As is typical of the marketplace, both investors X and Y demand higher returns from riskier securities. In evaluating the risk associated with a class of MBS, Investor X performs its own independent risk analysis, however, while Investor Y relies exclusively on the risk analysis provided by the rating agency categorization.

The Pricing of Different Structures in an S&P- or Fitch-Rated Transaction

Assuming the loss coverage ratios prescribed in Exhibit 1, consider how in an S&P- or Fitch-rated transaction Investors X and Y would evaluate the Structure A securities and Structure B securities described in Exhibits 2 and 3. As the economic rights represented by the A-1, A-2, A-3, A-4, A-5, and A-6

EXHIBIT 9 ■ Continued

Calculation of Cash Flows:

In Scenario I, all the losses with respect to the E-1 class are absorbed by the C-2 class, and all the losses with respect to the C-6 class are absorbed by the C-7 class so that both the E-1 and C-6 classes are fully performing. Conversely, in Scenarios II, III, and IV, losses in the amount of: 1.80% – 1.70% = 0.10%; 1.90% – 1.70% = 0.20%, and 2.00% – 1.70% = 0.30%, respectively, of all scheduled payments would be absorbed by the C-6 and E-1 classes. However, since the E-1 class is 98.3/0.28, which equals 351 times larger than the C-6 class, the losses with respect to each E-1 security will accordingly be 351 times less severe than the losses with respect to each C-6 security.

For example, in Scenario III, Year 1, the loss with respect to both the C-6 and E-1 classes will be 0.20 of the total scheduled interest payment, which equals 0.20 (10% × $100,000,000) or $2,000,000. However, since there are only 280 C-6 securities but 98,300 E-1 securities, the loss with respect to each C-6 security will be $35.70, but the loss with respect to each E-1 security will be only $0.1. Given the assumptions presented, the expected occurrence of each of the four possible economic scenarios is: Scenario I: 70%, Scenario II: 10%, Scenario III: 10%. and Scenario IV: 10%. Therefore the weighted-average cash flow for each security for each year is equal to (70% × cash flow from Scenario I) + (10% × cash flow from Scenario II) + (10% × cash flow from Scenario III) + (10% cash flow from Scenario IV).

Calculation of r_{IDEAL}

$$-1{,}000 + \frac{100}{(1 + r_{IDEAL})} + \frac{100}{(+ r_{IDEAL})^2} + \frac{100}{(1 + r_{IDEAL})^3} + \frac{100}{(1 + r_{IDEAL})^4} + \frac{1{,}100}{(1 + r_{IDEAL})^5} = 0$$

$r_{IDEAL} = 10.00\%$

Calculation of CIRR for E-1 Class

$$-1{,}000 + \frac{99.94}{(1 + r_{AVG})} + \frac{99.94}{(1 + r_{AVG})^2} + \frac{99.94}{(1 + r_{AVG})^3} + \frac{99.94}{(1 + r_{AVG})^4} + \frac{1{,}099.32}{(1 + r_{AVG})^5} = 0$$

E-1 class $r_{AVG} = 9.98\%$
E-1 class CIRR = 10.00% – 9.98% = 0.02%

Calculation of CIRR for C-6 Class

$$-1{,}000 + \frac{79.29}{(1 + r_{AVG})} + \frac{79.29}{(1 + r_{AVG})^2} + \frac{79.24}{(1 + r_{AVG})^3} + \frac{79.29}{(1 + r_{AVG})^4} + \frac{872.14}{(1 + r_{AVG})^5} = 0$$

C-6 class $r_{AVG} = 4.11\%$
C-6 class CIRR = 10.00% – 4.11% = 5.89%

EXHIBIT 10 ■ The C-6 and E-1 Classes

Structure C		Structure E	
Size (%)	Class	Size (%)	Class
93.50%	C-1		
2.26%	C-2		
0.91%	C-3	98.30%	E-1
0.73%	C-4		
0.62%	C-5		
0.28%	C-6		
1.70%	C-7	1.70%	E-2

securities are identical to the economic rights represented by the B-1 securities, Investor X, which performs its independent risk analysis, will be willing to pay an identical price for either group of securities.

Mathematically, this can be expressed as follows:

$$(93.5Px_{A\text{-}1}) + (2.5Px_{A\text{-}2}) + (1.2Px_{A\text{-}3}) + (0.8Px_{A\text{-}4}) +$$

$$(1.0Px_{A\text{-}5}) + (0.5Px_{A\text{-}6}) = 99.5Px_{B\text{-}1} \quad (3)$$

where

Px_{A-1} = price Investor X would be willing to pay for an A-1 security;
Px_{A-2} = price Investor X would be willing to pay for an A-2 security;
Px_{A-3} = price Investor X would be willing to pay for an A-3 security;
Px_{A-4} = price Investor X would be willing to pay for an A-4 security;
Px_{A-5} = price Investor X would be willing to pay for an A-5 security;
Px_{A-6} = price Investor X would be willing to pay for an A-6 security;
Px_{B-1} = price Investor X would be willing to pay for a B-1 security.

In other words, the price Investor X will be willing to pay for a single B-1 security will equal the weighted average it is willing to pay for the relevant class A securities. This can be expressed mathematically as follows:

$$Px_{B-1} = Px_{A-AVG} \quad (4)$$

$$Px_{A-AVG} = \frac{(93.5Px_{A-1}) + (2.5Px_{A-2})}{99.5} + \frac{(1.2Px_{A-3}) + (0.8Px_{A-4})}{99.5} + \frac{(1.0Px_{A-5}) + (0.5Px_{A-6})}{99.5} \quad (5)$$

It is readily apparent that of the Structure A securities the class A-6 is the riskiest, and the class A-1 is the least riskiest. Therefore, based on its independent risk analysis in pricing the relevant Structure A securities, Investor X will be willing to pay the most for the A-1 security and the least for the A-6 security.

Mathematically, this can be expressed as follows:

$$Px_{A-1} > Px_{A-2} > Px_{A-3} > Px_{A-4} > Px_{A-5} > Px_{A-6} \quad (6)$$

Because the A-6 security is the cheapest of the relevant Structure A securities, it necessarily follows from the definition of Px_{A-AVG} that:

$$Px_{A-AVG} > Px_{A-6} \quad (7)$$

and therefore that:

$$Px_{B-1} > Px_{A-6} \quad (8)$$

In other words, an investor who like Investor X conducts its own financial analysis should conclude that, notwithstanding their identical S&P or Fitch ratings, a B-1 security is more valuable than an A-6 security.

Now consider the relative prices that Investor Y would be willing to pay for the A-1, A-2, A-3, A-4, A-5, and A-6, and the B-1 securities. Since, in evaluating risk, Investor Y relies exclusively on the rating agency categorization, the relative prices Investor Y would be willing to pay for each class of securities are as follows:

$$Py_{B-1} = Py_{A-6} \quad (9)$$

$$Py_{A-1} > Py_{A-2} > Py_{A-3} > Py_{A-4} > Py_{A-5} > Py_{A-6} \quad (10)$$

where

Py_{A-1} = price Investor Y. would be willing to pay for an A-1 security;
Py_{A-2} = price Investor Y would be willing to pay for an A-2 security;
Py_{A-3} = price Investor Y would be willing to pay for an A-3 security;
Py_{A-4} = price Investor Y would be willing to pay for an A-4 security;
Py_{A-5} = price Investor Y would be willing to pay for an A-5 security;
Py_{A-6} = price Investor Y would be willing to pay for an A-6 security;
Py_{B-1} = price Investor Y would be willing to pay for an B-1 security.

According to this pricing analysis, it is apparent that Investor Y will be willing to pay more for the Structure A securities than it would for the Structure B securities, notwithstanding that both groups of securities represent the same underlying economic interests. The difference between the amount Investor A would be willing to pay for the Structure A securities and the Structure B securities can be expressed as follows:

$$D_{Proceeds} = [93.5\,(Py_{A-1} - Py_{B-1})] + [2.5\,(Py_{A-2} - Py_{B-1})] + [1.2\,(Py_{A-3} - Py_{B-1})] + [0.8\,(Py_{A-4} - Py_{B-1})] + [1.0\,(Py_{A-5} - Py_{B-1})] \quad (11)$$

where $D_{Proceeds}$ = proceeds from sale of Structure A securities − proceeds from sale of Structure B securities

In other words, $D_{Proceeds}$, the difference in proceeds generated by the A and B structures, is equal to the extra amount that Investor Y is willing to pay for the A-1, A-2, A-3, A-4, and A-5 securities due to their higher ratings relative to the B-1 securities.

To the extent that market behavior is characterized by that of Investor X, securities firms will be indifferent to the structure selected, as all structures will yield the same amount of proceeds. Conversely, to the extent that market behavior is characterized by that of Investor Y, securities firms will generate $D_{Proceeds}$ of additional revenue by selecting Structure A over Structure B.

In general, in an S&P- or Fitch-rated transaction, the optimal top-down structure will always generate the most sale proceeds. Thus for pools of loans with loss coverage ratios as prescribed in Exhibit 1, Structure A, which is the optimal structure, is superior not only to Structure B, but also to all other possible structures.

The Pricing of Different Structures in a D&P-Rated Transaction

As we show in Exhibit 5, in a D&P-rated transaction the ratings assigned to the A-2, A-3, A-4, A-5, and A-6 securities will in comparison to the B-1 securities be relatively more severe than they would be in an S&P- or Fitch-rated transaction. Since Investor X conducts its own independent risk analysis, the change in the ratings assigned to the Structure A securities will have no impact on its pricing analysis. In other words, Investor X will still be willing to pay the same purchase price for all of the B-1 securities as it would for all of the A-1, A-2, A-3, A-4, A-5, and A-6 securities.

The change of ratings will have a dramatic effect, on the other hand, on Investor Y's pricing analysis. As the B-1 securities now have the same rating as the A-5 securities, Investor Y will price both securities identically. Similarly, Investor Y will price the A-1, A-2, A-3, and A-4 securities higher than the B-1 securities, and will price the A-6 securities lower than the B-1 securities.

Consequently, by using Structure A as opposed to Structure B, a securities firm will generate 1) more proceeds from the sale of the A-1, A-2, A-3, and A-4 securities than it will for the equal principal amount of B-1 securities, 2) an equal amount of proceeds from the sale of the A-5 securities as it will for the equal principal amount of B-1 securities, and 3) less proceeds from the sale of the A-6 securities than from the sale of an equal principal amount of B-1 securities. Thus, from the securities firm's perspective, in a D&P-rated transaction it is not necessarily true that the A structure will generate more revenue than the B structure.

Mathematically, this can be expressed as follows:

$$D_{Proceeds} = [93.5\,(Py_{A\text{-}1} - Py_{B\text{-}1})] + [2.5\,(Py_{A\text{-}2} - Py_{B\text{-}1})] + [1.2\,(Py_{A\text{-}3} - Py_{B\text{-}1})] + [0.8\,(Py_{A\text{-}4} - Py_{B\text{-}1})] + [1.0\,(Py_{B\text{-}1} - Py_{A\text{-}6})] \quad (12)$$

If based on the relative prices of $Py_{A\text{-}1}$, $Py_{A\text{-}2}$, $Py_{A\text{-}3}$, $Py_{A\text{-}4}$, $Py_{A\text{-}6}$, and $Py_{B\text{-}1}$, $D_{Proceeds}$ is positive, Structure A will generate more sale proceeds than Structure B. If $D_{Proceeds}$ is negative, Structure B will generate more sale proceeds than Structure A. Finally, if $D_{Proceeds}$ equals zero, then both Structures A and B will generate an equal amount of sale proceeds.

To the extent that market behavior is typified by the behavior of Investor Y, for a D&P-rated transaction to generate the maximum amount of revenues, it will be necessary for the securities firm to ascertain the prices that investors would be willing to pay for securities with each of the different D&P rating categories.

The Pricing of Different Structures in a Moody's-Rated Transaction

In general, all the pricing and structuring conclusions stated for a D&P-rated transaction apply with even greater force in a Moody's-rated transaction. Because D&P's concentration multiplier analysis accounts for only 75% of the loss severity, while Moody's CIRR analysis accounts for such loss severity fully, the relative structuring and pricing effects will be even more dramatic in a Moody's-rated transaction.

Same Structure — Different Rating Agencies

Because Investor X conducts its own independent risk analysis, it should be willing to pay the same purchase price for the Structure A securities, irrespective of which rating agency rated them. It is unclear whether Investor Y will pay more for the Structure A securities as rated by S&P or Fitch than it would for

the same securities as rated by D&P. The answer depends, in part, on whether, for purposes of its pricing analysis, Investor Y treats all securities assigned the same rating category equally, or whether it looks not only to the rating assigned but also to the agency that assigns the ratings.

In general, different investors have different investment objectives and considerations. Some investors are concerned only with the expected rate of return on their investment and can tolerate a portfolio with a greater risk of MBS default provided that the expected overall rate of return is maximized.

Other investors, due to regulatory and other considerations, prefer a portfolio whose MBS carry a lower likelihood of default even if this diminishes the rate of return. For the first type of investor, the Moody's rating is likely to be most meaningful, while for the latter, the S&P and Fitch ratings will be more meaningful. Finally, in order to obtain higher returns, some investors will tolerate a higher level of default as long as the frequency does not exceed a certain threshold. For such an investor, the D&P ratings would perhaps be most meaningful.

To the extent that Investor Y prices all MBS with the same rating category identically, irrespective of who assigned the ratings, it may be willing to pay more for a given class of MBS when rated by one rating agency than when rated by another. As the economics of a given security should not depend on the agency that rates a particular MBS transaction, it is evident that investors should not value two securities that have been assigned an identical rating category by different rating agencies equally.

Therefore, the inescapable conclusion is that it is important for investors to understand and independently analyze the class risk associated with the purchase of subordinated securities when they are comparing securities rated by different rating agencies.

ENDNOTES

The views expressed in this article are those of the author alone.

[1]"Residential Mortgages" [1993, p. 19.]

[2]See Jones, Hayssen, and Schneider [1995, p. 15].

[3]According to telephone interviews with Henry Hayssen, vice president of Duff & Phelps Rating Co. (May 1995).

[4]The actual concentration multipliers may differ because of rounding of the concentration ratios.

[5]"Moody's Approach to Rating Residential Mortgage Pass-Throughs" [1995, p. 8].

REFERENCES

"Concentration of Losses in Highly Leveraged Subordinate Classes." Duff & Phelps Credit Rating Co., June 1994.

"Fitch Mortgage Default Model." Fitch Investors Service, Inc., June 28, 1993.

Jones, Andrew B., Henry W. Hayssen, and Jennifer E. Schneider. "Rating of Residential Mortgage-Backed Securities." *Journal of Fixed Income*, March 1995, pp. 12-36.

"Moody's Approach to Rating Residential Mortgage Pass-Throughs." Moody's Investors Service Structured Finance Research & Commentary, New York, 1995.

"Residential Mortgages." Standard & Poor's Ratings Group *Creditreview*, October 25, 1993.