6 November 2003

CREDIT RATINGS FOR STRUCTURED PRODUCTS

A Review of Analytical Methodologies, Credit Assessment Accuracy, and Issuer Selectivity among the Credit Rating Agencies

*by NERA Senior Vice President Andrew Carron;
Columbia University Professor of Economics and
NERA Special Consultant Phoebus J. Dhrymes;
NERA Senior Consultant Tsvetan N. Beloreshki*

NERA
Economic Consulting

MMC Marsh & McLennan Companies

Michael Gill, Senior Analyst, National Economic Research Associates, provided substantial research assistance. **Jonathan Falk**, Vice President, National Economic Research Associates, provided statistical assistance.

Table of Contents

List of Exhibits

Preface

In late 2001, Moody's Investors Service ("Moody's") awarded a contract to National Economic Research Associates ("NERA") to conduct an independent study on aspects of the ratings process for structured products.

The study does not attempt to duplicate the process by which a credit rating is awarded. Rather, it compares the performance of rated structured finance products, and aims at evaluating the systematic differences, if any, created through the rating processes employed by the major credit rating agencies. Although the analysis should be of broad interest to market participants, its impetus was the debate over the treatment by one agency of securities, not previously rated by that agency, to be included in a rated structured transaction and, in particular, over the technique of "notching" adopted by some agencies.

Notching refers to the industry practice whereby one agency adjusts ratings of structured finance collateral from other agencies for the stated reasons of (1) bringing them in line with ratings it believes it would have assigned to the collateral and (2) adjusting for uncertainty and perceived differences in monitoring practices. The study is timely because rating agencies are being asked increasingly to rate collateralized debt obligations and other securities arbitrage programs with underlying collateral pools that include structured finance securities rated only by other rating agencies.

I. Summary

Scope

- This report covers structured products: residential mortgage backed securities ("RMBS"), commercial mortgage backed securities ("CMBS"), asset backed securities ("ABS"), and collateralized debt obligations ("CDOs").

- The scope of the study encompasses the extent of each agency's participation in rating structured products, the ratings methods of the credit rating agencies, historical ratings differences across transaction types and rating categories, systematic differences in historical performance among the credit rating agencies, and the possibility of "selection bias" with respect to the choice of (i) rating agencies asked to rate specific transactions; and (ii) collateral to be purchased by CDOs and other securities arbitrage programs.

- In setting the scope of the study, the objective has been to analyze the data in ways that might prove useful in determining a reasonable range for the ratings an agency would have assigned, if asked to rate a particular transaction, based only on the ratings of other agencies that were asked to rate the transaction.

- As with any set of empirical findings, there may be alternative interpretations that could be consistent with the data. Therefore, rather than argue for a single interpretation, the primary goal of the study is to present the facts, the range of possible interpretations, and the available evidence that can be used to differentiate among the potential interpretations.

Analyses Based on Data from Each Agency Individually

- Based on the transaction data provided by each agency, Moody's and Standard & Poor's had similar numbers of ratings. Fitch Ratings ("Fitch") had the fewest ratings and the highest percentage rate of growth. [Exhibits III.1 through III.7]

- At year-end 2001, there were more Moody's ratings in the ABS and CDO data sets than Fitch or Standard & Poor's ratings (excluding undisclosed ratings). In RMBS, the numbers of ratings were roughly equal. Fitch ratings were provided on a slightly higher number of the RMBS and CMBS relative to Standard & Poor's and Moody's. [Exhibits III.8 and III.9]

- For all three credit rating agencies, there are a number of sub-sectors where high participation share is related to a particularly high proportion of single-rated deals. In the multiborrower (CMBS), subprime home equity (RMBS), and synthetics (CDO) sectors, more than half of the issues that Fitch rated were rated by Fitch alone. For Moody's-rated issues, Moody's alone rated more than half of the issues in auto leases (ABS), ABS other, small business loans (ABS), CMBS single borrower, mortgage-backed bonds (RMBS), resecuritized MBS (RMBS), whole loan mortgage pools (RMBS), CLO/CBO other (CDO), credit derivatives (CDO), and structured notes (CDO). Standard & Poor's was the only rater on more than half the issues it rated in synthetics (CDO), student loans (ABS), and commercial properties (CMBS). Such concentration may result from specialized expertise, "rating shopping" by issuers, or other factors. [Exhibit III.10]

- The agencies have different methodologies for rating structured products. It is difficult to ascertain from the information provided how these methodological differences might be related to overall ratings differences or differences in ratings performance. [Section IV.]

- Issues for which the rating has changed are far more likely to experience further rating changes than similarly rated issues whose ratings have not changed. Furthermore, consecutive rating changes tend to be in the same direction. This indicates the existence of serial correlation, which may imply that new information is either serially correlated or is not fully assimilated by initial rating actions. Hence some rating changes may be incomplete (insufficient in size), an empirical fact, which may affect the results of some statistical tests on differences in ratings performance. [Exhibit IV.2]

- In recent years, there has been a cyclical pattern to the frequency of ratings changes, particularly in CMBS. No agency has consistently higher or lower frequency of ratings changes than any other. [Exhibit IV.3]

- Although most rating changes lead to a widening of rating differentials among agencies, there are instances when multiple rating agencies change their ratings in the same direction but at different points in time. Based on those instances where both a leading and a following rating change within a 360-day window could be identified, there were some sectors in which one agency initiated more sequential downgrades than another: Standard & Poor's was more likely to initiate a downgrade in ABS than Fitch; Standard & Poor's was more likely than Fitch or Moody's to initiate a downgrade in RMBS; Moody's and Standard & Poor's were more likely than Fitch to initiate CDO downgrades, although there were comparatively few CDO observations. [Exhibit IV.4]

Analyses Based on Jointly Rated Transactions

- In recent years, about one-third of Fitch's and Moody's ratings, and one-half of Standard & Poor's ratings, are in the highest (AAA) category, even though the ratings scale spans nine ratings categories and 21 notches above "default." Some of the subsequent analyses exclude securities rated AAA in order to highlight the differences that are more prevalent in the other ratings categories. [Exhibit V.1 and V.2]

- On jointly rated transactions, Fitch and Moody's agreed on 60.5 percent of the ratings, Fitch was higher on 31.3 percent (attributable largely to the RMBS sector), and Moody's was higher on 8.2 percent. Fitch and Standard & Poor's agreed on 82.2 percent of the ratings, Fitch was higher on 4.3 percent, and Standard & Poor's was higher on 13.5 percent. Moody's and Standard & Poor's agreed on 67.2 percent of the ratings, Moody's was higher on 19.3 percent, and Standard & Poor's was higher on 13.5 percent. Where there was disagreement between Fitch and Moody's, the difference averaged 2.3 notches when Fitch was higher, 1.9 notches when Moody's was higher. (On 5.2 percent of their joint ratings, most of which were RMBS ratings, Fitch rated investment grade and Moody's rated speculative grade versus 0.4 percent for the converse, the only such variance observed.) When there was disagreement between Standard & Poor's and Fitch, the difference was 1.7 notches when Standard & Poor's rated higher, 1.8 notches when Fitch rated higher. When there was disagreement between Moody's and Standard & Poor's, the difference was 2.0 notches when Moody's rated higher, 1.8 notches when Standard & Poor's rated higher. On average, Fitch rated 0.6 notches higher than Moody's, Standard & Poor's rated 0.1 notch higher than Fitch, and Moody's rated 0.1 notch higher than Standard & Poor's. Differences are greater for speculative grade than for investment grade securities. The credit rating differentials between Fitch and the other two agencies have become smaller in recent years. At year-end 2001, on average Moody's rated lower than Fitch by 0.3 notches, Standard & Poor's rated lower than Fitch by 0.1 notch, and Moody's rated lower than Standard & Poor's by 0.1 notch. [Exhibit V.3 through V.5]

- Ratings differences increase as time elapses from new issuance. Fitch's ratings go from 0.3 notches higher than Moody's at issuance to about 1 notch higher than Moody's overall after five years (largely the result of RMBS ratings), with a standard deviation of about 1.5 notches; for speculative grade issues after five years, Fitch's ratings were nearly 3 notches higher, with a standard deviation of almost 2 notches. There was no difference on average between Fitch and Standard & Poor's at issuance or after five years, although the standard deviation grew to more than 2 notches for speculative grade issues. Moody's ratings matched Standard & Poor's overall (with a standard deviation of about 1 notch after five years), and for speculative grade Moody's ratings go from no difference at issue to about 1 notch lower than Standard & Poor's (standard deviation of about 2 notches) after five years. The comparisons of longer-term securities necessarily include only those issued in earlier years, and thus do not reflect the performance of more recent cohorts. [Exhibit V.6]

- On jointly rated transactions, Fitch was more likely to rate the most subordinated tranche in a transaction, while one of the other agencies was more likely to rate the most senior tranche in the transaction. [Exhibit V.7]

- In recent years, there do not appear to be meaningful differences in the frequency of rating changes between agencies when both rate the same transaction. A pattern does exist for single-rated securities. Moody's changed its ratings more frequently than either Fitch or Standard & Poor's for most of the 1990s. At the end of the decade, however, Fitch seems to have increased substantially the frequency of its rating changes. [Exhibits V.8 and V.9]

Analyses Based on Historical Ratings Actions

- A transition matrix shows the historical frequency of one-year changes from each rating to each rating. For each agency, the transition rates are significantly different from year to year and from product to product. That is because the very large number of data points allows even small differences in ratings changes to produce statistically significant results. These differences may be due to cyclical (macroeconomic) factors and/or variations in the mix of securities rated, as well as changes in ratings methodology. [Section VI., Exhibits VI.1 through VI.6]

- Analysis of historical ratings changes indicates differences across agencies overall and in each of the four sectors considered. The differences are statistically significant. In certain sectors, it may not be possible to draw statistically significant conclusions regarding ratings differences because ratings several notches apart have historically similar probabilities of upgrades and downgrades. [Exhibits VI.7 through VI.9]

- Historically, downgrades have been most likely among speculative grade ABS rated by Fitch or Moody's, speculative grade CDOs rated by Moody's, and speculative grade CMBS and RMBS rated by Standard & Poor's. [Exhibit VI.8]

- There are significant differences in the frequency and direction of ratings changes between single- and multi-rated issues, particularly for those not rated AAA. Fitch and Moody's speculative grade ABS had more downgrades on their single-rated deals than on their multi-rated deals. Fitch and Standard & Poor's speculative grade RMBS had fewer downgrades on their single-rated deals than on their multi-rated deals. [Exhibits VI.10 through VI.12]

- When Fitch and Moody's issued downgrades, the number of notches downgraded was larger for single-rated securities than for multi-rated securities. Standard & Poor's downgraded fewer notches on average for single-rated securities than for multi-rated securities. [Exhibit VI.13 through VI.15]

- Fitch was significantly more likely to report upgrades on single-rated RMBS and downgrades on single-rated ABS than for multi-rated RMBS and ABS, respectively. Moody's was significantly more likely to report downgrades on single-rated RMBS and speculative grade ABS, than for corresponding multi-rated deals. Standard & Poor's was significantly more likely to report downgrades on single-rated investment grade CMBS and upgrades on single-rated RMBS, than for multi-rated CMBS and RMBS, respectively. Differences in downgrades between single- and jointly-rated deals could be due to differences in product mix, differences in monitoring practices, or differences in ratings criteria; the agencies maintain that their monitoring and ratings criteria are independent of whether other agencies also rate a particular security. [Exhibit VI.16 through VI.18]

- Performance differences are generally smaller than rating differences observed on jointly rated issues. While rating differences are based on a direct comparison, performance differences are based on statistical inference and are subject to assumptions that cannot be conclusively tested (such as the assumed absence of qualitative differences between single- and jointly-rated issues). [Sections V. and VI.]

- Comparisons of reported ratings changes indicate some differences between each agency's single-rated issues and issues rated by other agencies. Performance differences equate to less than one-half notch overall, but exceed one notch for speculative grade ratings in some sectors. [Exhibit VII.1]

- Although observed differences in performance are generally small between single- and multi-rated securities, there may not be a high degree of confidence associated with this conclusion for many speculative grade and low investment grade categories. It is not possible to rule out, with a high degree of confidence, that performance differences equivalent to several notches do exist. [Exhibit VII.2]

II. Introduction

A. Scope of the Study

The following topics were analyzed:

- The extent of each agency's participation in rating structured products
- Stated methodological differences among the credit rating agencies
- The historical performance (ratings changes) of rated structured finance products across transaction types and rating categories
- Systematic differences in historical performance, if any, among (various combinations of) the credit rating agencies
- The possibility of "selection," if any, as seen in the data – selection both with respect to the choice of (i) rating agencies asked to rate specific transactions; and (ii) collateral to be purchased by CDOs and other securities arbitrage programs

In setting the scope of the study, the objective has been to analyze the data in ways that might prove useful in determining a reasonable range for the ratings an agency would have assigned, if asked to rate a particular transaction, based only on the ratings of other agencies that were asked to rate the transaction.

As with any set of empirical findings, there may be alternative interpretations that could be consistent with the data. Therefore, rather than argue for a single interpretation, the primary goal of the study is to present the facts, the range of possible interpretations, and the available evidence that can be used to differentiate among the potential interpretations.

B. Credit Rating Agencies

1. Nationally Recognized Statistical Rating Organizations

In 1975, the U.S. Securities and Exchange Commission ("SEC") through its Division of Market Regulation created the regulatory category of "Nationally Recognized Statistical Rating Organizations" or "NRSROs." This designation was originally given to three credit rating agencies – Standard & Poor's Ratings Services, Moody's Investors Service, Inc. and Fitch, Inc.

The SEC's subsequent accreditation of four new entrants did not result in expansion of the number of industry participants. Through mergers among themselves and with Fitch, the industry "reverted" to the original three by the end of 2000.

Following the February, 2003 NRSRO designation of Dominion Bond Rating Service ("DBRS"), a Canadian firm, there are currently four NRSROs – Moody's Investors Service, Fitch Ratings, Standard & Poor's Division of the McGraw Hill Companies Inc., and Dominion Bond Rating Service.

2. *Market Role of Credit Rating Firms*

Market participants look to the credit rating firms for unbiased and reliable sources of relevant market information. Credit ratings are an important factor in the decision to invest.[1]

These credit rating agencies occupy a unique position in the financial markets. The NRSRO designation exempts them from the disclosure rules that apply to equity analysts and gives them broad access to market-sensitive corporate information. As a result, Fitch, Moody's, and Standard & Poor's have the means to provide market participants with better information than is available from public sources.

a. Resolution of Informational Asymmetry in Credit Markets

Asymmetric information can generally be described as a situation in which economic agents involved in a transaction have different information. In a transactional environment, one party's superior knowledge about its own (or its own product's) characteristics can lead to adverse selection, a situation where low quality products drive out good quality products, and result in market failures. A higher degree of complexity of the items being traded would be expected to exacerbate the problem. Thus, economic agents are faced with uncertainty with respect not only to economic (investment) risk but also with respect to the adequacy of their knowledge regarding the object of the transaction.

The issuance and, to a lesser extent, the secondary trading of fixed income instruments is an example of such an ex-ante (pre-contractual) informational asymmetry. Sellers (issuers) possess superior information about the quality of their bonds but no costless mechanism exists through which to convey that information to investors. Lacking a signaling mechanism, the market price in such an imperfectly informed market reflects the average bond quality (or perhaps below average

[1] The evidence presented in the existing body of economic literature (e.g., Jewell and Livingston 1998; Reiter and Ziebart 1991; Ederington, Yawitz, and Roberts 1987; and Liu and Thakor 1984) seems to indicate that ratings convey important information to the markets beyond that contained in financial data alone.

when agents are strongly risk averse), and high quality issuers bear the cost of this informational asymmetry. To the extent that, in such circumstances, quality bonds would be undervalued, their issuers have an incentive to incur the cost of a signaling mechanism that can let the market know the true quality of their issues. The availability of accurate and reliable information would in turn enable them to issue their bonds at higher prices (alternatively, lower yields).

An important means by which credit markets resolve informational asymmetries is through the use of credit ratings, which provide disinterested and reliable information to the market regarding the credit quality of different debt issues. The use of an independent third party such as a credit rating firm reduces the moral hazard problem of direct information transfer. Furthermore, since credit rating firms' future revenues depend upon the market's perception and acceptance of the quality of the information they gather and produce, they have a strong incentive for consistently producing high-quality product. Investors can then use a bond rating to infer the true credit quality of a bond and price it accordingly.

b. Liquidity Enhancement

Credit spreads are also dependent on technical and liquidity factors. Other things equal, credit markets demand higher spreads for relatively illiquid issues. This liquidity premium assumes an even greater importance in periods of increased market volatility.

The availability of a credit rating increases the liquidity of an issue by expanding its appeal to investors who were previously either unable (e.g., because of regulatory or investment strategy constraints) or unwilling to consider investing in unrated debt issues, and would therefore justify tighter credit spreads. Additionally, the existence of a credit rating is often a prerequisite for the subsequent acquisition of a credit enhancement, which could improve the issue's credit rating and further increase the issue's appeal to prospective investors.

c. Multiple Credit Ratings

Bond issuers often seek two or three ratings for their securities. The incentive for a borrower to obtain multiple credit ratings exists only if he believes an additional credit rating will provide a marginal benefit in the form of a stronger credit quality certification (double confirmation effect) or broader appeal to investors, and that the benefits will exceed the associated costs. If this were the case, one would expect a bond issue with two identical credit ratings to have a lower borrowing cost than a comparable bond issue with a single credit rating, and the borrowing cost of a bond issue with a split rating to be lower than a comparable bond issue with only the lower rating.

The sponsors of structured products issues are in frequent contact with the ratings agencies and thus are generally aware of how each agency views particular types of issues. By varying the collateral and the security structure, virtually any desired rating can be obtained – unlike sovereign, corporate or municipal debt where ratings are largely dependent on the inherent creditworthiness of the obligor or guarantor. Because sponsors have a choice of whether to accept a rating from any given agency, the observed pattern of ratings (single, double, or triple; identical or split) is reflective of both observed and unobserved ratings.

C. The Structured Products Market

Our focus is structured products. We limited our analysis to U.S. dollar-denominated publicly rated uninsured structured products. The rating agencies may use over 60 different categories to classify these instruments, although there is no direct correspondence of categories between agencies. We have grouped the securities into four categories, as shown in Exhibit II.1 and described below.

Exhibit II.1. Relationship between Agencies' and Standard Product Classifications

1. Residential Mortgage-backed Securities ("RMBS")

Until the 1970s, depository institutions (primarily savings and loan associations and savings banks) were the primary sources of residential mortgage financing in the U.S. Local housing was funded with locally collected deposits. The resulting loans were generally held in portfolio by the savings institutions that created the loans.

When there was buying and selling, it took place among these portfolio investors as whole loans, or unsecuritized mortgages. Due to its limitations in terms of available capital, geographic scope and product development, this system increasingly failed to meet the growing social need for housing. For example, when market interest rates rose over the course of a business cycle, deposits would flow out of the savings institutions and into higher paying instruments, choking off funds for housing.

The federal government responded to this situation by creating several new government-chartered entities to develop and promote securitization, a process by which a collection of loan receivables is put together in a package, and then bonds are issued against the package. It was the U.S. government's intention to simplify the trading of mortgage instruments, enhance market liquidity, and promote wider participation in the market by investors who had not traditionally invested in these instruments. The pioneering role in the development of the secondary mortgage market belongs to government-sponsored agencies, which were the first to issue mortgage-backed securities. The first mortgage-backed securities, pooling traditional fixed-rate level payment mortgages, were introduced by Freddie Mac and Ginnie Mae in 1970 followed in 1981 by Fannie Mae.

Fannie Mae, Freddie Mac, and Ginnie Mae issues are known as "agency" MBS. Mortgage-backed securities issued by other financial institutions and entities are generally referred to as "non-agency" or "private label" issues. Private-label securitization was pioneered by Bank of America, which completed the first securitization of jumbo loans in 1977. In 1982, Residential Funding Corporation entered the securitization market. Others followed soon, creating a network of mortgage conduits willing to provide an active and liquid market.

Our study excludes mortgage-backed securities issued or guaranteed by the government sponsored enterprises. Private label issues collateralized entirely by agency securities are similarly excluded. The remaining non-agency issues comprise the residential mortgage-backed securities analyzed in this study.[2]

2. *Commercial Mortgage-backed Securities ("CMBS")*

The commercial mortgage-backed securities marketplace was an unintentional offspring of the savings and loan crisis of the 1980s. Having taken over the assets of those insolvent financial institutions, the Resolution Trust Corporation found itself with many commercial real estate loans to sell. In the process, techniques were developed to package these loans.

The first non-agency securitization issue of multifamily mortgages in August 1991 marked the birth of the CMBS market and conduit structure, providing a new source of investment capital for real estate and becoming an important part of the capital market.

While the need of the Resolution Trust Corporation to liquidate large commercial mortgage holdings is largely credited with being the catalyst for the large-scale development of these instruments, it is also clear that CMBS development was part of a larger trend in securitization. Since its creation, the CMBS marketplace has experienced rapid and continuous growth, only briefly interrupted by the 1998 worldwide financial crisis and the 2001 terrorist actions against real estate targets in New York.

3. *Asset-backed Securities ("ABS")*

Asset-backed securities are bonds that represent pools of loans of similar types, terms and interest rates.[3] The first ABS issue, for Sperry Lease Finance in 1985, securitized computer leases. Securities backed by automobile loans and consumer receivables soon followed.

[2] We classify home equity loans (fixed seconds and home equity lines of credit) as RMBS. We classify loans backed by manufactured housing as ABS.

[3] Loans secured by real property (i.e., mortgages) are categorized as RMBS or CMBS when securitized.

By selling their loans to ABS packagers, the original lenders recover cash quickly, enabling them to make more loans. The asset-backed securities market has grown as different types of loans are securitized and sold in the investment markets.

Theoretically, any asset that has a revenue stream can be transformed into a marketable debt security. In practical terms, however, the vast majority of ABS are collateralized by loans and other financial assets, e.g., credit cards, student and consumer auto loans as well as manufactured-housing contracts and equipment leases.

4. Collateralized Debt Obligations ("CDO")

A Collateralized Debt Obligation is an ABS-type securitization where the underlying portfolio is composed of straight debt and/or structured securities (a CBO or "Collateralized Bond Obligation") or loans (a CLO or "Collateralized Loan Obligation") or possibly a mixture of securities and loans.[4] A CDO typically comprises a limited number of commercial borrowers (up to 500) as opposed to typical ABS portfolios, which may include obligations of tens of thousands of obligors. By order of volume outstanding, CDOs have securitized (or re-securitized) commercial loans, corporate bonds, ABS, RMBS, CMBS, and emerging market debt.

The first rated CDO came to market in 1990, but annual issuance was relatively low until 1995. The main types of structures employed by CDO issuers are the "balance sheet CDO" (whereby the issuer typically seeks to deconsolidate a debt portfolio) and the "arbitrage CDO" (which seek to achieve a market arbitrage between the cost of the collateral and the market value of the CDO tranches).

D. Data

1. Data obtained From the Credit Rating Agencies

Over the course of 2002 and early 2003 the three principal credit rating agencies provided NERA with their respective databases of ratings history information, from inception through 2001. Where two or more tranches in a deal carried the same rating and were equal in seniority, it was the general practice of Fitch and Standard & Poor's to list only one tranche in each such rating group. The CUSIP number was used as the means of matching tranches across agencies, as each agency employed proprietary deal and tranche identifiers. We supplemented the agency data with

[4] A CDO-like structure that is collateralized entirely by mortgages and/or mortgage-backed securities is generally referred to as a collateralized mortgage obligation (CMO), real estate mortgage investment conduit (REMIC), or (in the case of REMIC collateral) a Re-REMIC. CMOs, REMICs, and Re-REMICs are classified as RMBS or CMBS, not CDOs.

information from public sources. For each tranche (CUSIP number), the agencies provided the following information:

- Tranche Identifier (proprietary)
- Deal identifier (proprietary; used to identify different tranches of the same transaction)
- Tranche name (number/letter designation as provided by the issuer)
- Deal name (unstandardized free text)
- Market sector (see Exhibit II.1)
- Credit rating/date (one or more)

The rating agencies employ different rating scales. Consistent with common industry practices, we standardized each credit rating agency's rating scale as shown in Exhibit II.2.

Exhibit II.2. Standardized Credit Ratings

2. *Creation of NERA's Database*

We performed extensive work in order to create a unified database, which was to serve as the foundation for our analyses. With the agencies' technical assistance, we created a combined database from criteria applied consistently to the raw data.

The following adjustments were made to the data provided by the agencies:

- Exclude confidential, or "undisclosed" issues.[5] A central purpose of the study is to determine what information may be gleaned from public ratings. We include disclosed ratings of private placements, if it is an agency's practice to make such ratings public. One effect of this adjustment is that agencies may be treated asymmetrically. For example, all three agencies rated certain private placements by Commercial Financial Services that later suffered severe credit impairment and downgrades. Because Fitch and Moody's made some of their ratings public, those are included in our study. With one exception, the ratings by Standard & Poor's were not disclosed (even though they later became public knowledge) and are thus excluded from our study.

[5] Standard & Poor's provided us with the number of their undisclosed ratings (which we report in Exhibit III.1, Exhibit III.6, and Exhibit III.7) but not the CUSIPs or the issuer names, so they are excluded from all other exhibits.

- Exclude insured and agency-guaranteed issues, as well as those backed by a single corporate credit. Insured issues, as well as issues backed by federal agencies or a single private entity rely, at least partially, on third-party credit, and not on the characteristics of the issue structure and/or collateral. Such issues would not be representative of the structured products sector.

- Exclude issues backed by foreign (non-U.S. dollar) denominated bonds. The data obtained on the non-dollar category of issues were insufficient for the purposes of this analysis, particularly in view of the wide variation in structures.

- Exclude non-standard credit ratings, e.g., short-term ratings.

- For purposes of statistical analysis, group all ratings of CC/Ca and below into one "defaulted" category.

- Exclude tranches that lack a credit rating history (or whose rating history begins with a "NR" – not rated), that have no or ambiguous (duplicate) agency security identifier, or appear in more than one deal.

- Determine when a security was no longer rated due to maturity, call, or redemption. In some instances, this information was available directly from the agencies or public sources. We applied a filter to determine such ratings withdrawals based on, among other things, the observed continuation of ratings on later-maturing tranches in the same transaction. Moody's and Standard & Poor's indicated all ratings withdrawals (although not necessarily the reason), while Fitch did not. For Fitch-rated bonds that were also rated by another agency, we assumed the Fitch rating was withdrawn when the other agency rating was withdrawn. We estimated the number of Fitch single-rated bonds with withdrawn ratings based on the performance of Fitch multi-rated bonds, and excluded the same number of bonds based on random selection of Fitch single-rated bonds lacking subsequent rating action.

- Verify and supplement the rating agency data with publicly available information from market sources.

III. Who Rates What

A. Number and Distribution of Ratings

The following set of exhibits summarizes the quantity and distribution of data provided by the agencies. These data should not be interpreted in terms of market share, as the agencies have different criteria for the publication of their ratings. In particular, the agencies generally do not disclose their "confidential" or "non-publishable" ratings nor did the agencies include them in the data sets provided to us. Hence the numbers of ratings shown in our exhibits are lower than the figures in the agencies' own published ratings analyses, because the agencies do use the confidential ratings in their own tabulations.[6]

Exhibit III.1. Number of Ratings

Exhibit III.2. Number of Ratings by Rating Agency Combination

Exhibit III.3. Number of Deals by Rating Agency Combination

Exhibit III.4. Percentage of Ratings by Rating Agency Combination

Exhibit III.5. Percentage of Deals by Rating Agency Combination

Exhibit III.6. Number and Percentage of All Ratings by Rating Agency Combination

Exhibit III.7. Number of and Percentage of All Deals by Rating Agency Combination

Exhibit III.8. Number of Ratings by Market Sector

Exhibit III.9. Number and Percentage of Ratings by Rating Agency Combination

There was relatively little issuance of structured products before the early 1990s. Therefore, in many of the statistical analyses that follow, we restrict the scope of the data to 1993-2001.

[6] See, for example, Standard & Poor's. "Rating Transitions 2002: A Quarter Century of Outstanding Credit Performance of U.S. RMBS." 6 February 2003.

B. Variations in who rates what

1. Why a particular agency might be selected for a given transaction

There are several possible explanations for a sponsor's decision of which agencies to select for a particular transaction: quality of service, cost, investor demand, and rating differences among rating agencies are a few examples. If agencies specialize, we should see differences in agency participation rates across sectors. Rating differences will be considered later.

If an agency is considered, but does not end up rating a transaction, a reasonable inference is that it would not have provided a higher rating than the (lower of) the actual rating(s). One could argue that if, in general, higher ratings are not forgone due to cost, service, or investor requirements, then it would be reasonable to believe that observed ratings on transactions not rated by all three agencies are biased upward relative to ratings that would have been assigned from randomly assigned raters.

We address later the question of whether the presence of more than one rater influences the ratings that are assigned.

2. Data on variations across sectors in agency participation shares

Exhibit III.10 demonstrates the variations in each agency's participation rate across product categories, as calculated from the dataset provided to us,[7] and subsequent to the exclusion of certain ratings as described in section II. D. Hence these are not "market" shares.

Exhibit III.10. Number and Percentage of All Ratings by Rating Agency Combination and Sub-sector

Among market sectors for which at least 100 observations exist, there are a number of instances where high participation share is related to a particularly high proportion of single-rated deals. In the multiborrower (CMBS), subprime home equity (RMBS), and synthetics (CDO) sectors, more than half of the issues that Fitch rated were rated by Fitch alone. For Moody's-rated issues, Moody's alone rated more than half of the issues in auto leases (ABS), ABS other, small business loans (ABS), CMBS single borrower, mortgage-backed bonds (RMBS), resecuritized MBS (RMBS), whole loan mortgage pools (RMBS), CLO/CBO other (CDO), credit derivatives (CDO), and structured notes (CDO). Standard & Poor's was the only rater on more than half the issues it rated in synthetics (CDO), student loans (ABS), and commercial properties (CMBS).

[7] Standard & Poor's employs finer distinctions in its own analyses than it provided to us.

IV. What Ratings Mean

The leading rating agencies assess securities issuers as to their ability and willingness to pay interest and repay principal as scheduled. They use a combination of quantitative tools and qualitative analyses to evaluate the creditworthiness of an obligor, and have developed a grading system from which they assign credit ratings.

A. Ratings Determinants

The credit risk implicit in holding a structured security depends on (i) the probability that a credit, issuer, or other entity (e.g., trustee, servicer) underlying the instrument may default, (ii) the expected recovery contingent upon an event of default, and (iii) the term structure of default and recovery rates.

All other things being equal, the value of structured financial products is related inversely to the probability of default on the part of the underlying credits, and positively to the expected recovery rate. The term structure of default and recovery rates can be quite complicated and affect the value of the underlying fixed income instruments in a variety of ways. In general, however, the higher the correlation between default and recovery rates, the higher the value of a fixed income security.[8]

From that point of view, investment decisions as to whether or not to hold a fixed income instrument reflect investors' expectations of future default probabilities and recovery rates and how these relate to the ones implied by the marketplace. As a result, a market equilibrium is established in which the market default and recovery expectations are reflected into structured products' credit ratings, credit spreads and their corresponding valuations.

B. Meaning of Ratings and Ranges

1. Credit Rating Categories

The credit rating agencies use credit categories (combinations of letters) to convey to the marketplace their view of a particular security's creditworthiness. In addition, they apply modifiers to each generic rating category from double-A to triple-C. The 1, 2, and 3 numerical modifiers used

[8] While it might be reasonable to expect that states of the world characterized by a high expected probability of default would tend to be associated with low post-default recoveries, the empirical evidence on this relationship is inconclusive.

by Moody's indicate that the obligation ranks in the higher end, middle range, and lower end of that generic rating category, respectively. Similarly, Fitch and Standard & Poor's use "+" or "-" to denote relative status within major rating categories. The difference between adjacent modifiers is referred to as one "notch." We use the term "rating" to encompass the modifier, and "category" otherwise.

The highest-quality credit rating is triple-A. Securities considered to carry minimal likelihood of default are "investment grade" and are rated Baa3 or higher by Moody's, or BBB- or higher by Standard & Poor's and Fitch. Those companies rated below Baa3/BBB- are considered "speculative grade." They have a higher risk of default and are classified as high-yield bonds, as are some types of non-rated bonds.

Exhibit IV.1. Ratings Definitions

2. *Consistency Across Products*

Given the multitude of determinants of default risk across geographic, industry, and product sectors, maintaining consistency across sectors is a highly desirable goal for credit rating agencies. Aside from the obvious attractiveness to investors of the ability to easily compare across various investment choices, the importance of sectoral comparisons of credit risk has been heightened by various proposals dealing with bank capital regulations.

Achieving consistency in credit ratings, however, is apparently difficult to achieve. A number of academic studies have found evidence that the meaning of a given rating depends on the sector being rated, although none of these studies looked at structured products. For example, Morgan[9] finds that split ratings among multi-rated corporate bonds are more frequent in banking than in other sectors. Similarly, Jackson and Perraudin[10] document a tendency for yield spreads to be higher on bank debentures throughout the 1990s than spreads on comparably rated corporate bonds, suggesting that bond investors perceive banks as being riskier. In addition, Nickell, Perraudin, and Varotto[11] look at credit rating transitions, and conclude that banks tend to have less stable ratings than industrials.

[9] Donald P. Morgan, "Judging the Risks of Banks: Why Can't Bond Raters Agree?" Federal Reserve Bank of New York Working Paper, March 1999.

[10] Patricia Jackson and William Perraudin, "The Nature of Credit Risk: The Effect of Maturity, Type of Obligor, and Country of Domicile," *Financial Stability Review*, November 1999, pp. 128-140.

[11] Pamela Nickell, William Perraudin, and Simone Varotto, "Stability of Ratings Transitions," Bank of England Working Paper, 2001.

3. Credit Ratings and the Business Cycle

The goal of credit agencies is to rate "through the cycle."[12] In other words, an entity's credit rating should be independent of the phase of the business cycle. Rather, it should be based solely upon the entity's underlying fundamental economic characteristics and be unaffected by short-run variation in economic conditions.

Credit ratings are intended to distinguish the relatively risky credits from those that are relatively safe. Rather than being a pure measure of default risk, credit ratings can be viewed as an ordinal ranking of risks among a set of securities at a particular point in time. Moody's, for example, makes that connection explicit by interpreting its credit ratings as ordinal rankings of default risk that are valid at all points in time rather than absolute measures of default probability that are constant through time.[13]

Various academic studies examine the relationship between the state of the business cycle and credit ratings issued by the major credit rating agencies. At least one study of corporate bonds provides some evidence of procyclical assignment of credit ratings.[14] In particular, it finds that credit transition matrices tend to exhibit a higher frequency of downgrades during a recession and a higher occurrence of upgrades during booms. Put differently, based on the empirical evidence, the authors conclude that credit ratings move procyclically.

4. Credit Ratings and Path Dependency

It has been observed that the frequency and direction of rating changes for a security are related to prior rating changes for that security. Altman and Kao[15] find that corporate bond rating changes tend to exhibit serial correlation. This property, often referred to as *rating momentum*, suggests that a downgrade is more likely to be followed by a subsequent downgrade than by an upgrade, and vice versa. Thus, rating changes are not independent, a finding that has been carefully modeled by Lando and Skødeberg.[16]

[12] See, for example, Standard & Poor's, "Corporate Ratings Criteria," 2002, p. 41.

[13] Moody's Investors Services, "Special Report: Ratings Performance 1999," 2000.

[14] Nickell, Pamela, William Perraudin, and Simone Varotto. "Stability of Ratings Transitions." Journal of Banking and Finance (2000), vol. 24, 203-227.

[15] E. I. Altman and D. L. Kao, "The Implications of Corporate Bond Rating Drift," Financial Analysts Journal (1992): 64-75.

[16] D. Lando and T. M. Skødeberg, "Analyzing Rating Transitions and Rating Drift with Continuous Observations," *Journal of Banking and Finance*, 26, 2002, pp. 423-44.

We tabulated the number of upgrades, downgrades, and unchanged ratings for a given year separately depending on whether in the prior year the security had been upgraded, downgraded, or left unchanged. The results are shown in Exhibit IV.3.

Exhibit IV.2. Transition Probabilities Contingent on Prior Transitions

Overall, 6.1 percent of the transitions were upgrades, but among securities with an upgrade the previous year, 19.1 percent had an upgrade. Similarly, 2.7 percent of the transitions overall were downgrades, but among securities with a downgrade the previous year, 29.4 percent had a downgrade.

Because a security must be at least two years old before it can be measured as having had two transitions, we considered the possibility that it was the passage of time rather than serial correlation or "momentum" that was driving the results. To test this, we segregated the securities by age (time since issue). We found that the tendency toward ratings momentum is present for all sample subsets regardless of age.

Our subsequent analyses do not differentiate among ratings transitions on the basis of the rating transitions that preceded them. To the extent that credit rating agencies may allow different degrees of rating momentum or may rate different sets of issuers (i.e., clientele effect), it is conceivable that subsequent statistical tests may be somewhat affected and should be interpreted accordingly.

C. Stated Ratings Methods of the Agencies

Comparisons among the credit rating agencies' approaches to the assignment of credit ratings are somewhat hindered by the credit rating agencies' (understandable) reluctance to disclose their proprietary methodologies. Still, the common thread that underlies all their analyses is the use of a combination of advanced quantitative models based on a wealth of empirical data and evidence, and sophisticated qualitative analytical techniques.

1. Fitch

During the period covered by the data in our study, Fitch used a technique called "stress scenarios" to assign credit ratings to CDOs.[17] It assigned a single credit quality to the underlying pool using the weighted average rating of the individual bonds. Cash flow models were then used to apply stress scenarios, which represent default rates under different states of the economy, and to calculate the expected loss and the required level of credit enhancement. These models depend heavily on the

[17] See Fitch Ratings. "Rating Criteria for Cash Flow Collateralized Debt Obligations" 4 November 1999, pp. 4-5.

default probabilities and recovery rates used. The stress tests were run assuming both front-loaded and back-loaded default assumptions. In addition, Fitch issued guidelines regarding the acceptable concentration of industry and credit rating exposure.

In 2003 Fitch Ratings launched the Fitch Default VECTOR Model (VECTOR), a quantitative portfolio analytics tool that incorporates default probability, recovery rate assumptions and asset correlation to calculate potential portfolio default and loss distributions.[18]

VECTOR is a multi-period Monte Carlo simulation model that simulates the default behavior of individual assets for each year of the transaction's life. It assumes that a firm defaults when the value of its assets falls below the value of its liabilities (or its default threshold). The model simulates correlated asset values for each obligor and each period, which is compared to the default threshold derived from the rating and its corresponding default probability in the default matrix.

VECTOR applies an annual multi-step process. At every annual step an asset portfolio is updated, whereby defaulted assets are removed and default amounts and recoveries upon default are recorded. VECTOR simulates the asset values for each year of a transaction, allowing the modeling of time-varying inputs such as correlation and default rates, and to incorporate amortization characteristics for every individual portfolio.

2. Moody's

Moody's credit analysis of structured products is built around a method that produces a single expected loss number for a given collateral and security's subordination level, which, combined with some qualitative factors, is used to determine the credit rating.[19]

For CDOs, expected loss is calculated using the Binomial Expansion Technique (BET), a method that is not computationally intensive but which relies on a number of simplifying assumptions. Given a collateral pool with a number of securities that may have various correlated default probabilities, the technique creates a pool of identical bonds. Each bond's credit rating and recovery rate is calculated as the weighted-average credit rating and recovery rate of the actual collateral pool. The default probabilities of these bonds are assumed to be independent. The number of such bonds, called the "diversity score," is a function of the actual bonds' default correlation. The score is calculated, in part, based on the number of issuers and industries in the actual pool. Finally, the binomial formula is used to calculate the probability of any number of the hypothetical bonds

[18] Fitch Ratings. "Global Rating Criteria for Collateralized Debt Obligations" 14 July 2003.

[19] See Moody's Investors Service. "The Evolving Meaning of Moody's Bond Ratings." August 1999; and "The Binomial Expansion Method Applied to CBO/CLO." 13 December 1996. Moody's weights differ from those used by Fitch when calculating the weighted-average pool rating, which may result in differences for the final ratings for individual tranches.

defaulting and, by summing over the probabilities and the corresponding losses, the expected loss is calculated.

Qualitative aspects of the rating include, among others, legal and "ramp-up" risk. Legal risks include these issues: bankruptcy remoteness, asset transfer, substantive consolidation, and subordination and enforceability. Ramp-up risks have do to with the possibility that he parameters of the final asset pool, such as credit rating or diversification, may be different by the time the final asset pool is formed.

3. Standard & Poor's

Standard & Poor's approach to structured products considers the default risk of the underlying contracts, the capabilities of the servicer and other administrative entities, and the structure (degree of subordination) in the proposed transaction. The agency relies extensively on the historical performance of similar assets to develop its collateral default estimates. There is some variation across sectors due to legal differences among contracts, availability of information, diversification, and so forth.[20]

For CDOs, Standard & Poor's uses a computationally intensive method that focuses on estimating a pool of securities' "probability of default." The procedure, which combines Monte Carlo simulation techniques with cash flow models, allows for the calculation of expected losses and credit ratings.[21]

The simulation uses individual bonds' credit ratings and a historical transition matrix to estimate the default probability for each period during the life of the security. Different default correlations assumptions are applied to securities in different industry groups. The resulting collateral default distribution is combined with a cash flow model for the deal in order to calculate the default probability for each tranche. Given average maturities and the calculated default probabilities, ratings are assigned. Standard & Poor's also runs various "stress tests" by stressing selected variables, such as default probabilities and recovery rates, to test the credit enhancement of the deal structure.

[20] See, for example, Standard & Poor's. "Manufactured Housing Criteria." January 2000; "Auto Loan Criteria." 1999.

[21] See Standard & Poor's. "Global CBO/CLO Criteria." 1999.

D. Measuring Defaults and Losses

1. Lack of Uniform Reporting

One of the problems associated with comparing ratings across rating agencies is the lack of uniform reporting regarding major credit events, such as credit defaults. To the extent that these are major adverse credit events whose occurrence is objectively observable, those could provide a valuable source for analyses.

Unfortunately, there is no established uniform industry practice with respect to such events, which allows the possibility of a single event being concurrently reported as a downgrade by one agency and as a withdrawn rating by another. This lack of uniform reporting practices across the credit rating agencies, along with the scarcity of default events in some sectors, render such tabulations difficult, if not impossible, to compile.

Less severe credit events, such as a reduction in the amount of subordination in a transaction, are tracked through servicer and trustee reports, but are not collected systematically. Only the rating agencies' reactions to these events, in the form of watch lists or downgrades, are observable. This fact necessarily colors any interpretation of ratings differences as equivalent to differences in actual credit performance.

2. All-or-none Nature of Some Defaults

Historically, many structured products defaults have been due to reasons exogenous to the credit quality underlying the instrument. Prominent among those factors are cases of (alleged) fraud and negative corporate events (e.g., bankruptcies, mergers or acquisitions resulting in a change of the servicer). One such event can affect several transactions simultaneously. Although the rating agencies state that they consider such factors in the structured products ratings process, the large number of defaults (and downgrades) attributable to a relatively small number of such "all-or-none" events make the aggregate default rates somewhat noisy indicators of the reliability of individual ratings.

E. Benefits and limitations of measuring credit performance by tracking announced ratings changes

Each rating is intended to connote a particular distribution of default probabilities within a specified period of time and, possibly, the magnitude of loss in the event of default. For each rating, there is a probability associated with moving to any rating (including staying the same) over any given period of time (customarily, increments of one year). A ratings change is commonly known as a "transition." The lower the rating, the higher is the expected probability of moving to lower ratings (including default).

This study analyzes actual historical ratings transitions. We group the securities in various ways (e.g., sector, issue year) and calculate, for each group of securities with the same rating at the start of a year, what percentage have moved to each rating by the end of the year. This is a "vector" of new ratings for each initial rating. Combining the vectors for each of the 20 possible initial ratings creates a ratings transition "matrix."

Therefore, we will say that the credit ratings assigned by two rating agencies are equivalent if the probabilities of the ratings changes (as represented by their respective credit transition matrices) of an arbitrary portfolio of securities are the same.

1. Benefits of measuring credit performance by tracking announced ratings changes.

An analysis that measures performance by tracking announced ratings changes has several significant benefits. This approach:

- Sheds light on the relative performance of credit ratings over time – a key concern for market participants.
- Examines differences in ratings assigned by the major agencies over time. Academic studies that have examined this question typically employ static approaches.[22]
- Yields insights into the development of the ratings practices over time.
- Exploits a rich set of data.
- Provides insight in an area where the academic and professional literature is not extensive – and the market and public policy implications of economic analysis are significant.

2. Limits of measuring credit performance by tracking announced ratings changes.

An analysis that measures performance simply by tracking announced ratings changes rests on several assumptions. These assumptions place limits on the conclusions that can be drawn from such an analysis. In particular, this approach:

[22] See, for instance, R. Cantor and F. Packer, "Differences of Opinion and Selection Bias in the Credit Rating Industry," *Journal of Banking and Finance*, 21, 1997.

- Assumes that rating changes accurately reflect changes in the credit quality of the security.

- Assumes consistency in rating agency judgments – or, at least, consistency in the relationships between agency judgments.

- Assumes that agency monitoring is consistent over time. The frequency with which agencies review their outstanding ratings affects the frequency of ratings changes and the overall magnitude of ratings transitions.

- Assumes that ratings transitions are stable or "homogeneous" over time. In other words, the ratings transitions experience of a given credit rating agency is independent of the choice of time period.

- Assumes that the rating transitions differentials resulting from the differences between the credit rating agencies' respective methodologies and analytical techniques do not vary over time.

- Abstracts from potential effects of credit cycles, and other macroeconomic "shocks" on differences in ratings transitions.[23]

- Assumes that sector-specific developments do not significantly affect observed differences in transitions.[24]

3. *Monitoring*

In the context of credit ratings, monitoring refers to the agencies' established procedures and capabilities related to the ongoing monitoring of changes in the marketplace, which may warrant action on their part.

Differentials in the observed credit rating agencies monitoring practices can be attributed to, among others, factors such as differences in costs of and policies on monitoring frequency, ratings criteria and methodological precision (e.g., higher precision in assigning ratings would lower the need for corrective actions, absent quality changes), and clientele effects (e.g., variations in actual credit performance across product mixes).

[23] Recent academic work suggests that credit cycles do matter for ratings transitions. Whether differences in ratings across agencies are sensitive to macroeconomic shocks is an issue that has yet to be explored in the academic literature. See R. Cantor and E. Falkenstein, "Testing for Rating Consistency in Annual Default Rates," *Journal of Fixed Income*, September 2001.

[24] Cantor and Falkenstein (2001) argue that sector specific events matter.

Exhibit IV.3 illustrates the observed frequency of credit rating changes for the three major rating agencies, which is measured as the trailing four-quarter moving average of rating actions on a per rating basis (as opposed to a per security rated basis).

Exhibit IV.3. Rating Changes per Rating

Overall there were between 1 and 5 rating changes per 100 ratings per quarter over the last five years of the period. Each agency had the most or the least rating changes for roughly the same length of time. Within products, a cyclical pattern of rating change frequency is observable, especially in CMBS, although no pattern among the agencies is seen. The variation in frequency across agencies appears to be the result of small numbers of ratings, particularly in the earlier years, as well as specialization in subsectors subject to greater or lesser credit fluctuations than the sector as a whole. Speculative grade issues have more cyclicality and more frequent ratings changes than investment grade securities. A reasonable conclusion is that market events have more to do with the frequency of ratings changes than do the agencies' monitoring practices.

Exhibit IV.4 attempts to capture the ability and speed with which credit rating agencies react to market changes. Using the subset of securities issued since 1993 that are rated by two or three agencies, the exhibit measures "leading rating actions," defined as a credit rating change in a direction diverging from the credit rating of an alternative credit rating agency, which is followed by a credit rating action in the same direction by the latter agency.[25] For this purpose, a split rating at issue is interpreted as an initial diverging action if there is a subsequent rating change by one agency that moves in the direction of the original rating of the other agency. The exhibit presents results for all ratings changes and then for downgrades alone.

Exhibit IV.4. Number and Percentage of Leading Rating Actions

Overall (accounting for both upgrades and downgrades), Fitch initiated somewhat more ratings changes than Moody's on the transactions rated by both. Standard & Poor's was more likely to initiate a ratings change than Fitch on their jointly rated transactions. Standard & Poor's was also is more likely to be first to change ratings on deals it rated with Moody's.

Using a lookback period of 360 days and considering only downgrades, Fitch was more likely to precede Moody's on jointly rated ABS and Standard & Poor's was more likely to initiate a downgrade in ABS than Fitch; there was little difference between Moody's and Standard & Poor's on their jointly rated ABS issues. Standard & Poor's was more likely than Fitch or Moody's to

[25] This analysis does not take into account rating actions with respect to ratings "watch lists" that may have been taken by the credit rating agencies. If one agency reacts more quickly to another agency's watch list, the first agency will appear to be the leader in rating changes. We were not provided with sufficient data on watch lists to correct for this potential bias.

initiate a downgrade in RMBS; there were too few ratings changes in RMBS jointly rated by Fitch and Moody's to draw a conclusion.

In CMBS, there were too few downgrades for the results to be significant. This result contrasts with a study on CMBS issues by Nomura Fixed Income Research that found differences in leading rating actions among the agencies.[26] The Nomura study, however, covered a different time period and used a narrower data set than our study.

The CDO sector showed no significant difference in leading downgrades between Moody's and Standard & Poor's. Fitch was less likely to initiate downgrades on issues rated jointly with either of the other two agencies, although there were relatively few observations.

[26] Nomura Fixed Income Research, "Temporal Aspects of CMBS Downgrades and Surveillance," 2003. See also Nomura Fixed Income Research, "CMBS Watchlistings, Downgrades, and Surveillance." 2 October 2003.

V. Ratings Differences Among Agencies

A. Distribution of Credit Ratings By Agency

We begin our analysis of differences between and among the agencies by presenting data on the distribution of each agency's ratings over time. The credit rating distributions of credit ratings issued by the three credit rating agencies is shown in Exhibit V.1.

Exhibit V.1. Credit Rating Distribution

In recent years, about 30 percent of Fitch's and Moody's ratings are in the highest (AAA/Aaa) category. For Standard & Poor's the percentage has been closer to 40 percent. These figures are more useful as indicators of the importance of triple-A ratings to the structured marketplace than of meaningful differences among the agencies, as these figures are not adjusted for the mix of products rated.

Exhibit V.2 provides more detail. These exhibits display each agency's ratings by product and indicate variations according to the number of agencies rating the transactions.

Exhibit V.2. Credit Rating Distribution by Rating Agency Combination

There are apparent differences in participation shares by product and depending on which agencies participate in rating a transaction. The observed differences in the credit rating distribution patterns across different credit rating agency combinations provide further evidence pointing to the existence of "clientele" and/or niche (specialization) effects.

B. Distribution of credit ratings assigned by different combinations of credit rating agencies

Exhibit V.3 shows the distribution of credit ratings for securities rated by at least two credit rating agencies. The ratings are compared at year-end; these are not new-issue ratings.

Exhibit V.3. Distribution of Ratings for Jointly Rated Securities

Not only are more securities rated triple-A than any other rating, but the agencies also tend to agree far more frequently on triple-A ratings than on any other rating. Even for the other ratings, however, one agency's rating is most likely to match another agency's rating rather than be higher or lower. Fitch and Moody's agreed 60.5 percent of the time (of which 24.6 percent were AAA ratings by both). Fitch was higher on 31.3 percent and Moody's was higher on 8.2 percent. Fitch and Standard

& Poor's agreed 82.2 percent of the time (41.4 percent were AAA by both), Fitch was higher on 4.3 percent, and Standard & Poor's was higher on 13.5 percent. Moody's and Standard & Poor's agreed 67.2 percent of the time (36.4 percent were AAA by both), Moody's was higher on 19.3 percent, and Standard & Poor's was higher on 13.5 percent.

There was more agreement on investment grade securities than on speculative grade securities. Fitch and Moody's agreed on 63.9 percent of the investment grade ratings but only 34.3 percent of the speculative grade ratings. On 5.2 percent of their joint ratings, Fitch rated investment grade and Moody's rated speculative grade versus 0.4 percent for the converse, the only variance of this magnitude observed. Fitch and Standard & Poor's agreed on 83.7 percent of the investment grade ratings but only 57.8 percent of the speculative grade ratings. Moody's and Standard & Poor's agreed on 68.5 percent of the investment grade ratings but only 38.8 percent of the speculative grade ratings.

When there was disagreement between Fitch and Moody's, the difference averaged 2.3 notches when Fitch was higher, 1.9 notches when Moody's was higher. When there was disagreement between Standard & Poor's and Fitch, the difference was 1.7 notches when Standard & Poor's rated higher, 1.8 notches when Fitch rated higher. When there was disagreement between Moody's and Standard & Poor's, the difference was 2.0 notches when Moody's rated higher, 1.8 notches when Standard & Poor's rated higher. On average, Fitch rated 0.6 notches higher than Moody's, Standard & Poor's rated 0.1 notch higher than Fitch, and Moody's rated 0.1 notch higher than Standard & Poor's. Differences are greater for speculative grade than for investment grade securities. The credit rating differentials between Fitch and the other two agencies have become smaller in recent years. At year-end 2001, on average Moody's rated lower than Fitch by 0.3 notches, Standard & Poor's rated lower than Fitch by 0.1 notches, and Moody's rated lower than Standard & Poor's by 0.1 notches.

C. Patterns of subsequent ratings changes for the same security with different ratings by different agencies ("split ratings")

This study attempts to provide empirical evidence about the factors that do and do not lead to differences in ratings. One source of information that can be useful in an agency's calibration of its own ratings vis-à-vis those of its competitors is the examination of split ratings. Differences in agencies' ratings may, at least in theory, be explained by methodological differences, "rating shopping," adverse selection of collateral, and other factors. It is worth noting that split ratings, particularly those awarded at issue, form the observable subset of the universe of the total distribution of ratings differences, with its complement consisting of differences which are unobserved due to factors such as rating shopping.

1. Prior Research

a. Cantor and Packer (1996)

A paper by Cantor and Packer examines the procedure the National Association of Insurance Commissioners ("NAIC") employs to classify the credit quality of securities with split ratings.[27] The NAIC's procedure provides a revealing point of entry into questions surrounding the information content of split ratings because – unlike many other regulators – the NAIC conducts independent analysis of split-rated securities, and assigns discretionary ratings based on its analysis. Other regulators tend to follow an explicit rule-based procedure, adopting either the highest or second highest rating in all cases where agency ratings diverge.

Cantor and Packer found that the NAIC's use of discretion leads to "a ranking of risks considerably different from that which would be produced by the split-rating rules employed by other regulators." Where Standard & Poor's and Moody's rating diverged, the NAIC agreed with the lower rating 73 percent of the time. The authors concluded that the NAIC usually assessed credit quality closer to the lower rating, consistent with the observed market practice: yields are closer to those implied by the lower of two ratings when there is a split.

b. CSFB

In its publication "Japan Credit Comment Weekly," CSFB surveyed the rating methodologies different agencies use when assessing the creditworthiness of CDOs.[28] CSFB discussed the binomial expansion technique Moody's uses, the Monte Carlo approach Standard & Poor's uses, and the "stress scenarios" approach favored by Fitch. CSFB observed that "Moody's has an established projected loss ratio for each rating level (known as an 'idealized expected loss') and this 'idealized' figure is not always consistent with the results of Moody's default study."[29] CSFB also emphasizes that, "There is also a major difference between Fitch and Moody's when it comes to applying 'rating factors' to arrive at an average rating for the underlying asset pool. Even in cases where there is an equivalent distribution of credit ratings within the asset pool, the method used by

[27] R. Cantor and F. Packer, "Discretion in Response to Split Ratings: The Case of NAIC," Journal of Insurance Regulation, Vol. 15, Winter 1996. Another paper by Cantor and Packer investigates differences in ratings assigned by the agencies. (R. Cantor and F. Packer, "Differences of Opinion and Selection Bias in the Credit Rating Industry," Journal of Banking and Finance, 21, 1997.) They used corporate bond data from the end of 1993. They hypothesized that split ratings could be attributed either to higher default risks associated with the particular letter grades of some agencies, i.e., rating scales differentials, or to sample selection bias induced by the rating agencies' policies of rating only on request. The results of the study suggest that observed differences in average ratings reflect differences in rating scales.

[28] CSFB, "Japan Credit Comment, Vol. 2001-47," December 17, 2001.

[29] *Ibid*., p. 10.

Fitch will tend to give a higher average rating for the pool."[30] CSFB concluded that, "When it comes to CDO credit ratings, it is difficult, in our opinion, to make generalizations regarding the degree of strictness applied by one credit rating agency or another. Indeed, a comparison of CDO ratings can really only be done on a case-by-case basis."[31]

2. *Data*

For this part of our analysis, we use the subset of split-rated securities and consider how credit ratings on the same securities differ across agencies. The results are presented in Exhibit V.4. The "Higher" series show the average number of notches higher that one agency rated when it rated higher than the other agency on jointly rated issues. Similarly, the "Lower" series show the average number of notches lower that one agency rated when it rated lower than the other agency on jointly rated deals. The "Net" series shows the average number of notches difference that one agency rated over *all* jointly rated issues.

Exhibit V.4. Rating Notch Differences, Jointly Rated Bonds

The analysis shows that the average credit rating differentials across credit rating agencies are now relatively small as a result of a converging trend. While the data subset including investment-grade issues point to a similar result, the differences across credit rating agencies are somewhat more pronounced for non-investment grade securities.[32]

The same data can be presented somewhat differently by focusing on the frequency of disagreement between the credit rating agencies (i.e., leaving out the size of the credit rating differences whenever those exist). See Exhibit V.5.

Exhibit V.5. Percentage of Ratings Higher, Lower, and Identical Relative to One or More Other Agencies

In the mid-1990s, Fitch's ratings tended to be higher than Moody's for investment grade and lower for speculative grade. The range of agreement between Moody's and Standard & Poor's increased in recent years.

[30] *Ibid*., p. 11.

[31] *Ibid*., p. 12.

[32] It should be noted that the data for non-investment grade securities rated by Fitch in the early 1990s are especially sparse.

We next test for ratings differences over time. For jointly rated issues, we measured the differences between agencies in notches at the time of issue and then at successive year-ends. Results are presented in Exhibit V.6.

Exhibit V.6. Dispersion of Ratings Differences on Jointly Rated Securities

There appears to be a trend in credit ratings differences for multi-rated securities. The magnitude of ratings differences increases with the time elapsed since issue.[33] This could be an indication that ratings are not independent; the process of assigning a new rating may cause ratings to be more similar than they otherwise would be, because of a common base of information that is lacking in the after-market or pressures by issuers to conform. Other possible explanations could be differences in monitoring policy (considered in the next part of the report) or ratings criteria.

Fitch's ratings go from 0.3 notches higher than Moody's at issuance to about 1 notch higher than Moody's overall after five years (largely the result of RMBS ratings), with a standard deviation of about 1.5 notches; for speculative grade issues after five years, Fitch's ratings were nearly 3 notches higher, with a standard deviation of almost 2 notches. There was no difference on average between Fitch and Standard & Poor's at issuance or after five years, although the standard deviation grew to more than 2 notches for speculative grade issues. Moody's ratings matched Standard & Poor's overall (with a standard deviation of about 1 notch after five years), and for speculative grade Moody's ratings go from no difference at issue to about 1 notch lower than Standard & Poor's (standard deviation of about 2 notches) after five years. The large standard deviations indicate a substantial difference of opinion on individual transactions apart from any directional bias.

D. Distribution of credit ratings by degree of subordination

Structured product transactions typically contain two or more tranches within a seniority hierarchy. While an agency asked to rate one tranche (or group of tranches with the same seniority and rating) typically rates all of the rated tranches, this is not universally the case. In many instances, two or more agencies are asked to rate different groups of tranches in a transaction. As with the decision to seek a rating generally, the decision to seek different raters for different tranches may be driven by cost, specialization, investor demand, or issuer selection.

Rating agencies may develop expertise in certain categories, leading to higher participation shares. Investors in the most senior tranches of structured product transactions tend to be drawn from a different group than the investors in subordinated tranches. These investor groups may have different preferences among rating agencies, leading to observed differences in which agencies rate

[33] For an alternative view, see Fitch Ratings. "Structured Finance Ratings: Similar at Issuance and Over Time." 7 June 2002.

which types of tranches. Also, issue sponsors have the option to decline a rating. They will do so if the rating is substantially lower than that of one or two other agencies, a process known as "ratings shopping."[34]

Exhibit V.7 shows the number of ratings assigned by credit rating agencies to tranches of different seniority for the subset of deals rated jointly by at least two credit rating agencies. These data allow for comparison of different agencies' propensity to rate senior or junior tranches.

Exhibit V.7. Number of Ratings Assigned by Credit Rating Agencies for Jointly Rated Securities by Tranche Seniority

For transactions on which Fitch and at least one other agency each rated at least one tranche, Fitch was more likely to be the sole agency to rate the most subordinated tranche while the other agency was more likely to be the sole agency to rate the most senior tranche. For transactions rated by Moody's and Standard & Poor's, Moody's was more likely to be the sole agency rating the most senior or the most subordinated tranche. (We also reviewed the data for each product individually and found that this pattern held across all sectors.)

E. Similarities and differences in frequency of ratings changes for single- and multi-rated securities

We previously considered the frequency of ratings changes by agency and found no systematic difference by agency, although macroeconomic factors seemed to play an important role. In Exhibit V.8 we calculate differences in the frequency of ratings changes for different agencies on the same transaction.

Exhibit V.8. Rating Changes per Rating

In recent years, there do not appear to be meaningful differences in the frequency of rating changes between agencies when both rate the same transaction.

We next consider securities rated by only one agency, in comparison with securities carrying two or more ratings. Exhibit V.9 summarizes our findings in comparing the rating monitoring practices of the different credit rating agencies with respect to single- and multi-rated transactions.

Exhibit V.9. Rating Changes per Rating, Four-Quarter Moving Average, Bonds Rated by Fitch Only, Standard & Poor's Only, Moody's Only, and by Two or More Agencies

[34] See Peretyatkin, Vladislav and William Perraudin. "Expected Loss and Probability of Default Approaches to Rating Collateralised Debt Obligations and the Scope for 'Ratings Shopping.'" 10 January 2002.

A pattern does exist for single-rated securities. The frequency of ratings changes for Moody's consistently exceeded that of Fitch and Standard & Poor's for most of the 1990s. At the end of the decade, however, Fitch seems to have increased substantially the frequency of its rating changes. This pattern appears also to be present for the CMBS, RMBS and ABS sub-sectors. As previously noted, a greater frequency of rating changes could represent closer monitoring practices, variation in the mix of securities rated, or a need to correct prior ratings.

VI. Performance Differences Among Agencies

As will be seen below, observed performance differences among the agencies are generally smaller than the rating differences observed on jointly rated issues. While the rating differences are based on a direct comparison (jointly rated transactions), the performance differences are based on statistical inference and are subject to assumptions that cannot be conclusively tested (such as the assumed absence of differences between single-rated and jointly-rated issues). Hence, there may not be a high degree of confidence associated with conclusion based on performance differences. It is not possible to rule out, with a high degree of confidence, that performance differences equivalent to the ratings differences do exist.

A. Stability and Consistency of Each Agency's Ratings

A rating change may be indicative of one or a combination of the following factors: (a) a change in credit quality, (b) a change in monitoring policy, or (c) a change in ratings criteria.

Credit ratings stability, defined as the stability of credit rating transition matrices over different time periods, can be indicative of, among others, low sensitivity of credit products to macroeconomic factors, as well as of a high level of accuracy in the rating methods and techniques employed.

At the same time, the credit ratings stability observed through a credit rating agency's actions may deviate from the actual credit picture. This result can be a product of a particular agency's monitoring policies (e.g., infrequent monitoring) and/or lack of incentives to update ratings in response to perceived changes in credit quality.

Another goal of credit rating agencies is the consistency of their ratings across product categories. Put simply, it is desirable that, given the application of consistent rating methodologies, the interpretation of a given credit rating be the same regardless of the specific asset class and features of the rated product.

B. Stability of an Agency's Credit Ratings Over Time

1. Published Transition Matrices

Each of the agencies periodically compiles and publishes historical transitions for its structured product ratings. Some of these reports relating to the period and products covered by our study are summarized below.

a. Fitch

"Structured Finance Rating Transition Study" (May 8, 2002). Fitch's study examines and presents data on credit rating transitions for ABS, RMBS, and CMBS, over the 1991-2001 time period.

"CDO Transition Study and First-Half 2002 Review"(August 23, 2002). Fitch's study examines and presents data on credit rating transitions for arbitrage cash flow and balance sheet CDO issues over the 1995-2001 time period.

b. Moody's

Global Credit Research – "How and Why Do Structured Finance Ratings Change? Rating Transition Study for Single-Family Residential Mortgage Pass-Through Securities" (May 12, 1995). Moody's report focuses on residential mortgage pass-throughs, and includes both one-year and multi-year transition matrices.

Structured Finance – "Credit Migration of CDO Notes, 1996-2001"(February 27, 2002). The study presents a series of one-year transition matrices for arbitrage cash flows, CBOs, CLOs, emerging market CDOs, and balance sheet CDOs. Some matrices are presented on a dollar-weighted basis. The report also presents transition matrices for issues of different vintages.

"Structured Finance Rating Transitions: 1983-2002" (January 2, 2003). Moody's report presents a rating transition study for all structured finance securities over the period from 1983 to 2002. It presents one- and multi-year transition matrices for structured finance ratings and – separately – corporate finance ratings, both adjusted to account for withdrawn ratings.

c. Standard & Poor's

"Rating Transitions 2001: U.S. ABS Credit Ratings Endure the Test of Recession" (January 14, 2002). Standard & Poor's report discusses issues involving ABS. It reviews issues, credit rating actions, and provides single- and multi-year transition matrices for the period following 1985.

"Rating Transitions 2001: RMBS Ratings Show Continued Resiliency" (January 15, 2002). Standard & Poor's report discusses issues involving RMBS. It reviews issues, credit rating actions, and provides single- and multi-year transition matrices for the period following 1978.

"Rating Transitions 2001: CMBS Continues to Show Strong Credit Performance" (January 29, 2002). Standard & Poor's report discusses issues involving CMBS. It reviews issues, credit rating actions, and provides single- and multi-year transition matrices.

"Rating Transitions 2002: Global CDO and Credit Default Swap Rating Performance." (13 March 2003). This is Standard & Poor's compilation of performance for rated CDOs.

2. Transition Matrices

To the extent that our analysis is based on transition matrices derived from both single- and multi-rated deals, it relies on the credit rating agencies' consistent treatment of single- and multi-rated deals. In other words, we rely on the credit rating agencies' policies and the discipline imposed on them by the marketplace to ensure that that the observed credit rating transition matrices are not materially affected by the potential lack of proper or sufficient incentives for the agencies to adjust appropriately and in a timely fashion the credit ratings of single-rated deals.

We calculate one-year credit transition matrices on the basis of observed transitions between the beginning and the end of each calendar year for which data are available.[35] The weighted average one-year matrices are then calculated over all the credit transitions observed during the entire time period for which data are available.[36] The results of these calculations are presented in Exhibit VI.1.

Exhibit VI.1. One-Year Transition Matrix

The shaded diagonal indicates the share of unchanged ratings. Downgrades are to the upper right of the diagonal, and upgrades to the lower left.

3. Prior Research

A number of industry[37] and academic[38] research studies have documented the fact that ratings transition matrices vary along a number of dimensions. Chief among those are the choice and length of the time period over which the transition process is estimated, the stage of the business cycle, the industry of the obligor and the length of time elapsed since the security issuance.

a. Nomura

Nomura Fixed Income Research's study examines ABS credit migrations due to adverse credit events over the period from 1990 through mid-2001[39] (the authors exclude from their analyses

[35] Securities receiving their first rating during a year are not included in the analysis until the following full calendar year. This is consistent with industry practice.

[36] The weights used in the calculation of the weighted average one-year matrices are the ratios of the number of all observed transitions between credit rating *i* and credit rating *j* and the total number of securities rated *i* at the beginning of each period.

[37] L.V. Carty, "Moody's Rating Migration and Credit Quality Correlation, 1920-1996," Special Comment, Moody's Investors Service, 1997; Standard and Poor's, "Ratings Performance 1997 - Stability and Transition," Research Report, 1998.

[38] E. I. Altman and D. L. Kao, "The Implication of Corporate Bond Ratings Drift," *Financial Analysts Journal*, 1992, pp. 64-75.

[39] Nomura Fixed Income Research, "ABS Credit Migrations," March 5, 2002.

CBOs, CLOs, CMBS, and RMBS). Nomura presents a typology of adverse events using the following classification scheme:

- A deal is said to experience a "default" if any tranche that initially carried an investment grade rating defaulted on a payment or was downgraded to default status.

- A deal is said to experience a "near default" if a tranche that was investment grade at issuance fell to Caa/CCC or worse – but did not otherwise qualify for default.

- A deal is said to experience a "major downgrade" if a tranche is downgraded from Aaa/AAA or downgraded from investment to speculative grade – and does not otherwise qualify for the default or near default categories.

- All other downgrades are considered "minor downgrades."

The study finds that (i) deals rated by both Moody's and Standard & Poor's experience lower frequencies of adverse credit events than deals that lacked ratings from either, (ii) deals rated by Moody's and S&P only experienced the lowest frequencies of adverse credit events, and (iii) for deals rated by only one rating agency, Fitch-rated deals had the lowest frequency of downgrades and Moody's-rated deals had the lowest frequency of defaults and near defaults. Additionally, the study finds that Fitch's performance is substantially better when the deals originally rated by Duff & Phelps are excluded.[40] The study assumes that the agencies' ratings scales are equivalent, and reports that there are "few instances of split ratings" in structured products and no academic studies on the sector.[41]

The authors also make interesting observations concerning the stability of rating practices. Citing "market participants," the report suggests that the rating agencies were too conservative in their early structured finance rating efforts, inasmuch as performance was superior to comparably rated corporate bonds. In response, rating agency standards for structured financings may have "drifted over time in response to a perceived excess of caution during the early stages of the market.[42]

[40] *Ibid*., p. 12.

[41] *Ibid*., p. 17.

[42] *Ibid*.

b. Cantor and Falkenstein (September 2001)

A paper by Cantor and Falkenstein examines whether Moody's corporate bond credit ratings are consistent over time and across sectors, and investigates the reliability of historical default rates as estimates of underlying default probabilities associated with Moody's ratings.[43]

Cantor and Falkenstein note that the statistical significance of differences in average default rates is commonly measured under the assumption that these rates are drawn from independent, binomially distributed sample populations. However, Cantor and Falkenstein observe that unpredictable macroeconomic and sector-specific developments drive large and persistent fluctuations in default rates – and that the presence of such "shocks" invalidates the standard significance tests. They argue that observed fluctuations in default rates are largely the result of changes in economic conditions, and that such fluctuations cannot be considered unusual draws from independent, binomially distributed populations.[44] In their case studies, Cantor and Falkenstein's test suggests that substantial differences in observed default rates need not be associated with statistically significant differences in underlying probabilities of default.

c. Deutsche Bank – "ABS and CDO Survey: A survey of rating changes in the year 2001" (January 22, 2002)

Deutsche Bank's survey takes a look at ABS and CDO ratings changes, and provides detailed review of ratings transitions, including a classification of agency rationales for ratings changes. This release lists ratings transitions by sector – or by structured product type – for the different agencies.

4. Statistical Tests

We perform a number of statistical tests in order to determine the stability of one-year credit transition matrices over time. In this report, we rely extensively on a χ^2 (chi-squared) test of statistical significance for the purpose of testing the differences between credit transition matrices. In this instance, we adjust the standard setup for such statistical tests to accommodate for the singularity of the row covariance matrices Φ_i. As a result, the tests are carried out using the generalized inverse $\Phi_{i(g)}$, so that the test statistic becomes

$$n(\hat{p}_i - p_i)' \pi_i \Phi_{i(g)} (\hat{p}_i - p_i) \xrightarrow{d} \chi^2_{rank(\Phi_i)}, \text{ where}$$

n is the number of credit transition observations,

[43] R. Cantor and E. Falkenstein, "Testing for Rating Consistency in Annual Default Rates," *Journal of Fixed Income*, September 2001. Cantor is employed at Moody's.

[44] *Ibid*., pp. 37-8.

p_i is the vector of conditional probabilities of ratings at the end of the period conditional on a security being rated i as of the beginning of the period, and

$$\pi_i = \lim_{n \longrightarrow \infty} \frac{n_i}{n},$$

where n_i are the number of securities rated i at the beginning of the period.

The model from which these tests are derived assumes that, conditionally on being rated i at the beginning of the period, the probability of migrating to another rating at the end of the period is given by the multinomial distribution. The distribution of the test employed above simply relies on the limiting distribution of such probability estimates properly normalized.

In an attempt to correct for the effects of macroeconomic factors on the result of the analysis, we perform additional tests based on longer (five-year) time horizons. The results of these statistical tests are presented in the following exhibits.

Exhibit VI.2. Statistical Test of Differences between Each One-Year Transition Matrix and Weighted Average of One-Year Transition Matrices

Exhibit VI.3. Statistical Test of Differences between Each Five-Year Transition Matrix and One-Year Transition Matrix Raised to the Fifth Power

Exhibit VI.4. Statistical Test of Differences between Each Five-Year Transition Matrix and Five-Year Weighted Average of One-Year Transition Matrices

Exhibit VI.5. Statistical Test of Differences between Pairs of Non-Overlapping Five-Year Transition Matrices

The results of these statistical tests indicate that the transitions of credit ratings assigned by all three major credit rating agencies are non-stationary over time. It does not appear that this result is attributable to the effects of macroeconomic forces and business cycles. Our findings of non-stationarity in credit rating agencies' transition matrices is consistent with prior evidence.

We should also point out that because of the large data-set employed in this analysis we have very "efficient" estimators, i.e., our estimates have extremely small standard errors.[45]

[45] This is also attributable to the fact that this study does not model correlations between credit transitions (e.g., over time, over the business cycle, within industry groups).

In the modeling of the rating process we assume that the rating actions of the credit rating agencies are independent. To the extent that these assumptions do not hold exactly, or nearly so, the cogency with which we can press our results is correspondingly diminished. However, we think that in the main these assumptions correspond rather well with the workings of this market and the rating process.

In other words, because the sample is very large and the null hypothesis is that the two transition matrices are identical, any observed difference, even if quite small, is magnified by the sample size and may well yield statistical significance. To the extent that differences may not be of economic relevance, even if rejecting statistically the proposition that two matrices are identical, such tests may not imply appreciable or systematic differences.

Consequently, small differences are noted as "statistically" significant. The reader may exercise his judgment as to the materiality of the observed differences from the point of view of the economic marketplace. These findings are likely the result of random events affecting individual securities rather than a systematic change in ratings criteria or monitoring policy. There is no pattern with respect to ratings direction in the transition matrix differences.

C. Consistency of an agency's credit ratings across product lines

As discussed earlier in this section, it is desirable that the interpretation of a given credit rating be the same regardless of the specific asset class and features of the rated product. We perform a number of statistical tests in order to determine the consistency of weighted-average one-year credit transition matrices across major product categories, e.g., ABS, RMBS, CMBS and CDO. The results of these statistical tests are presented in Exhibit VI.6.

Exhibit VI.6. Statistical Test of Differences in One-Year Transition Matrices between Pairs of Products

The results of our statistical analysis point to statistically significant differences between transition matrices across different product lines. This observation is particularly true for the time periods after 1993, for which more data points are available.

Statistical testing of consistency for transition matrices across product categories is, by necessity, a joint-hypothesis test, whose outcome depends not only on the consistency of credit rating methodologies applied to the different product categories, but on a variety of additional factors as well. For example, the macroeconomic environment may affect products differently, and there may have been sector-specific events that affected performance. Therefore, the interpretation of these statistical tests should be adjusted accordingly.

D. Similarities and differences in subsequent ratings changes for the same rating by different agencies

1. Theory

In this section we approach the central question of whether there are significant differences among the agencies' rating scales. To answer this question, we measure differences between one agency's transition matrix and that of another agency. We are interested in determining whether these transition matrices are the same or different, and if they are different whether there is a significant and economically relevant systematic difference.

Because there are stated differences in the credit rating agencies' respective methods for assigning credit ratings, there may well be differences among the credit rating agencies' rating scales. The existence of such differences poses challenges for both investors and the credit rating agencies themselves. On the one hand, investors prefer to have the ability to compare credit ratings across credit rating agencies, and to do so at a relatively low cost. On the other hand, credit rating agencies face the task of benchmarking their actions against those of their direct competitors, including assigning ratings to structured transactions containing securities they have not rated.

2. Differences in transition matrices

Exhibit VI.7 shows the differences in weighted-average one-year transition matrices between paired credit rating agencies. The values in the cells are calculated by subtracting the values in one agency's transition matrix (Exhibit VI.1) from the corresponding values in the other agency's matrix. The analysis is also replicated to the ABS, RMBS, CMBS and CDO product sectors.

Exhibit VI.7. Differences in Ratings Transition Rates

The magnitude of the values in the matrix suggests that there are differences between agencies. This could be due to any or all of the following factors: performance differences among securities, as the tables present data on all ratings, not just joint ratings; differences in monitoring policy; or differences in ratings method. At the same time, the existence of positive and negative values on both sides of the main diagonal suggests no apparent systematic difference. To make any such differentials more apparent, we present the differences in upgrade/downgrade probabilities between paired credit rating agencies in Exhibit VI.8. The analysis is also replicated to the ABS, RMBS, CMBS and CDO product sectors.

Exhibit VI.8. Average Probability of Transitions

Overall, all three agencies have changed 6-8 percent of their ratings each year. More than 15 percent of the following sectors were downgraded per year: Fitch and Moody's ratings for speculative grade

ABS, and Moody's ratings for speculative grade CDOs. Standard & Poor's changed fewer ratings than the other two agencies, except in speculative grade CMBS and RMBS.

3. Statistical tests of differences in transition matrices

We perform a number of statistical tests in order to determine whether or not the differences observed across the credit rating agencies' transition matrices are statistically significant. The results of these statistical tests are presented in Exhibit VI.9.

Exhibit VI.9. Agency Rating Transition Matrix Comparison

As we found when comparing each agency's transition matrix across products or over time, there are statistically significant differences between the agencies' transition matrices overall and for each product, for most time periods analyzed. We repeat the caution that the existence of differences does not imply the existence of bias.

The foregoing analyses fail to support the hypothesis that the transition probabilities implied by one agency's rating scale are systematically higher or lower than the probabilities implied by another agency's rating scale. At the same time, the wide range of performance means that one cannot rule out the possibility that such differences do exist.

E. Similarities and differences in subsequent ratings changes for single- and multi-rated securities

1. Theory

There are a number of factors that may result in differences in credit rating transitions between single- and multi-rated issues. For example, it has been posited that, without the discipline imposed by a second (and/or third) credit rating, a credit rating agency may deviate in a systematic way from its "normal" rating methods, particularly in market sectors where it occupies a dominant position.

It is worth pointing out, however, that differences in ratings changes between single- and multi-rated securities can also indicate differences in relative accuracy of prior rating (if the frequency of changes is different) and relative bias of prior rating (if frequency of upgrades or of downgrades is different) as well as a differing product mix.

2. Differences in transition matrices

Exhibit VI.10 shows the differences in weighted-average one-year transition matrices between single- and multi-rated securities for each of the three credit rating agencies. In each instance, we compare the agency's single-rated issues with other issues rated by that agency and at least one other agency. The analysis is replicated to the ABS, RMBS, CMBS and CDO product sectors.7

Exhibit VI.10. Differences in Transition Matrices between Single- and Multi-Rated Securities

Differences for AAA-rated issues are very small. Also, differences are smaller for the middle ("2") notch than for the higher ("1") and lower ("3") notches within each category. That may be due to the preponderance of middle-notch ratings at issue (see Exhibit VI.1) and the tendency toward dispersion over time (see Exhibit V.6).

Similarly, we present the differences in the probabilities of upgrade/downgrade moves between single- and multi-rated securities for each of the three credit rating agencies. The analysis is also replicated within the ABS, RMBS, CMBS and CDO product sectors. Exhibit VI.11 weights each observation (one security at one year-end) equally. While this methodology permits the usual statistical tests to be applied, the results may be biased if one agency rated more highly rated transactions with fewer subsequent rating changes than another agency. Exhibit VI.12 corrects for this possible bias by giving equal weight to each rating and year-end combination, regardless of how many observations were combined.

Exhibit VI.11. Average Probability of Transition, Weighted by Population

We again use the chi-squared test to determine whether the differences in probabilities were statistically significant. The differences in probabilities are generally highly statistically significant.

Exhibit VI.12. Average Probability of Transition, Each Rating Equally Weighted

The numbers in Exhibit VI.11 are substantially different from the corresponding values in Exhibit VI.12. This shows that there are substantial differences in the ratings mix. Accordingly, we focus on the latter exhibit.

Column 11 of the exhibit is a measure of the relative volatility of each agency's single ratings in comparison with ratings where that agency and one or two others also participated. Column 13 shows the difference for downgrades alone. Fitch and Moody's speculative grade ABS ratings had at least 10 percentage points more downgrades on their single-rated deals than on their multi-rated deals. Fitch and Standard & Poor's speculative grade RMBS ratings had at least 10 percentage points fewer downgrades on their single-rated deals than on their multi-rated deals.

Next we consider the differences in the sizes of upgrade/downgrade moves between single- and multi-rated securities for each of the three credit rating agencies. Exhibit VI.13 shows the average number of notches moved for securities with ratings changes. The analysis is also replicated within the ABS, RMBS, CMBS and CDO product sectors.

Exhibit VI.13. Average Number of Notches Moved per Year for Securities with Ratings Changes

In most categories, Fitch's and Moody's notches per downgrade are larger for single-rated issues than for multi-rated issues. Standard & Poor's notches per downgrade are smaller for its single-rated issues than for its multi-rated issues.

Exhibit VI.14 presents the same data relative to all rated securities, not just those for which ratings were changed, giving equal weight to each observation. Exhibit VI.15 gives equal weight to each rating. Although the general pattern of results is the same as in Exhibit VI.13, it demonstrates that the differences among agencies are relatively small in terms of the probability of downgrade.

Exhibit VI.14. Average Number of Notches Moved per Year as a Percentage of All Rated Securities, Weighted by Population

Exhibit VI.15. Average Number of Notches Moved per Year as a Percentage of All Rated Securities, Each Rating Equally Weighted

Exhibit VI.16 presents the results of the statistical tests with respect to the variance in the probabilities of upgrade/downgrade moves between single- and multi-rated securities for each of the three credit rating agencies.

Exhibit VI.16. Difference in the Differences in the Probability of Upgrades versus Downgrades, Weighted by Population

Positive values in this table indicate a higher probability of an upgrade versus a downgrade for single-rated deals than for multi-rated deals. Fitch is significantly more likely to report upgrades on single-rated RMBS and downgrades on single-rated ABS than for multi-rated RMBS and ABS, respectively. Moody's is significantly more likely to report downgrades on single-rated RMBS and speculative grade ABS, and upgrades on investment grade CMBS, than for the corresponding multi-rated deals. Standard & Poor's is significantly more likely to report downgrades on single-rated investment grade CMBS and upgrades on single-rated speculative grade RMBS, than for multi-rated CMBS and RMBS, respectively.

The following exhibits present the results of the statistical tests with respect to the differences in each agency's credit rating transition matrices with respect to single- and multi-rated securities.

Exhibit VI.17. Comparison of Rating Transition Matrices by Agency Combination

Exhibit VI.18. Statistical Test of Differences in Transition Matrices by Agency Combination, by Year and Rating

All of the agencies show statistically significant differences overall between their single-rated and multi-rated transition matrices. Fitch's matrices for each year beginning in 1998 are significant, as are Moody's for 1994-96 and Standard & Poor's for 1994, 1997, and 2000.

VII. Inferred Ratings

A. Background: "Notching"

The structured products marketplace poses a number of yet unresolved issues to each credit rating agency. Assuming the possibility of differences in the meaning of ratings and "selection" bias (both with respect to the choice of rating agency asked to rate specific collateral ["rating shopping"] and CDO issuer ["collateral shopping"]) on pools of single-rated collateral to be purchased by CDOs and other securities arbitrage programs, how should agencies evaluate securities they have not rated? This study is the first one to attempt to propose well-defined questions and to provide answers to those questions based on the unique dataset provided to us.

B. Prior research

Moody's (and possibly other agencies) have analyzed their undisclosed ratings relative to the public ratings of other agencies on a given transaction. The scope and the reported results of these studies are, by necessity, somewhat limited. They suffer from data limitations (e.g., incomplete and non-contemporaneous data) and the impossibility of independent verification of rating decisions. As a result, the reported results of these internal studies should be evaluated in light of the results from the present study.

Moody's releases on ratings of non-Moody's rated securities include a study of CMBS transactions Moody's did not rate in 2001.[46] Moody's compares the ratings produced by Fitch and/or Standard & Poor's with Moody's own shadow ratings for 24 transactions. Moody's says its rating would have been lower than the other agencies' 84 percent of the time. This outcome could be the result of any or all of a number of causes: bias in the collateral selected by the sponsors, differences in ratings criteria among the agencies, differences in monitoring practices, or an "unrepresentative" sample of securities. The results of this study "do not necessarily imply that Moody's has more stringent standards in general than its competitors."

[46] Moody's Investors Service. "Moody's Studies Ratings of Non-Moody's-Rated CMBS and Revises Notching Practices." 25 January 2002.

Another Moody's report says that the Moody's ratings estimates on 17 CDO tranches, which the agency had not rate) were "on average 5 notches lower than the other agencies' ratings."[47] The methodology and results of this study were subsequently challenged by Fitch.

Fitch noted that the Moody's report fails to adjust for the passage of time, and account for the subsequent narrowing of the credit ratings gaps as a result of the adjustments in the other agencies' ratings. In Fitch's view, Moody's uses "the unique deterioration in some CDO products in 2001 to suggest that all structured finance ratings from the 'other' agencies are suspect for inclusion in resecuritization" while ignoring the fact that during the period "15 [Moody's] tranches were downgraded by an average of six notches within 18 months of Moody's original rating assignment."[48]

C. Range of differences in ratings

Assume that a portfolio of structured securities has been rated by a combination of credit rating agencies (collectively, "agency *A*"), and that those credit ratings have been made publicly available. Based on this information alone, what rating (or range of ratings) would an alternative credit rating agency ("agency *B*"), which has not been asked by the issuer to rate the transaction, likely assign to the same security?

We previously addressed this question by comparing jointly rated transactions (sections V. B and V. C). We found that differences in ratings did exist, particularly for lower rated issues. From that information on jointly rated issues, inferences can be drawn about ratings differences for single-rated issues. In this section, we do not compare ratings directly. Rather, we look at ratings transitions and infer similarity in ratings from similarity in transitions.

We approach the current question in two ways: (i) the adjustments to *A*'s ratings to achieve the closest match to *B*'s ratings transitions, and (ii) the hypothetical shift in *A*'s ratings that ensures they do not overstate credit quality (downgrades according to *B*) with a given probability.

[47] Moody's Investors Service. "Moody's Studies Ratings of Non-Moody's-Rated CDOs and Confirms Rating Estimate Approach." 22 March 2002. Moody's also analyzed RMBS (See Moody's Investors Service. "Moody's Study of Non-Moody's-Rated RMBS." 18 April 2002).

[48] Fitch Ratings, "Should Moody's Notch its Own Ratings?" 13 June 2002.

1. Aligning the agencies' rating scales

The following analytical approach provides a framework for the determination of the appropriate adjustments a credit rating agency, acting as a rational economic agent, would make to the credit ratings assigned by another credit rating agency.

Let M be the number of discrete credit ratings available. Let V_A be a vector of length M of credit ratings assigned to a portfolio of N securities by a credit rating agency *A*. Let also T_A and T_B be the K-period credit rating transition matrices (estimated using historical data) of the credit rating agencies *A* and *B*, respectively.

We postulate that in choosing the optimal V_B^*, credit rating agency *B* would seek to assign ratings to the N portfolio securities in a manner that minimizes, under some appropriate measure,[49] the deviation between agency *A*'s and agency *B*'s expected portfolio credit rating distributions after a period of length K-period.[50]

In other words, credit rating agency *B* chooses the optimal vector V_B^* such that $V_B^* = \underset{V_B}{Min}\left\|V_A * T_A - V_B * T_B\right\| \ni v_{B,i} \geq 0\ \forall i = \overline{1, M}$.

The "average" notch adjustment needed to be made by agency *B* is calculated as $\Delta = \sum_{j-1}^{M} j * (v_{A,j} - v_{B^*,j})$.

We then use Monte Carlo techniques in order to simulate the dispersion of credit ratings around the expected ratings distribution, i.e., the outcome vector $V_B^* * T_B$, and infer back a confidence interval around the vector V_B^*.

The following exhibit presents our estimates of the adjustments to their competitors' ratings that the credit rating agencies need to make in order to achieve the closest match across their respective rating scales.

Exhibit VII.1. Differentials to Equilibrate Single-Rated Securities to Another Agency's Ratings

[49] This study defines the distance between two vectors as $\left\|X - Y\right\| = \sum_{j-1}^{M}\left|x_j - y_j\right|$.

[50] The precise choice of the length of the time period K depends on the particular objective function of each credit rating agency or other economic agents performing the analysis.

In the aggregate, the rating performance of each agency's single-rated issues essentially matches the aggregate performance of the other two agencies' deals carrying the same rating. Differentials are nearly always less than one-quarter notch, approaching one-half notch only for longer time periods.

Over longer time periods, differentials were larger. While no differentials exceeded one notch for a one-year horizon, for two- and three-year horizons, differentials exceeding one notch were seen in Fitch-rated and Moody's-rated speculative grade ABS relative to Standard & Poor's (and vice versa), and Moody's-rated speculative grade CDOs relative to Fitch and Standard & Poor's. At four years and five years, differentials exceeded one notch for various combinations of agencies in all four sectors.

The lack of consistency across sectors and over time suggests that the results may not be stable, and would therefore be unreliable indicators of future ratings transitions. Consequently, any rating inferences drawn from them should be done cautiously.

2. Number of securities rated higher/lower at a given confidence level

Historical data provide an indication as to both the expected value and the standard deviation of the differential between the credit ratings assigned by different combinations of credit rating agencies. Therefore, a decision on how to interpret another agency's rating need not be based solely on the optimal adjustment algorithm discussed in the preceding subsection. Alternatively, one could choose a policy designed to ensure a minimum performance standard at a certain confidence level. Exhibit VII.2 shows how one agency could interpret ratings provided by other agencies to achieve a given probability that securities it has not rated will perform no worse than would be expected for a particular rating. (As before, "no worse" means no higher probability of downgrades.)

Continuing the example from the preceding subsection, assume that agency *B* wants to know the adjustments for both the closest match (equal chance of transitions on the securities rated by *A* being better or worse than expected transitions on securities rated by *B*) and a "worst case" (99% probability that transitions on securities rated by *A* are no worse than the expected transitions on securities rated by *B*). The information in this exhibit tells agency *B* how many notches to assume for a given degree of confidence. The ratings for agency *A* are shown in the left hand column; the corresponding ratings for agency *B* are shown across the top of each matrix. The numbers in the cells show the probability that agency *B* would rate at least as high as a particular *B* rating for any given rating by agency *A*.

Exhibit VII.2. Probability of Different Ratings for Securities Not Rated by an Agency

The exhibit gives the probability associated with each combination of ratings by pairs of agencies. The combinations associated with 90, 95, and 99 percent probability are highlighted.

In general, high probabilities are achieved with smaller adjustments for investment grade issues than for speculative grade issues. Also, smaller adjustments are required to reach a given confidence level for issues with a “2” modifier than for either “1” or “3.” Securities rated by both of the other two agencies typically require fewer notches to reach a given probability than for single-rated securities. Looking at specific sectors, smaller adjustments are required for RMBS and CMBS than for the ABS and CDO sectors.

VIII. Afterword

To our knowledge, this is the first study to have collected and analyzed data on structured products provided by all three rating agencies. Although our work is complete, we hope and expect that further analysis and interpretation will be forthcoming. The rating agencies, issuers, investors, and analysts will bring to bear their different perspectives, and the market will be better informed as a result.

Ratings changes for structured products were sharply higher in 2002 as compared with the period covered by our study. The addition of data for that year alone would increase not only the aggregate amount of information but also the experience during a downturn.

Further work in this area might also involve developing measures of performance other than ratings changes. Although the task would be large, examination of the performance of the ultimate collateral (e.g., debt service ratios, valuation changes, defaults) would be useful to market participants.

As the market gains more experience with non-dollar issues, the expansion of this study to the international sector will become possible. Similarly, new product types can be included as data become available.

IX. Bibliography

Adler, Tamara, Richard Watson and Fabrice Susini. "Re: The New Basel Capital Accord - Securitisation Aspects of the Internal Ratings Based Approach (IRB) and Appropriate Capital Risk Weightings for Securitisation." European Securitisation Forum, 31 May 2001.

________. "Re: The New Basel Capital Accord - Asset Securitisation Aspects of the Standardised Approach." European Securitisation Forum, 25 May 2001.

Altman, E. I. and D. L. Kao. "The implication of corporate bond ratings drift." Financial Analysts Journal (1992): 64-75.

Banc One Capital Markets, Inc. "ABS Market Update." 19 February 2002.

Basawa, I.V. and B.L.S. Prakasa Rao, "Statisitcal Inference for Stochastic Processes." (1980) New York: Academic Press.

Billingsley, Patrick, "Statistical Methods in Markov Chains." The Annals of Mathematical Statistics (1961), vol. 32, 12-40.

The Bond Market Association. Oztan, Omer and Godfried De Vidts. Untitled Commentary on the New Basel Capital Accord. 30 May 2001.

The Bond Market Administration. Research Quarterly. February 2002.

The Bond Market Association. "The Bond Market Association Issues Statement on CDO "Notching"; Announces Plans to Conduct Roundtable on Issue in Early 2002." 19 December 2001.

Cantor, Richard and Eric Falkenstein. "Testing for Rating Consistency in Annual Default Rates." Journal of Fixed Income (September 2001): 36-51.

Cantor, Richard and Frank Packer. "Discretion in Response to Split Ratings: The Case of NAIC." Journal of Insurance Regulation (15, Winter 1996): 235-255.

________. "Differences of opinion and selection bias in the credit rating industry." Journal of Banking and Finance (21, 1997): 1395-1417.

CMAlert. "Commercial Mortgage Alert." 15 March 2002.

Credit Suisse First Boston. "CSFB CDO Ratings Watch: January." 7 February 2002.

Credit Suisse First Boston. "Japan Credit Comment, Vol. 2001-47." 17 December 2001.

Deutsche Bank. "ABS and CDO Survey: A survey of rating changes in the year 2001." 17 January 2002.

Ederington, L., J. Yawitz and B. Roberts. "The informational content of bond ratings." Journal of Financial Research (1987): 211-26.

Ellis, David M. "Different Side of the Same Story: Investors' and Issuers' Views of Rating Agencies." Journal of Fixed Income (March 1998): 35-45.

Fitch Ratings. "CDO Transition Study and First-Half 2002 Review." 23 August 2002.

Fitch Ratings. "CMBS Ratings Performance Indicators Remain Strong." 8 April 2002.

Fitch Ratings. "Global Rating Criteria for Collateralized Debt Obligations." 14 July 2003.

Fitch Ratings. "Press Release: Survey Shows Majority of Structured Finance Executives Oppose Notching as Practiced by Moody's and S&P." 27 March 2002.

Fitch Ratings. "Rating Criteria for Cash Flow Collateralized Debt Obligations" 4 November 1999.

Fitch Ratings. "Should Moody's Notch its Own Ratings?" 13 June 2002.

Fitch Ratings. "Structured Finance Default Study." 8 January 2001.

Fitch Ratings. "Structured Finance Rating Transition Study." 8 May 2002.

Fitch Ratings. "Structured Finance Ratings: Similar at Issuance and Over Time." 7 June 2002.

Fitch Ratings. Joynt, Stephen W. "Open Letter to the Investment Community on "Notching"." 18 July 2002.

Jackson, Patricia and William Perraudin. "The Nature of Credit Risk: The Effect of Maturity, Type of Obligor, and Country of Domicile." Financial Stability Review (November 1999): 128-40.

Jarrow, R.A., D. Lando, and S.M. Turnbull, "A Markov Model for the Term Structure of Credit Risk Spreads." The Review of Financial Studies (1997), vol. 10, 481-523.

Jewell, J. and M. Livingston. "Split ratings, bond yields, and underwriter spreads." The Journal of Financial Research (1998): 185-204.

Kijima, Masaaki, "Monotonicities in a Markov Chain Model for Valuing Corporate Bonds Subject to Credit Risk." Mathematica Finance, vol. 8 (1998):229-247.

Kim, J. "Conditioning the Transition Matrix." Risk: Credit Risk Special Report, October 1999, 37-40.

Lando, D. and T. M. Skødeberg. "Analyzing Rating Transitions and Rating Drift with Continuous Observations." Journal of Banking and Finance 26 (2002): 423-44.

Liu, P. and V. Thakor. "Interest yields, credit ratings, and economic characteristics of state bonds: An empirical analysis." Journal of Money, Credit and Banking (1984): 344-51.

Miller, George P. "Re: Commission Services Second Consultative Document on Review of Regulatory Capital for Credit Institutions and Investment Firms." European Securitisation Forum, 23 May 2001.

________. "Re: The New Basel Capital Accord - Securitization Aspects of the IRB Approach." The Bond Market Association, 31 May 2001.

Moody's Investors Service. "A Review of Non-Moody's-Rated Collateral in Resecuritizations: Dimensioning the Market." 13 May 2002.

Moody's Investors Service. "Comments on the Fitch CMBS Default Study." 25 July 2002.

Moody's Investors Service. "Credit Migration of CDO Notes, 1996-2001." 27 February 2002.

Moody's Investors Service. "How and Why Do Structured Finance Ratings Change? Rating Transition Study for Single-Family Residential Mortgage Pass-Through Securities." 12 May 1995.

Moody's Investors Service. "How Moody's Deals with Non-Moody's-Rated Collateral Instruments within Moody's-Rated CDOs." 23 April 2002.

Moody's Investors Service. "Moody's Approach to Rating Market-Value CDOs." 3 April 1998.

Moody's Investors Service. "Moody's Approach to Rating Multisector CDOs." 15 September 2000.

Moody's Investors Service. "Moody's CMBS Research Highlights Differences Among Agencies." 25 July 2002.

Moody's Investors Service. "Moody's Notching Guidelines for Non-Moody's-Rate RMBS." 17 July 2002.

Moody's Investors Service. "Moody's Rating Migration and Credit Quality Correlation, 1920-1996, Special Comment." 1997.

Moody's Investors Service. "Moody's Studies Ratings of Non-Moody's-Rated CDOs and Confirms Rating Estimate Approach." 22 March 2002.

Moody's Investors Service. "Moody's Studies Ratings of Non-Moody's-Rated CMBS and Revises Notching Practices." 25 January 2002.

Moody's Investors Service. "Moody's Study of Non-Moody's-Rated RMBS." 18 April 2002.

Moody's Investors Service. "Moody's Views on Notching." 22 June 2002.

Moody's Investors Service. "Non-Moody's Rated Collateral in Structured Investment Vehicles." 19 July 2001.

Moody's Investors Service. "Non-Moody's-Rated Collateral In CDOs." 31 August 2001.

Moody's Investors Service. "Notching Conventions for Multisector CDOs." 17 November 2000.

Moody's Investors Service. "Rating Changes in the U.S. Asset-Backed Securities Market: 2001 Second Half Update." 25 January 2002.

Moody's Investors Service. "Responses to the Letter issued by Steve Joynt, President of Fitch, on July 18, 2002." 24 July 2002.

Moody's Investors Service. "Special Report: Ratings Performance 1999." 2000.

Moody's Investors Service. "Structured Finance Rating Comparison Report." January 2003.

Moody's Investors Service. "Structured Finance Rating Transitions: 1983-2002." January 2003.

Moody's Investors Service. "The Binomial Expansion Method Applied to CBO/CLO Analysis." 13 December 1996.

Moody's Investors Service. "The Double Binomial Method and Its Application to a Special Case of CBO Structures." 20 March 1998.

Moody's Investors Service. "The Evolving Meaning of Moody's Bond Ratings." August 1999.

Moody's Investors Service. "Updated Notching Conventions for Multisector CDOs." 24 July 2002.

Morgan, Donald P. "Judging the Risks of Banks: Why Can't Raters Agree?" Federal Reserve Bank of New York Working Paper (March 1998).

Nickell, Pamela, William Perraudin, and Simone Varotto. "Stability of Ratings Transitions." Journal of Banking and Finance (2000), vol. 24, 203-227.

Nomura Fixed Income Research. "ABS Credit Migrations." 9 January 2002.

Nomura Fixed Income Research, “CMBS Watchlistings, Downgrades, and Surveillance.” 2 October 2003.

Nomura Fixed Income Research. “Temporal Aspects of CMBS Downgrades and Surveillance.” 2003.

Nomura Fixed Income Research. “U.S. Fixed Income Research: Mid-Year Review - Tale of Two Cities.” July 2002.

Peretyatkin, Vladislav and William Perraudin "Expected Loss and Probability of Default Approaches to Rating Collateralised Debt Obligations and the Scope for 'Ratings Shopping'," by, chapter in *Credit Ratings: Methodologies, Rationale and Default Risk* edited by Michael K. Ong, Risk Books, 2002.

“Re: The New Basel Capital Accord - Assets Securitisation Under the IRB Approach.” European Securitisation Forum, 12 December 2001.

Reiter, S. and D. Ziebart. “Bond yields, ratings and financial information: Evidence from public utility issues.” Financial Review (1991) 26: 45-73.

Rosenblatt, Marty, Jim Johnson and Jim Mountain. “Securitization Accounting under FASB 140.” Deloitte & Touche, January 2002.

Rozens, Alexander. “Moody’s defends rating policies after Fitch study.” 29 March 2002 <http://biz.yahoo.com/rf/020328/financial_moodys_notching_1.html >

Sebton, Ennanuelle and Scott Christopher Rankin. “Re: The New Basel Capital Accord - Synthetic Securitisation.” European Securitisation Forum and International Swaps and Derivatives Association, Inc., 7 March 2002.

________. “Re: The New Basel Capital Accord - Synthetic Securitisation.” European Securitisation Forum and International Swaps and Derivatives Association, Inc., 12 December 2001.

Standard & Poor’s. “Auto Loan Criteria.” 1999.

Standard & Poor’s. “Corporate Ratings Criteria.” 2002, 41.

Standard & Poor’s. “European Asset-Backed Transactions Transition Study 2001: Volumes Rocket Yet Stability Remains.” 14 February 2002.

Standard & Poor’s. “Global CBO/CLO Criteria.” 1999.

Standard & Poor’s. “Interest Shortfalls and Their Impact on CMBS Ratings.” 4 December 2001.

Standard & Poor’s. “Manufactured Housing Criteria.” January 2000.

Standard & Poor's. "Rating Transitions 2002: A Quarter Century of Outstanding Credit Performance of U.S. RMBS." 06 February 2003.

Standard & Poor's. "Rating Transitions 2002: Global CDO and Credit Default Swap Rating Performance." 13 March 2003.

Standard & Poor's. "Rating Transitions 2002: Respectable Credit Performance of U.S. CMBS." 16 January 2003.

Standard & Poor's. "Rating Transitions 2002: U.S. ABS Weather a Turbulent Year." 31 January 2003.

Standard & Poor's. "Ratings Performance 1997 – stability and transition." Research Report, 1998.

U.S. Department of the Treasury. Rules and Regulations. 66 Federal Register 230 (29 November 2001): 59639-5

X. Authors

A. Andrew S. Carron

Dr. Carron is the Chair of NERA's Securities and Finance Practice. He specializes in securities and financial economics, focusing on fixed income instruments, derivatives and risk management. He has been qualified at arbitration hearings and at trial as an expert in financial economics, securities markets, industry customs and practices, suitability of investment recommendations, and prudence under the ERISA standard. Dr. Carron has testified on behalf of both claimants and respondents in broker-customer arbitrations involving allegations of unsuitability, churning and excessive mark-ups. He has been retained for analyses of both liability and damages in commercial disputes, litigation involving claims of accounting fraud and lawsuits relating to hedge funds, banking, and real estate investment.

Prior to joining NERA, Dr. Carron was Director–Global Risk Management at CS First Boston, where he was responsible for the oversight of risk exposure for his firm's trading activities in mortgage- and asset-backed securities, residential and consumer loans and real estate. He also directed fixed income research for global bonds, emerging markets, and currencies for two years in London.

Dr. Carron has also served as senior staff member on the President's Commission on Housing and was a consultant to the Federal Home Loan Bank Board.

Dr. Carron has published articles in the *Journal of Real Estate Finance and Economics*, *Journal of Economic Literature*, *Brookings Papers on Economic Activity*, *Standard & Poor's CreditWeek* and *American Banker*. His 1982 book, *The Plight of the Thrift Institutions*, was the first publication to foresee the eventual collapse of the savings and loan industry.

Dr. Carron holds Ph.D., M.A. and M.Phil. degrees in Economics from Yale University and a B.A. degree in Economics from Harvard University.

B. Phoebus J. Dhrymes

Phoebus J. Dhrymes is a Professor of Economics at Columbia University, where his research and teaching are focused in the area of econometrics. He is the author of several books including: *Introductory Econometrics; Topics in Advanced Econometrics: Linear and Nonlinear Simultaneous Equations;* and *Time Series, Unit Roots and Cointegration*. Prior to Columbia, he was a member of the faculty at Harvard University and the University of Pennsylvania, and held visiting appointments at Stanford University, the University of California at Los Angeles, Monash University in Australia, and the Institute for Advanced Studies in Vienna, Austria.

Professor Dhrymes' papers have appeared in *Econometrica, International Economics Review, Journal of Econometrics, Econometric Theory, Review of Economics and Statistics, American Economic Review, American Journal of Finance, European Journal of Finance* and many others. Professor Dhrymes is a fellow of the Econometric Society and the American Statistical Association.

Professor Dhrymes holds a Ph.D. in Economics from the Massachusetts Institute of Technology, an honorary Ph.D. in Economic Science from the University of Cyprus, and a B.A. in Economics from the University of Texas at Austin.

C. Tsvetan N. Beloreshki

Mr. Beloreshki specializes in securities and financial economics, focusing on fixed income, foreign exchange and derivative securities, structured products, financial engineering, risk management and alternative risk finance. He has been qualified at arbitration hearings and at trial as an expert in financial economics, securities markets, market microstructure, industry customs and practices, financial engineering and securities valuation.

Prior to joining NERA, Mr. Beloreshki was a member of Banque Paribas' Structured Products and Credit Derivatives team in London and New York. In that capacity, he gained extensive experience in the areas of structuring, valuation, trading and risk management of portfolios of multi-currency complex financial instruments and derivative structures. There he developed methods and techniques to identify credit and cross-currency arbitrage as well as relative value opportunities across the spectrum of emerging market fixed income instruments, asset swaps and credit derivatives markets.

Mr. Beloreshki has published articles and working papers in the areas of fixed income securities valuation and structured products and equity derivatives securities litigation. He has presented at a number of seminars and conferences. Among others, the topics of his talks include the valuation and applications of fixed income structured products and credit derivatives, as well as securities litigation issues related to complex financial structures and derivative instruments.

Mr. Beloreshki holds an M.B.A. degree in Econometrics and Finance and a B.A. degree in Economics from the University of Chicago.