Rating Shopping or Catering? An Examination of the Response to Competitive Pressure for CDO Credit Ratings

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ABSTRACT

We examine whether "rating shopping" or "rating catering" is a more accurate characterization of rating agency interactions regarding collateralized debt obligations (CDOs) prior to the credit crisis. Inconsistent with rating shopping alone, AAA CDO tranches rated by both Moody's and S&P are more likely to default than tranches rated by only one of them. For the typical CDO, there is considerable disagreement between S&P's and Moody's assumptions on default correlations and even collateral quality, yet their AAA tranche sizes are typically identical. Consistent with meeting competitive pressure, we find that both S&P and Moody's make adjustments beyond their model outputs when the other rating agency has more favorable assumptions. Finally, validating S&P's and Moody's initial assessments, risk disagreements, though ignored at issuance, predict disagreement in credit ratings in subsequent downgrades. Overall, our results are supportive of rating catering where rating agencies inflate ratings to match competitor ratings.

By both facilitating the housing bubble and triggering massive write-downs for banks, structured finance credit ratings are often perceived to be among the most important drivers of the 2007-2009 credit crisis.[1] A striking feature of this episode is that major rating agencies unanimously gave AAA ratings to trillions of dollars of collateralized debt obligations (CDOs). Several novel theories have offered competing models and policy solutions regarding rating agency competition and rating inflation.[2] Most of these models are customized to the universe of complex securities; yet, surprisingly little empirical work has examined the role of rating agency competition within structured finance ratings. In this paper, using unique data, we empirically evaluate "rating shopping" and "rating catering" as alternative explanations for CDO credit rating agency behavior.

The first and often-cited view called "rating shopping" refers to a situation where issuers solicit ratings from multiple agencies and then choose the most favorable ones (as modeled by Skreta and Veldkamp (2009), Faure-Grimaud, Peyache, and Quesada (2009), and Farhi, Lerner, and Tirole (2011)). In this line of analysis, even though rating agencies adhere to their standards and issue unbiased ratings, rating inflation is a natural consequence of the rating shopping process and not driven by the rating agencies. Hence, if rating solicitation is publicly disclosed (as is now required),[3] then, as Sangiorgi and Spatt (2011) show, rating shopping will be innocuous since investors can infer the true value of CDOs from the number of ratings initially solicited. Empirically, we find that the pure rating shopping explanation cannot be the primary reason for rating inflation, as we will later illustrate.

A second scenario is called "rating catering." The first part of rating catering still involves rating shopping by the issuers. However, rating agencies do not strictly adhere to their standards due

[1] For example, Coffee (2009) and Partnoy (2009 and 2010) argue that reliance on credit ratings and trust in credit rating agencies were main causes of the crisis.

[2] As we will further discuss, recent examples include those focused on credit rating agency interactions: Skreta and Veldkamp (2009), Farhi, Lerner, and Tirole (2011), Bolton, Freixas, and Shapiro (2012), and Bar-Isaac and Shapiro (2012); and those focused credit rating agency policy reform: Pagnon and Volpin (2010), Sangiorgi and Spatt (2011), and Opp, Opp, and Harris (2012).

[3] http://www.sec.gov/spotlight/dodd-frank/creditratingagencies.shtml.

to a focus on current and future revenues or market share. The incentive of attracting business by inflating ratings is carefully modeled in Bolton, Freixas, and Shapiro (2012), which shows that competition facilitates rating shopping. Under pressure from investment banks, the rating agency with the most stringent standard will frequently stretch their standards to match the more lenient rating agency. In this view, rating agencies fight for market share and cater to issuers' demands.

The empirical literature finds mixed evidence on rating agency competition. In the corporate bond domain, Becker and Milbourn (2011) find that competition from Fitch lowers overall rating quality of Moody's and S&P through rating inflation and find no support for rating shopping. Kisgen and Strahan (2010) find some evidence consistent with catering in that a new rating agency (DBRS) issues more optimistic ratings on larger and higher yield bond issuances prior to official regulatory acceptance.[4] John, Ravid, and Reisel (2010) find rating biases from self-serving bond notching practices. In contrast, Bongaerts, Cremers, and Goetzmann (2012) find some evidence of rating agency shopping for corporate bonds near the investment grade boundary. Analyzing asset-backed securities (ABS), Benmelech and Dlugosz (2009b) find some support for rating shopping, as they show that ABS collateral with only one rating was downgraded more often.[5] The theoretical literature emphasizes that both shopping (Skreta and Veldkamp (2009), Sangiorgi and Spatt (2011)) and rating inflation (Opp, Opp, and Harris (2012)) are more likely to occur in the CDO market because it is the most complex and difficult market to independently evaluate.[6] In addition to examining CDOs, our primary empirical approach is quite distinct from previous work as the measure of competitive pressure is direct and exogenous (pre-determined by rating agencies'

[4] Goodman, et al. (1997) also argue that the entrance of Fitch may have led to the softening of rating criteria. Xia (2012) finds that competition from Egan-Jones (the only rating company paid by investors) improves S&P corporate bond ratings, especially in opaque firms. Kraft (2011) finds mixed evidence as to whether Moody's caters their bond ratings.

[5] They also caution that "it is not clear that rating shopping led to the rating collapse as the majority of the tranches in our sample are rated by 2 or 3 agencies." Their downgrading sample ends in January 2008 before much of the downgrading had yet to occur.

[6] On related conflicts of interest, Cornaggia, Cornaggia, and Hund (2011) argue that credit rating agency (CRA) standards were the loosest and least accurate in the rating markets paying the most fees, such as structured finance.

methodologies and criteria before coming to specific CDOs). Our findings on CDO ratings are most consistent with the "race to the bottom" conclusion reached for corporate bond ratings in Becker and Milbourn (2011) and the model of Bolton, Freixas, and Shapiro (2012).

We start by examining the CDO universe using comprehensive Bloomberg data, with a focus on the prevalence of multiple ratings. In contrast to the basic shopping premise that only the most desirable ratings will be retained, from 1997-2007, 84.7% of all AAA CDO capital with a rating from either Moody's or S&P also receives a rating from the other agency. For dual-rated tranches that were rated AAA by at least one of these two agencies, 96.3% of the capital received identical ratings from Moody's and S&P.

We examine this large universe of 2,790 CDOs to see if the presence of multiple ratings matters for future deal performance. In contrast to the rating shopping view, we find that CDOs rated by S&P or Moody's exclusively actually perform better than deals that S&P and Moody's rated together. Thus, if investors had assumed that dual certification was better than a single rating via an unraveling mechanism, they would have been incorrect. Moreover, CDOs rated by S&P, Moody's, and Fitch are more likely to default than CDOs rated by just S&P and Fitch.

To understand how multiple ratings could be harmful, we collect unique detailed data for 724 CDOs with data from both Moody's and S&P. Surprisingly, there is considerable disagreement between Moody's and S&P on the key assumptions—probabilities of default differ on average by 30.3% between Moody's and S&P on the same deal and default correlations differ by 57.6%. Gauged by the same model, the assumption differences amount to an 8.9% difference in total AAA tranche size. These assumption differences between Moody's and S&P's are not offset by their model differences.

One way to reconcile different model inputs and outputs with similar ratings is to allow for adjustments beyond modeling. We separate the difference between Moody's and S&P's approaches

into two components: one part due to assumption differences, and the other resulting from modeling differences. For any rating agencies claiming independence, there is no direct justification to issue adjustments due to assumption differences regarding the collateral risk.

We find that collateral risk disagreement (a difference in assumptions) is an important variable in explaining rating adjustments (actual AAA size minus modeled AAA size). Consistent with rating catering, when Moody's makes collateral assumptions that produce ten percent more AAA than S&P's assumptions, S&P issues a four percent adjustment above model output. The second most important variable is a competitor's adjustments—S&P is more likely to issue an adjustment when Moody's also does so.

We further find that collateral risk disagreement at issuance predicts future relative downgrading magnitudes. Consistent with rating agencies issuing ratings due to competitive pressures and not due to their perception of fundamentals, we find that when S&P had worse perceptions of a CDO's risk at the time of issuance, they later downgrade these CDOs more than Moody's (and vice versa). Ultimately, it appears that while rating agencies originally agreed about ratings, they disagreed on subsequent ratings in a manner verifying the original disagreements about collateral risk.

Our findings point to rating agencies stretching beyond their models to match a competitor's rating and overriding their independent assessment of the collateral quality. Our findings suggest that shopping by issuers without outright rating inflation by the rating agencies cannot fully explain poor CDO ratings. A more nuanced version of rating shopping should include rating agencies yielding to competitive pressures and hence, rating agencies directly facilitating rating inflation. The primary problem does not seem to be excessive exercising of market power by the rating agencies, but rather caving in to market forces on the quality dimension, even with only one or two main competitors. Our findings have important implications for the implementation of the Dodd-Frank

Act by the U.S. Securities and Exchange Commission (SEC). While much recent focus is on curbing rating shopping, less attention is paid to competitive rating pressure.

Our paper relates to a growing literature improving the understanding of problems in structured finance valuation and ratings. Coval, Jurek, and Stafford (2009a) show that the most senior tranches of CDOs were massively mispriced, and Coval, Jurek, and Stafford (2009b) demonstrate that CDO valuation models hinged on a high degree of confidence in the parameter inputs. Our paper shows that rating agencies could have known from their competitor's actions that there existed substantial parameter uncertainty in key inputs like collateral default correlations. He, Qian, and Strahan (2012) find that larger issuers received more favorable MBS ratings. Ashcraft, Goldsmith-Pinkham, and Vickery (2010) show that RMBS standards deteriorated from 2005 to 2007, and Stanton and Wallace (2011) find that CMBS subordination levels gradually decreased through 2007. For CDO ratings, Griffin and Tang (2012) find that adjustments from one CRA were made at an increasing rate from 2005-2007.[7] They cannot find an economic explanation for why adjustments are made as we do. Unlike the prior literature, this paper is the first to demonstrate that CDO rating adjustments are strongly related to competitive pressure.

The rest of this paper is organized as follows. Section 1 describes the related literature, details the differences between Moody's and S&P's CDO modeling approaches, and develops our hypotheses. Section 2 describes the data. Section 3 examines the effects of multiple credit ratings on performance using comprehensive Bloomberg data. Section 4 documents differences in the implied AAA size from Moody's and S&P and the differences in their modeling approaches. Section 5

[7] Griffin and Tang (2011) show that the business group use more favorable assumptions than the surveillance group within the same CRA. Begley and Purnanandam (2012) show that equity tranches vary across deals with sensible features such as asymmetric information. Faltin-Traeger and Mayer (2011) show that mortgage-backed securities (MBS) collateral included in CDOs underperformed other MBS. Lax standards (Keys, Mukherjee, Seru, and Vig (2010) and Mian and Sufi (2009)) or fraud (Ben-David (2011)) in the mortgage origination process could have inflated the collateral quality of mortgage related CDOs as analyzed by Barnett-Hart (2009).

examines the relation between adjustments and disagreement over collateral risk. Section 6 relates collateral risk disagreement to future relative rating downgrading. Section 7 concludes.

1. CDO Credit Ratings

This section discusses prior research on CDO credit ratings, industry practices, and develops testable hypotheses for our empirical analysis.

1.1 Literature Related to Credit Rating Agency Competition

There is no shortage of opinions regarding the causes of poor CDO ratings performance in the aftermath of the financial crisis. One widely held view is that CDO rating shopping by underwriters or issuers was to blame. Under this view, because underwriters pick the most favorable of two or three ratings, shopping naturally results in rating inflation even though rating agencies issue truthful ratings.[8]

Reputation concerns are not always sufficient for rating agencies to report truthfully, as argued by Mathis, McAndrews, and Rochet (2009). In particular, the underwriter may leverage one agency's rating to pressure another rating agency. Such explicit competition could lead to a "race to the bottom" (as shown more generally by Golan, Parlour, and Rajan (2011)).[9] Rating agencies may cater their rating results in order to be retained and receive their fees both now and in the future. In relation to these concerns, an SEC (2008) report mentions one CRA employee stating, "we think the only way to compete is to have a paradigm shift in thinking [...]." Strategic rating catering, as modeled by Bolton, Freixas, and Shapiro (2012), leads to rating agencies knowingly inflating ratings in boom times. They also show that rating inflation is possible even in the absence of rating

[8] Such rating shopping games are modeled by Skreta and Veldkamp (2009), Faure-Grimaud, Peyache, and Quesada (2009), Farhi, Lerner, and Tirole (2011), and Sangiorgi and Spatt (2011). In these models, truth-telling is assumed and implicitly enforced by reputation concerns. For example, Skreta and Veldkamp (2009, p680) assume that "our model's rating agencies report the truth."

[9] See also "'Race to the Bottom' at Moody's, S&P Secured Subprime's Boom, Bust", Bloomberg, August 25, 2008. Available online: http://www.bloomberg.com/apps/news?pid=newsarchive&sid=ax3vfya_Vtdo

shopping.[10] There is no prior empirical study distinguishing the rating shopping and rating catering hypotheses in the CDO domain, though both shopping (Skreta and Veldkamp (2009), Sangiorgi and Spatt (2011)) and rating inflation (Opp, Opp, and Harris (2012)) are much more likely to occur in the CDO market. For corporate bonds, equity analysts and CDS markets can act as substitutes for the role of rating analysts. Indeed, Fong, Hong, Kacperczyk, and Kubik (2011) find that the loss of an equity analyst leads to a half-notch increase in a firm's credit rating. They discuss implications for the CDO market, where there are few analysts and hence little external certification.

Rating agencies serve the dual role of certifiers and evaluators, and hence share similarities with the information environments of both auditors and equity analysts. Competition between information intermediaries is generally believed to be good for information production, but there is some conflicting evidence. Ljungqvist, Marston, and Wilhelm (2006) find that equity analyst recommendations do not influence the outcome of underwriter competition, and Hong and Kacperczyk (2010) find that competition between analysts reduces optimism bias. Doherty, Kartasheva, and Phillips (2012) find that a new market entrant increases the quality of insurance companies' ratings. On the other hand, Numan and Willekens (2011) show that the presence of a close competitor reduces audit quality. However, the setup of the CDO ratings market is distinct from other markets. Moody's and S&P dominate the CDO ratings market, whereas these other markets are more diverse. Firms only hire one auditor, but issuers can use multiple ratings. Auditors, like rating agencies, usually receive payments directly from issuers, whereas equity analysts do not.

1.2 Rating Approaches

[10] Other related papers include Camanho, Deb, and Liu (2010), Damiano, Li, and Suen (2008), and Bar-Isaac and Shapiro (2012). Camanho, Deb, and Liu (2010) show that competition among multiple rating agencies induces rating inflation. Fulghieri, Strobl, and Xia (2012) provide a model of unsolicited ratings and shows that a system with unsolicited ratings may have more stringent standards.

CDO notes are issued by special purpose vehicles (SPVs) with different seniority levels and payoff schedules secured by a collateral asset pool.[11] The size, rating, and value of each tranche are determined by modeling the hypothetical default probabilities and the default correlation across all collateral assets. Although the modeling concepts are similar, there are some fundamental differences between the approaches of Moody's and S&P.[12] Moody's primarily uses the binomial expansion technique (BET) method to model CDOs.[13] S&P uses the Gaussian Copula Monte Carlo Simulation approach.

The main innovation in Moody's BET CDO valuation model is to incorporate default correlations by modeling the collateral pool as a smaller number of independent assets, where the number of representative assets in the pool is the diversity score (DS). Each representative asset has an independent probability of default of p. Therefore, the total number of defaults over the life of a deal follows a binomial distribution.[14] Total expected loss is calculated by computing a weighted average of the loss a tranche suffers given j defaults, with the probability of j defaults which is determined by the binomial distribution. An "idealized" expected loss table then converts the expected loss to a credit rating.

In contrast to Moody's reduced-form diversity score approach, the structural approach used by S&P (or copula approach, which is also used by Fitch) assumes that movements in asset values are correlated. All asset values are simulated many times with a given correlation structure to

[11] Lucas, Goodman, and Fabozzi (2006), Rutledge and Raynes (2003 and 2010), Longstaff and Rajan (2008), Benmelech and Dlugosz (2009a), Sanders (2009), and Coval, Jurek, and Stafford (2009b) detail CDO structure and mechanics. Griffin and Tang (2011 and 2012) describes related components of the issuance to ratings process.

[12] Our discussion is based on official documents from Moody's and S&P describing rating methodologies, numerous conversations with current and former employees of both rating agencies, and former investment bank employees who interacted with rating agencies.

[13] Moody's states that they use Monte Carlo simulations for synthetic CDOs and CDO^{2}s (since 2004). In the continuing surveillance reports for all CDOs in our sample the underlying collateral correlation metric reported by Moody's is the Diversity Score. Since this is a direct model input used in their BET model, we infer that all of the CDOs in our sample use the Moody's BET model.

[14] Moody's introduced the BET model in 1996, and then introduced the Correlated BET model, an extension of the original BET model, in 2004. However, for all CDOs in our sample Moody's continued to report the Diversity Score used in the original version of their BET model.

produce a distribution of the portfolio value. This distribution is then used to generate a set of scenario default rates (SDR). The calculation of SDR is analogous to finding Value-at-Risk (VaR) at a given confidence level for a rating and is the main model output that S&P provides publically.

Apart from S&P's credit risk modeling of the collateral pool, each tranche must undergo a separate cash flow analysis (except synthetic CDOs which are relatively more recent). Different scenarios of default timing patterns, interest rates, and recovery rates are considered under a cash flow analysis that factors in the payment timing, overcollateralization, and excess spread of a CDO to determine the break-even default rate (BDR). The BDR is the maximum level of default that the collateral pool can withstand while still meeting the tranche's payment obligations. To earn the desired rating, the tranche must be able to withstand a loss (BDR) that is greater than the possible losses the underlying pool could incur in an extreme scenario (SDR). Interestingly, S&P's Gaussian Copula credit risk model is the main model S&P discussed and distributed in industry. Secondary cash flow modeling is only sparsely described and their cash flow model is not publically distributed. Hence, we, like most practitioners, focus on the S&P credit risk model.

1.3 The Rating Process

The underwriter typically proposes a deal structure along with legal documents when soliciting credit ratings for the notes from the major CRAs. The CDO structurers from the underwriting bank often keep in close communication with the rating analysts. If disagreement arises between a CRA and the underwriter, the underwriter may discuss these disagreements with the rating agency and seek to persuade the analyst that higher ratings are indeed justifiable.[15] Although S&P would not discuss rating assumptions and results with Moody's directly, the investment banker may selectively discuss the preliminary rating indicators of one rating agency with the other. If the

[15] One former investment bank quant who interacted with Moody's and S&P regarding CDO transactions explained to us how she would work to persuade the CRA quants for a proposed deal structure through her modeling. She recalled that one rating agency counterpart even thanked her for teaching him so much. We asked what happened if she wasn't successful and she said that was when her boss would make a phone call to his boss.

underwriter does not obtain their desired ratings, they could historically pay a small contract-breaking fee to hide this rating information. The underwriter may still potentially use ratings from another rating agency, though CDO prospectuses often specify which rating agencies will issue ratings and their levels. After the deal is rated and the collateral pool is completely "ramped," each credit rating agency's surveillance team monitors the performance of the CDO and updates the credit ratings when necessary. Most of our analysis uses data from the first available surveillance reports issued by both rating agencies, supplemented by pre-sale and new issue reports.

1.4 Collateral Credit Quality Disagreements

Besides different modeling approaches, each rating agency has criteria to ascertain a deal's collateral default correlation and credit quality. Moody's and S&P's criteria for calculating correlations and asset quality vary, hence these key correlation and asset quality assumptions can differ across rating agencies on the same deal. To meaningfully compare the importance of these disagreements, we can evaluate a CDO using each set of assumptions, but under the same CRA model. We focus on Moody's and S&P, which are the major players for CDO ratings, and we did not collect Fitch data.

1.5 Hypotheses

When issuers shop for ratings from multiple rating agencies and rating agencies maintain their standards, CDOs that receive ratings from two or more rating agencies should be of higher quality and therefore perform better than those receiving ratings from one rating agency, as discussed by Benmelech and Dlugosz (2009b) and Bongaerts, Cremers, and Goetzmann (2012).

H1: With credit rating agency shopping, securities with two or more ratings should perform better than those only able to receive one rating.

Alternatively, rating agencies may respond to competitive pressure by catering their services in order to maintain or gain market share. In such scenarios, the presence of more than one credit rating should not be positively related to deal quality.

H1A: With rating catering, dual ratings provide no certification value and should not be positively related to future performance.

Beyond rating performance, we can examine actual rating practices. Griffin and Tang (2012) show that actual rating results can be different from model outputs. Discerning the adjustment motivation is difficult for a single rating agency in isolation but possible with our rating agency comparison between S&P and Moody's.

Suppose that the reason for Moody's higher amount of AAA is that they classified the underlying collateral as being of higher quality and/or having lower default correlations. In this case, S&P is disadvantaged by their stricter evaluation of collateral quality and correlations. To gauge the scale of this disadvantage, we could take Moody's assumptions regarding collateral quality and default correlation and run them through S&P's model. The difference between S&P's model output under S&P's assumptions and S&P's model output under Moody's assumptions is an estimate for how much Moody's looser assumptions affect the AAA size. We call this difference the collateral risk disagreement (CRD). For example, if the S&P SDR with S&P assumptions is 0.30 and the SDR is 0.20 under Moody's assumptions then the collateral risk disagreement is 0.10, indicating that Moody's has considerably more favorable collateral risk assumptions. Both rating agencies had formal guidelines as to how they should measure the underlying collateral quality and cross-correlation among assets. This process should not be done on a deal-by-deal basis. With rating agency catering, when one rating agency makes relatively more optimistic evaluations of the collateral risk (either because of different priors or a pressure to please issuers), the other rating agency may face a choice of issuing an adjustment or losing business.

H2: With only credit rating agency shopping and no catering, rating agencies' adjustments should be unrelated to Collateral Risk Disagreement (CRD).

H2A: With rating agency catering, S&P's adjustments should be positively related to its Collateral Risk Disagreement (CRD), and vice versa for Moody's.

Rating agency competition is most relevant for new ratings, when the largest fees are paid. Therefore, we expect that initial disagreements will have implications in terms of subsequent relative rating downgrades. In other words, when S&P and Moody's are forced to downgrade CDOs due to poor performance, S&P downgrades will be more severe relative to Moody's for those CDOs where they initially had a much worse assessment of the CDO's collateral risk. Also, the rating agencies may become more honest when investors are less "trusting" and when reputation concern is higher (Bolton, Freixas, and Shapiro (2012)). If the credit crisis triggers a decrease in investor trust, rating agencies may need to be more truthful in the downgrading after the start of the crisis. The downgrade can serve as a regime switch where S&P essentially assesses the CDO according to its initially harsher evaluation.

H3: With only credit rating agency shopping and no catering, initial Collateral Risk Disagreement (CRD) should be unrelated to future relative downgrading.

H3A: With rating catering, CDOs with worse initial collateral assessments by S&P will have relatively greater subsequent downgrades by S&P as compared to Moody's.

2. Data and Descriptive Statistics

Before turning to our specific sample, we first use a large universe of CDOs to examine the prevalence of dual ratings from Moody's and S&P. We retrieve ratings data for all CDOs listed on

Bloomberg, with issuance dates from 1997 to 2007 with data collection details outlined in the Internet Appendix IA 2.[16]

We examine CDOs with at least one AAA tranche rated by Moody's or S&P. We examine AAA tranches because they typically account for the majority (75 to 80%) of capital issued. Table 1 includes 5,525 AAA-rated tranches from 2,790 CDOs with a total value of $1.80 trillion. The Securities Industry and Financial Markets Association (SIFMA) has kept track of global CDO issuance since 2000. Over the period of 2000-2007, our sample represents a principal value of $1,406.9 billion, which makes up 81.4% of the $1,727.5 billion Global CDO Issuance reported by SIFMA over the same period.

Panel A shows that 60.7% of those tranches have ratings from both Moody's and S&P, but not Fitch, and an additional 17.0% have ratings from Moody's, S&P, and Fitch. Thus, 77.7% of the tranches and 84.7% of the AAA capital have ratings from both Moody's and S&P. Another 8.2% of the AAA-rated CDO capital has a single rating from either Moody's or S&P, and 7.0% has ratings from either Moody's or S&P in conjunction with Fitch. Only 0.5% of the tranches use single ratings from Fitch.[17] Overall, Moody's and S&P play the dominant role in AAA ratings for CDOs.

Panel B shows the number of originally AAA-rated tranches from S&P and/or Moody's through time. The proportion of AAA tranches rated by both Moody's and S&P in terms of number of tranches is highest in 2001-2002. In 2002, 96.4% of all AAA tranches in capital value were rated by both Moody's and S&P.

Next, we analyze if there is disagreement across ratings. We consider all tranches rated by Moody's and S&P with at least one AAA rating by either agency. Panel C of Table 1 shows that 96.3% of the AAA tranche capital has matching AAA ratings. In 0.9% of the cases, S&P gives the tranche

[16] This Bloomberg sample has many CDOs under duplicate tickers which we identify and remove based on ticker names and tranche sizes/ratings.

[17] Because we require a CDO to have at least one tranche with a AAA rating from Moody's or S&P, we do not consider CDOs who's entire set of tranches is rated exclusively by Fitch.

an AAA rating and Moody's rating is lower, while 2.8% of the time Moody's gives the AAA rating (Aaa in Moody's terminology) and S&P's rating is lower. Therefore, in the vast majority of cases Moody's and S&P issue the same AAA ratings.

We now turn to describing our specific detailed data set that is collected from the first available surveillance reports obtained from both S&P and Moody's. Surveillance reports do not always appear immediately after the CDOs are ramped.[18] We are only able to locate surveillance data on 1,452 CDOs for Moody's and 1,577 CDOs for S&P. The intersection of our list of reports generates 1,379 CDOs which were rated by both agencies over the life of the CDO. We lose 449 CDOs because of a lack of sufficient data reported by Moody's, reducing our sample to 930 CDOs. To maintain comparability between credit rating agencies, we compare surveillance data that is within 180 days of the other rating agency. This restriction excludes another 206 CDOs, leaving 724 CDOs with the necessary data for the overlapping sample.[19] For S&P reports we have the actual credit risk model output (SDR) for 643 reports. For the remaining 81 with missing SDR information we estimate S&P's SDR.[20] Because Moody's does not disclose its model output, we do not have a reference point to judge the success of our replication of Moody's model. However, our Moody's modeling replication strictly follows their extensive BET model documentation.

[18] Consistent with the missing reports, one former rating agency employee noted to us privately that surveillance was often not performed.

[19] We have been extremely careful to compile as much data as possible from Moody's and S&P reports. Lost observations are consistent with the general lack of reporting or non-reporting of deal inputs.

[20] We use a simple Monte Carlo simulation model and replicate S&P's SDRs quite closely—obtaining an adjusted R^2 of 0.954 for the overlapped sample with actual SDRs as shown in the Internet Appendix Table IA.1. Nevertheless we replicate several of our key results for the sample where none of the SDRs are estimated and report the results in the Internet Appendix Table IA.3.

3. Value of Multiple Ratings

In this section we examine whether a CDO's performance is related to which agencies rate the deal by focusing on the rating history of all the 2,790 Bloomberg CDOs with initial Moody's or S&P AAA ratings from 1997 to 2007.

If shopping is rampant, a deal with dual rating agency certification should perform better than a deal that was only able to obtain a single rating as described in Hypothesis H1. However, under rating catering (H1A), dual rating certification is not informative because rating agencies are pushing to gain business. To examine these issues, we look at the performance of CDOs with respect to three different measures of future performance: 1) the number of notches the initially AAA-rated tranches of a CDO are downgraded in the future as of June 30, 2010, 2) the likelihood that a deal experiences an Event of Default (EOD), as defined in the CDO's prospectus, and 3) the likelihood that the AAA tranches of a CDO are downgraded to the lowest rating possible.

Each measure has its advantages and disadvantages. The number of notches downgraded can be advantageous to the extent that credit ratings represent a forward-looking measure of expected performance. Nevertheless, if rating agencies seek to salvage their reputation relative to their competitor, then CDOs rated by multiple agencies may actually be downgraded more quickly and severely compared to those rated by one agency.

Downgrading is the choice of rating agencies. We augment ratings with information regarding EOD notices so that our performance data is not solely contingent on ratings. These EODs are issued when a particular deal fails to meet any one of a set number of conditions pre-specified in its prospectus, ranging from a failed interest coverage ratio test to a failure to fully meet its interest payment obligations. Such events are not up for interpretations, and therefore should not suffer from any confounding effects. On the other hand, it is possible that a deal has suffered

irrevocable damage and has not yet received an EOD notice, or that through our searching process, we did not observe such a notice.[21]

For this reason, we also look at deals which have a tranche initially rated AAA that we deem in, or almost in, default as classified by either having its rating downgraded to 'C or 'D' by either agency, indicating that it is nearly or in default, or having its rating withdrawn from all agencies after being downgraded to speculative grade. Rating agencies will classify a CDO as in default when certain covenants, such as a failure to meet an interest or principal payment, are violated.

Before performing a formal analysis, we examine our hypothesis graphically. Each CDO is placed into one of three disjoint groups. The first two groups that a CDO could belong to, *S&P Exclusively* and *Moody's Exclusively*, represent CDOs which received credit ratings from S&P but not Moody's (or vice versa). The final group, *Dual Rated*, contains all CDOs which received dual ratings by both S&P and Moody's. The Moody's and S&P Exclusive samples are smaller and may be skewed towards different types of CDOs. For this reason, and as a rough control for type differences, we first compute an average for a year using collateral type weights from the entire sample and not from each pool.[22] Panel A of Figure 1 shows the average number of notches the lowest AAA tranche of a CDO is downgraded by S&P over time for those CDOs which obtain dual ratings as well as those only rated by S&P. Within each year, those CDOs only rated by S&P are downgraded by fewer notches than those rated by both S&P and Moody's.

Panel B shows the analogous graph when focusing on CDOs rated solely by Moody's compared to those that received dual ratings. As opposed to the previous panel, up until 2005 CDOs that received multiple ratings experienced fewer downgrades relative to those only rated by Moody's, although the magnitude of the difference is rather small. However, starting in 2006 this

[21] The details of the data collection process are outlined in Internet Appendix IA 2.
[22] All CDOs within a given collateral type each year are aggregated together but the weights are the frequency of that type over the entire sample (so that the weights are the same across Moody's and S&P subsamples).

pattern dramatically changed, with dual ratings underperforming their counterparts. Furthermore, the magnitude of the differences increased from roughly one notch in previous years to over five notches for 2006 and two notches for 2007.

Panel C illustrates the differences across all three mutually exclusive groups for a separate measure of CDO performance, the Event of Default notice. Similar to the previous two panels, while the performance of dual-rated CDOs originating up until 2004 perform in a similar fashion to those with a single rating, this pattern does not hold for the latter part of the sample. For CDOs in 2005-2007 (where the majority of CDO capital is issued), dual-rated deals largely underperform. Finally, in Panel D we see that dual-rated CDOs have their ratings dropped to the lowest possible level and/or have their ratings withdrawn more often than the other two groups.

To control for other possible factors, we move to a multivariate regression framework. For our regression analysis, the presence of a credit rating by the rating agencies is the primary independent variable and we segment the sample into five mutually exclusive partitions. The first two, *S&P Exclusively* and *Moody's Exclusively*, represent CDOs who received credit ratings from S&P but not Moody's (or vice versa). The next two groups apply to CDOs that were rated by both S&P and Moody's but where one agency awarded more AAA ratings to tranches relative to the other. In the case where S&P gave at least one more AAA rating compared to Moody's, the CDO would fall into the category *Both, S&P Favorable*. The final group, which serves as the base case, contains all CDOs that were rated by both S&P and Moody's and additionally received identical AAA ratings.

Table 2 presents ordered or plain logit regressions with the measures of CDO performance described above as the dependent variables. In the first column, we examine all CDOs that were rated by S&P with S&P downgrade notches as the dependent variable. After controlling for vintage year and collateral type, we find that the relative likelihood of a CDO being downgraded when rated by S&P and not Moody's, as shown by the odds ratio, is roughly one-third those when being rated

by both agencies, a result that is highly statistically significant (z-stat=-6.36). In addition, when both agencies rate a CDO, but S&P does not award as large a portion of the CDO an AAA rating, the odds are less than half as likely of the tranche being downgraded. The second column performs a similar regression for those CDOs rated by Moody's with performance measured by the number of Moody's downgrading. In a manner consistent with the previous figure, those CDOs that are rated by Moody's but not S&P were also less likely to be downgraded in the future, with an odds ratio of 0.41 (z-stat=-5.25). In a similar fashion to the previous test, CDOs with a subordinate AAA rating from S&P are less likely to be downgraded, with an odds ratio of 0.32 (z-stat=-3.86).

The third column shifts the focus to our second measure, Event of Default, as the dependent variable with an ordinary logit regression. We find that single rated deals, either by S&P or Moody's, are significantly less likely to experience an EOD (odds ratio of 0.18 or 0.21). In an analogous regression using the third measure of poor performance, we find a qualitatively similar pattern, but the coefficient is insignificance for CDOs only rated by Moody's.[23]

Our results appear different from Benmelech and Dlugosz (2009b) who find that structured finance collateral with dual ratings performed better than those with one rating. However, they examine the performance of underlying collateral that make up a set of 534 ABS CDOs instead of the performance of the actual CDO tranches as we do.[24] Therefore, we repeat our analysis for only those CDOs whose underlying collateral are comprised of ABS securities. Table 3 reports the results of this analysis. Overall, we find the same relationships still hold, with a few exceptions. While we find quantitatively similar results for CDOs that were rated by S&P and not Moody's, deals which receive ratings exclusively from Moody's become less statistically significant in one regression and

[23] Similar analysis is performed using OLS and ordered probit regressions to eliminate the possibility of a specific modeling framework driving our results. We find similar results in all specifications performed. These results are reported in the internet appendix Table IA.2.

[24] In addition to our differences in methods, their ratings data stops in January 2008 when much severe MBS downgrading had yet to occur. Our ratings data extends to June 30, 2010. Cordell, Huang, and Williams (2011) find that ABS CDOs tranches rated by S&P underperform (in Table 18) but note that their results may be idiosyncratic since this only consists of 23 bonds. We have 640 AAA CDO tranches rated by S&P but not Moody's.

insignificant in the other regression when using the ratings-based measures of future performance. These findings, both for the larger sample as well as the subset of CDOs containing mainly ABS collateral, provide empirical evidence that is contrary to the general idea of dual certification. If the rating agencies are roughly equivalent in their ability to assess the riskiness of a deal, and provide ratings which are independent and have not been inflated, the procurement of multiple ratings should be a signal of a safer security. Instead, the presence of both rating agencies in the rating environment for a deal appears to be associated with lower quality deals, measured in multiple ways.

Since Event of Default notices are a hard measure not determined by rating agencies, we exploit this measure for further analysis. Rather than ordered logit, Table 4 presents the results of logit and probit regressions where we focus solely on these EOD notices. We first look at the effects of having multiple ratings without distinguishing between specific combinations of the three agencies. The first two specifications find that after controlling for vintage and collateral type effects, the odds of experiencing an Event of Default when possessing a sole rating are less than one-sixteenth of those for deals who have multiple ratings.[25] Ordered probit regression results are similar. In addition, we cannot detect any difference between having two or three ratings.

The remaining specifications take a finer approach by looking at the specific combination of rating agencies rating a deal, as opposed to just the number of ratings received. The third specification breaks this group into those deals whose sole rating is from S&P versus those who are rated by Moody's. Under both the logit and probit frameworks, the effect is not driven by one rating agency or the other, as being exclusively rated by either is associated with a decreased likelihood of experiencing an EOD. The final regression looks at all the possible combinations of the three agencies that could issue ratings for a deal. The results indicate that the presence of a dual rating for

[25] The only difference between the first and second specifications is a switch in the base case from two raters to three raters. This allows us to test the difference between one rater and both of these base cases statistically.

a CDO by the top two agencies is associated with a higher chance of default. Furthermore, those securities only rated by S&P perform better than the base case of being rated by S&P and Fitch.

The results indicate that the two major rating agencies lower their standards when they jointly rate a deal, which is inconsistent with rating shopping (H1) but consistent with rating catering (H1A). We now shift our focus to the evaluations performed by S&P and Moody's for a subset of CDOs where we have unique data on rating inputs and outputs.

4. Rating Assumption Differences

In this section, we first examine the key model assumptions and the degree to which they differ between Moody's and S&P from deal to deal, and then combine those differences into a single summary measure, "collateral risk disagreement."

4.1 Collateral Asset Default Correlation and Credit Quality

We first illustrate how the rating agencies account for the credit risk of the underlying collateral inputs. CDO collateral pools consist of many assets. Rating agencies will first assign ratings to unrated assets or take ratings from other rating agencies and "notch down." Each asset has its own probability of default before the maturity of the CDO. The credit quality of the CDO's collateral asset pool is characterized by the average default probability. Those default probabilities are derived from the assets' credit ratings. Both S&P and Moody's convert ratings into numerical default probabilities using historical data. In contrast to S&P's straightforward default measure, Moody's employs a rating factor framework, which we convert to a probability of default using Moody's historical default tables. All else equal, a lower default probability allows a CDO to have larger AAA-rated tranches.

Panel A of Figure 2 presents a scatter-plot of Moody's and S&P's probability of default estimates by CDO type. The 45-degree line is where the CDOs would fall if the CRAs agreed

perfectly on collateral quality. There are considerable deviations from the 45-degree line. S&P assumed higher default probabilities for CLOs relative to Moody's. Moreover, Moody's had a tighter range of assumed collateral default probabilities for CLOs when compared to S&P. The average absolute difference in collateral default probabilities is 0.047, which represents a 30.3% deviation from the average collateral default probability.

Next, we perform a similar comparison for the default correlation assumptions made. Moody's and S&P use different terminologies for default correlations, which makes them difficult to compare directly.[26] We convert both measures into conventional default correlations bounded by [-1, 1].[27] Panel B of Figure 2 plots Moody's assumed default correlations against those of S&P for the overlapping sample of CDOs. Moody's and S&P's default correlations are positively related but they still have considerable disagreement as shown by the large deviations from the 45-degree line. The average absolute difference divided by the average of the two correlation measures is 58.6%.[28]

4.2 Collateral Risk Disagreement

The disagreements on credit quality and default correlation may allow for considerable cross-sectional variations in AAA sizes as long as the effects are not offsetting. We have two concerns: 1) we want to measure the combined effect of assumption differences regarding both default correlations and underlying collateral default probability, and 2) we want to measure these assumption differences in terms of their effect on AAA sizes.

In order to compare Moody's and S&P's inputs and models in a meaningful way, we need to transform these inputs by the same function. As previously discussed, Table 1A.1 shows that our

[26] Moody's uses Diversity Score (DS) to measure how many independent assets are needed to represent the collateral pool. S&P reports a correlation measure (CM) which is the ratio of the standard deviation of the portfolio default rate computed with correlation to that computed without correlation.
[27] Griffin and Nickerson (2012) discuss the economic interpretation and the appropriate level of default correlations.
[28] A third factor for CDO valuation is maturity. Partly due to S&P's use of 7-year maturity for MBS and Moody's reporting of the legal maturity which is much longer, Moody's assumed maturity is on average 3.6 years longer than S&P's assumption. Nonetheless, while Moody's reports the legal maturity on these deals, in their modeling process they use a weighted average life that frequently ranges from 6 to 7.5 years and hence is quite similar to S&P's.

replication of S&P's model is highly successful. Hence, we plug assumptions from both rating agencies into to our version of S&P's model to obtain the effect on the AAA tranche sizes.[29]

Figure 3 shows the scatter-plot of these implied AAA size differences under both Moody's and S&P's assumptions gauged by our highly accurate replication of S&P's model. If the combined effect of Moody's probability of default and default correlation assumptions net out to be the same as S&P's, then all CDOs would lie on the 45 degree line. Yet, Figure 3 shows that many CDOs do not fall on the line, meaning that the two rating agencies have disagreements regarding the underlying CDO's overall credit risk and hence the underlying AAA tranche size. It is conceptually possible that Moody's and S&P's modeling differences further offset each other such that both Moody's and S&P's models call for the same AAA sizes. However, as shown in Internet Appendix Figure IA.1, this is not the case—when evaluating Moody's assumptions using Moody's model, there is an even larger difference when compared to S&P's model and assumptions.

We define collateral risk disagreement (CRD) as the difference between S&P's and Moody's underlying assessment of credit risk under the same model (either S&P's or Moody's model). In Figure 4 we plot the distribution of CRD under S&P's model. About four-ninths of the CDOs have an implied AAA tranche sizes more than 5% different between S&P and Moody's. The average absolute CRD is 5.6%. To put this in perspective, junior CDO tranches may be 2-5% of the CDO, so for CDOs "rated at the edge" this difference could be substantial. Relative to a deal's overall collateral risk, the average disagreement as a percentage of SDR for AAA ratings is 8.9%. Additionally, CRD is shifted to the right of zero, meaning that Moody's has more lenient credit risk assumptions on average. If S&P applied Moody's assumed inputs, they would give 1.2% more AAA

[29] Following Griffin and Tang (2012), we use 1-SDR as the allowable AAA because this is the largest amount strictly feasible from their credit risk model, which is the only one from S&P publicly available. We will control for the cash flow channel in the regression analysis. To isolate collateral quality and correlation risk disagreement, we use the weighted average maturity assumptions from S&P.

than under their own. We explore the cross-sectional implications of the risk disagreements in the next section.

5. Collateral Risk Disagreement and AAA Size Adjustments

The previous section shows that model inputs between Moody's and S&P are substantially different. Then how can it be that the actual ratings are often identical? To understand this puzzle, we examine the relationship between adjustments beyond rating model outputs and collateral risk disagreement as described in Hypotheses H2 and H2A. For each rating agency, the actual AAA size (for example 80%) minus the amount of AAA implied from the rating agency's own model output (1-SDR) (say 68%) is defined as its AAA adjustment (12%) following Griffin and Tang (2012). Note that, as discussed in the data section, we have the actual AAA size from S&P's model for 88.8% of the observations, whereas for Moody's we use the model output from our replication that carefully follows their documentation. Note that our main results for S&P adjustments (in Panel A below) are in no way contingent on the Moody's model replication. We require that both S&P and Moody's rate a deal to be included in our sample, but we do not require that they give identical ratings to all AAA tranches.

5.1 Are Different Assessments of Collateral Risk Related to Adjustments?

We first graphically present the relation between CRD and AAA size adjustment. Panel A of Figure 5 shows a positive association between S&P's AAA adjustment and the collateral risk disagreement between S&P and Moody's. When CRD is positive, S&P has a more negative view of the underlying collateral risk and is at a disadvantage. The figure indicates that S&P tends to issue larger positive adjustments in such cases. Panel B displays the analogous examination of Moody's out-of-model AAA adjustment and disagreement in collateral riskiness. Here CRD is the difference between the AAA allowable under Moody's model when using Moody's assumptions and when

using S&P's assumptions. There does not appear to be a discernible univariate relationship between CRD and Moody's adjustments. Next, we run multivariate regressions to separate the effect of collateral risk disagreement from other factors potentially affecting adjustments.

What is the expected role that collateral risk disagreement plays in the adjustments issued by a rating agency? In the absence of all other differences between S&P and Moody's in the rating process, including model differences, the importance of cash flow modeling, and even possible adjustments by the other rating agency (merited or not), collateral risk should play a different role in different scenarios. Namely, we expect collateral risk disagreement to be important when an agency believes the collateral to be riskier than their competitor does. To illustrate this point, imagine a CDO rated by both agencies but where the two rating agencies differ on the underlying collateral risk. If a S&P analyst considers the collateral to be riskier, either from a correlation or credit quality standpoint, then he faces the decision of issuing an adjustment in order to match the amount of AAA issued by Moody's or potentially losing the deal. However, if S&P had in fact considered the collateral to be safer, relative to Moody's, (and CRD is negative) the opposite relationship would not necessarily be observed. In such a case, S&P would be fully justified in issuing AAA ratings to a larger portion of the CDO, leaving Moody's with the choice to issue an adjustment or not.[30] Therefore, in this scenario, the realization of a negative collateral risk disagreement would not be as strongly related to a negative adjustment by S&P.[31]

We split our measure of collateral risk disagreement up into different independent variables. The first variable, *Positive CRD*, assumes the value of the CRD as described in previous sections

[30] In this scenario, we would actually observe an out-of-model adjustment of zero from S&P.

[31] However, it is possible that if rating agencies differ in their methodology the previous pattern would not be observed. Consider the previous example if Moody's was able to issue a AAA rating to a larger portion of the CDO relative to S&P in the absence of an out-of-model adjustment. If this was the case, then even when S&P deemed the collateral to be relatively safer (and CRD is negative), their model may still imply that a smaller portion of the deal be rated AAA compared to Moody's. In such a case, they would still face the decision to either issue an adjustment or risk losing the deal. Our results are highly significant when CRD is not split into positive and negative groupings.

when CRD is greater than zero, and is set to zero in all other cases. Conversely, *Negative CRD* is set to the CRD in all cases where the value is less than zero, and set to zero otherwise.

Panel A of Table 5 presents regression results using S&P's AAA size adjustment as the dependent variable and positive and negative collateral risk disagreement between S&P's assumptions and Moody's assumptions as the key independent variables. Column 1 does not include any control variables. The 0.201 R^2 reveals a significant explanatory power of collateral risk disagreement for adjustment. The coefficient estimate 0.790 (*t*-stat=7.40) for Positive CRD suggests that when Moody's has a 1% more lenient evaluation of collateral risk, S&P would adjust its own model by 0.79% in terms of final AAA fraction in the CDO. In a similar fashion, the point estimate of 0.561 (*t*-stat=4.16) for Negative CRD suggests that even when S&P finds the collateral to be 1% safer, the adjustment they issue decreases by 0.56%. This finding is robust to CDO characteristics (column 2), CDO type (column 3), and vintage year (column 4) controls. The coefficient estimate on Positive CRD only drops to 0.700 (*t*-stat=4.97) with all above controls in column 4.

Griffin and Tang (2012) found that the most important component in explaining adjustments was that CDOs with a "model-implied small amount of AAA (a high SDR)" received larger adjustments. In column 5, we indeed find a significant relationship between adjustments and model direct SDR. However, collateral risk disagreement remains highly significant in the presence of model SDR. The magnitude of the coefficient decreases to 0.31 for Positive CRD, indicating that when Moody's assumptions imply an SDR ten percent lower than S&P's SDR, S&P issues a three percent adjustment. This finding is also robust to the full set of controls in column 6.

Panel B of Table 5 uses Moody's estimated adjustment as the dependent variable.[32] Here CRD is defined as AAA size with Moody's assumptions minus AAA size with S&P's assumptions, both under our version of Moody's model. Similar to the previous results, the coefficient of *Positive*

[32] It should be noted that because Moody's model requires more data, we lose some observations relative to the previous panel.

CRD is positive and strongly statistically significant in all specifications considered. Moody's issues an adjustment whenever the collateral is viewed as being riskier, relative to S&P's evaluation. The coefficients remain relatively stable across the different regressions. For a 10% difference in AAA size under the rating agencies' respective assumptions, the adjustment by Moody's ranges from 4.0% when no controls are included up to 4.7% when controlling for only SDR. However, in contrast to the first panel, the coefficient for *Negative CRD* is not statistically significant in any of the specifications. Whenever Moody's finds the collateral to be less risky, they do not reduce their adjustment (or make a negative adjustment).

5.2 Other Explanations and Controls

Adjustments to a model without cash flow considerations (like S&Ps) can be due to: a) legitimate positive cash flow features of the CDO, b) an ad hoc deviation justified through the use of cash flow analysis that is catered to justify a result, or c) out-of-model deviations beyond the formal modeling process. We construct an empirical measure for the cash flow features of each CDO. While we do not have S&P's cash flow model to measure the importance of cash flows from deal to deal, Moody's implicitly builds cash flow considerations into their model. Therefore, for each CDO we determine the appropriate AAA size under Moody's model using S&P's assumptions and the cash flow dynamics specific to the deal. We then calculate what the AAA size would be using the same model and collateral risk assumptions if the deal had generic cash flow features.[33]

Moody's and S&P's models may also differ in the way they model the collateral risk of a particular deal, *Collateral Modeling Difference*, even if they are very similar on average. We calculate the SDR that would have been generated by S&P's model, had it used the asset default distribution generated by Moody's model with S&P's collateral risk assumptions. We then subtract this value

[33] This generic structure is constructed for each CDO type (ABS, CBO, CDO^2, and CLO) by using the median values of interest and overcollateralization coverage ratios, coupon payments to each tranche conditioning on its initial rating, and the Libor rate for the year the deal was issued. The difference between these two AAA sizes should capture the relative amount of cash flow protection this CDO affords above the median deal, holding collateral risk constant.

from the SDR generated under S&P's model. Hence, this measure captures the difference between Moody's and S&P with respect to a deal's collateral default distribution, holding collateral risk assumptions constant.

Table 6 shows that both S&P's (Panel A) and Moody's (Panel B) adjustments bear some relation to differences in the agencies' collateral modeling approach (*Collateral Modeling Difference*) and each deal's specific cash flow structuring (*Cash Flow Protection*), even after controlling for a deal's overall collateral risk, SDR. Additionally, we include the competitor's adjustment in our analysis. Moody's and S&P could both issue an adjustment because of some unobservable deal feature or because of competitive pressure. S&P adjustments are consistently larger when Moody's issues larger adjustments, and vice versa. In Panel A the coefficient estimate for Moody's adjustments in the last specification is 0.30, indicating that a 10% Moody's adjustment is associated with a 3% S&P adjustment. Similarly, the coefficient in Panel B indicates that a 10% adjustment by S&P only leads to an adjustment of 4.5% by Moody's. However, while this demonstrates a correlation between the two adjustments, we cannot show a directional relationship.

More importantly, our original assumption disagreement variables (CRD) are significant with similar coefficients when considering both S&P's adjustment in Panel A and Moody's adjustment in Panel B. The positive relationship between collateral risk disagreement and AAA adjustment (as called for in Hypothesis H2A) is consistent and stable across different model specifications.

6. Are Initial Collateral Risk Disagreements Borne Out in Future Ratings?

While we show that disagreements in collateral risk assessments are strongly related to adjustments issued, there remains the possibility that an unobservable variable in the modeling process in conjunction with sample construction drives the relationship between disagreement and adjustment. This point is illustrated as follows. Every CDO in our sample is rated (though not

identically) by both Moody's and S&P. If S&P estimates a higher level of risk in the underlying collateral then a positive omitted variable in S&P's rating process would be necessary for them to rate the deal, allowing the deal to be observed in our sample.[34] In such cases we would observe a positive adjustment and positive collateral risk disagreement. Furthermore, if the omitted rating process variable was negative then they would not rate the deal and it would not enter our sample. However, since the majority of the AAA tranches (84.7% of the capital) were rated by both agencies, this explanation becomes less likely because one would need another reason why the omitted rating process variable was typically positive, without inflecting conflict of interest. Nevertheless, we seek to formally address this potential concern.

It is important to note that while at the time of issuance there is considerable business pressure on rating agencies, this outside influence attenuates in subsequent rating actions (downgrading from AAA). Rating agencies were likely highly concerned about the general perception of structured finance ratings and did not want to downgrade ratings too quickly. However, once rating agencies were eventually forced to downgrade, subsequent surveillance analysis on individual deals should be subject to much less pressure to match a competitor's ratings in the cross-section. We can use this regime shift to differentiate between views.

If the CDO rating process was indeed subject to some kind of omitted rating variable, one would expect the rating agency to continue to place weight on this rating variable in subsequent rating revisions. In such a case, if collateral risk disagreement was merely capturing correlation with this omitted variable, future relative rating changes of the CDO should be unrelated to disagreements in collateral risk. On the other hand, if an agency administered higher ratings than their model initially prescribed, then whenever the structured finance products began to falter, the agency would revert back to their original beliefs about the riskiness of the deal. Therefore, we focus

[34] Note that the omitted variable must be outside of S&P's credit risk model because we have the output coming directly from S&P's credit risk model.

on relative downgrading ("downgrading disagreement"). If S&P initially issued ratings above what their original assessment of credit risk dictated, and not from any omitted deal quality variable, then they would issue larger downgrades relative to Moody's on deals where S&P had much worse initial perceptions of collateral risk (high CRD) as described in Hypothesis H3A.

In order to examine these possible alternatives we employ ordered logit and ordered probit regressions. For each CDO we compute the number of notches that S&P downgrades the lowest seniority tranche receiving an AAA rating and subtract off the number of notches that Moody's downgraded the same tranche as of June 30, 2010.[35] Consequently, deals that were downgraded more severely by S&P will take on a positive value. Since collateral risk disagreement is a measure of S&P's assessment of a CDO's asset risk relative to Moody's, (under catering) CRD should be positively related to the magnitude of the downgrades that S&P issues relative to Moody's.

Panel A of Table 7 reports the ordered probit regression results of downgrading disagreement on collateral risk disagreement along with other control variables. The rating agencies have different surveillance units for different asset types which likely have differing opinions of future risk. For this reason, we include control variables for collateral type along with CRD in the first specification. We find that CRD is positive and highly significant (z-stat=2.56). Specifically, when S&P thought that a CDO had riskier collateral relative to Moody's evaluation (but both assigned AAA ratings at issuance), they tended to subsequently downgrade the CDO more severely.

The effect of CRD on downgrading disagreement is robust after controlling for SDR in the second specification. Because ABS CDOs were subject to vintage effects in later years that caused the underlying collateral to be of particularly low quality, we include controls for ABS CDOs issued from 2004 to 2007 in the third specification. The fourth specification also includes controls for tranche insurance, proxies for the experience of the underwriter and collateral manager, and the

[35] For 18 CDOs of our 724 CDOs, we are unable to locate the CDO on Bloomberg even after extensive searching.

presence of a Fitch rating. In all specifications CRD remains positive and statistically significant. Following Griffin and Tang (2012), in the first four specifications we include dummy variables to control for effects of five downgrading shocks, potentially related to unobserved collateral type, that S&P issued over the period from 2007 to 2009 related to the composition of the underlying collateral pool. In the fifth specification we exclude those shocks. In all specifications, the coefficient estimate for CRD is positive and significant. Panel B of Table 7 reports identical regressions using an ordered logit regression and finds similar statistical significance.

These findings both validate collateral risk disagreement as a measure of disagreement between rating agencies and support Hypothesis H3A that rating agencies gave adjustments at issuance due to competitive pressures. More practically, this finding provides additional justification for the recently adopted SEC Rule 17g-7 as part of the implementation of Dodd-Frank Act Section 932 requiring the performance analysis of subsequent rating changes in comparison to initial ratings.

7. Summary and Concluding Remarks

We analyze whether "rating shopping" or "rating catering" is the better explanation for CDO ratings under competition. For the overall CDO universe, we examine the popular shopping view that deals with multiple ratings are of better quality than those with only one rating. Contrary to the intuition that rating shopping alone leads to rating inflation, we find that CDOs rated by both S&P and Moody's default more than those with ratings from S&P or Moody's alone. Additionally, when one rating agency issues an AAA rating, only in 3.7% of cases does the other rating agency issue a non-AAA rating.

We examine how different rating agencies often reach identical AAA conclusions. For a sample of 724 CDOs rated by Moody's and S&P with unique input and output data, we find large differences in key modeling assumptions. These differences are not offsetting and lead to model-

implied AAA support levels that are on average 8.9% different. We examine the implications of these differences. We find that S&P issues AAA size adjustments when they assess a CDO's collateral to be riskier relative to Moody's. Similarly, Moody's is more likely to issue an adjustment when S&P uses more favorable collateral risk assumptions. Additionally, each rating agency makes larger adjustments when the other rating agency also issues an adjustment. Although the agencies disagreed on underlying assumptions and agreed on ratings at issuance, they later disagreed on continuing ratings in a manner validating their initial difference in underlying credit risk assessment. Our results are consistent with rating agencies reaching beyond their model due to competitive pressure, or "racing to the bottom."

Our study provides evidence for rating catering and challenges the popular view that CDO rating inflation was simply a by-product of the design of the market/shopping process and not a direct fault of the rating agencies. Our findings suggest that the competitive pressure of this same shopping process led to inflation directly from the rating agencies. It is common, and convenient, to blame the financial crisis on misguided and complex models. While complex models can make a process less transparent and alchemy difficult to detect, our results suggest that behind the sophistication, the ratings process was subject to quite plain and old motivations.

Our findings have important implications for regulatory reform. We believe that the Dodd-Frank Act has made strides in the right direction in terms of making regulation less reliant on ratings, calling for more transparency, and calling for rating agencies to face expert liability.[36] However, the implementation of Dodd-Frank by the SEC also faces practical challenges, as evidenced by the July 22, 2010 SEC ruling which indefinitely delayed rating agency expert liability for fear that the asset-

[36] Darbellay and Partnoy (2012) carefully survey Dodd-Frank implementation and describe detailed suggestions for further reform. Transparency is shown optimal in theory by Pagano and Volpin (2010). A common rating agency objection to transparency is that releasing CRA data and modeling would release their proprietary knowledge and destroy incentives to create better procedures. For CDOs the modeling process used by the rating agencies is already publicly described and the underlying data they use is predominately from trustees.

backed market would be shut down. Our findings indicate that encouraging more rating agencies to compete for business from issuers may exacerbate the current problems without further reforms. Full transparency, while not a panacea, can partially offset the conflicts of interest inherent in the issuer-pay model by making it easier to pinpoint rating inflation. In our opinion, the current requirements regarding transparency are insufficient. Credit rating agencies should clearly report all their key assumptions, all underlying data used in their calculations, the full methodology they follow, fees received, and any non-modeling choices for all ratings. This would enable investors, new rating agencies, academics, and third-party experts to more easily scrutinize ratings. Five years after credit rating failure, there is still surprisingly little data disclosure to assure reliable ratings.

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Panel A

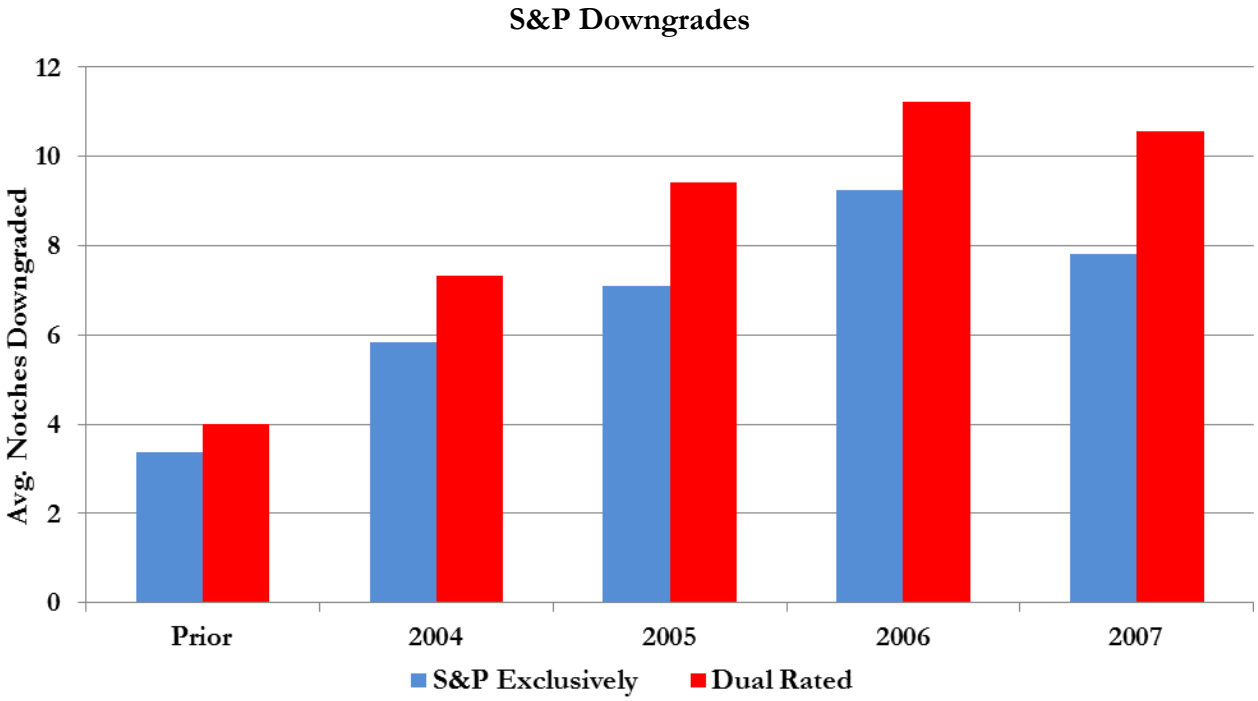
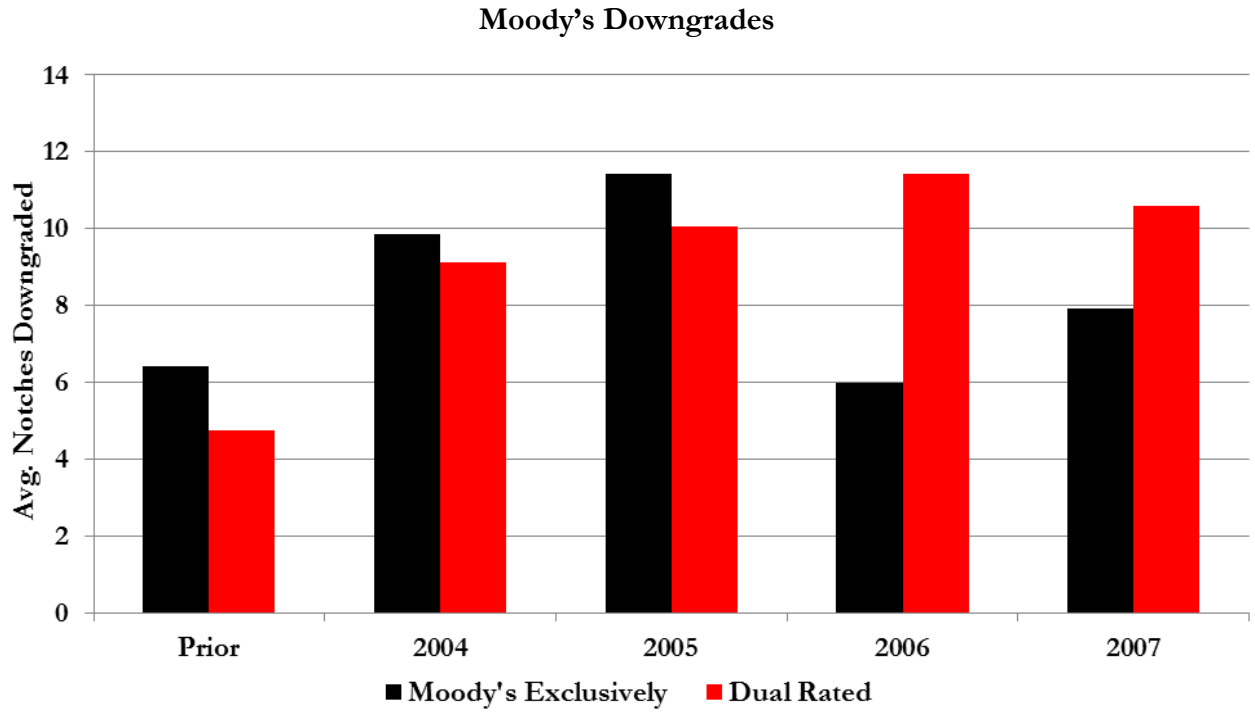
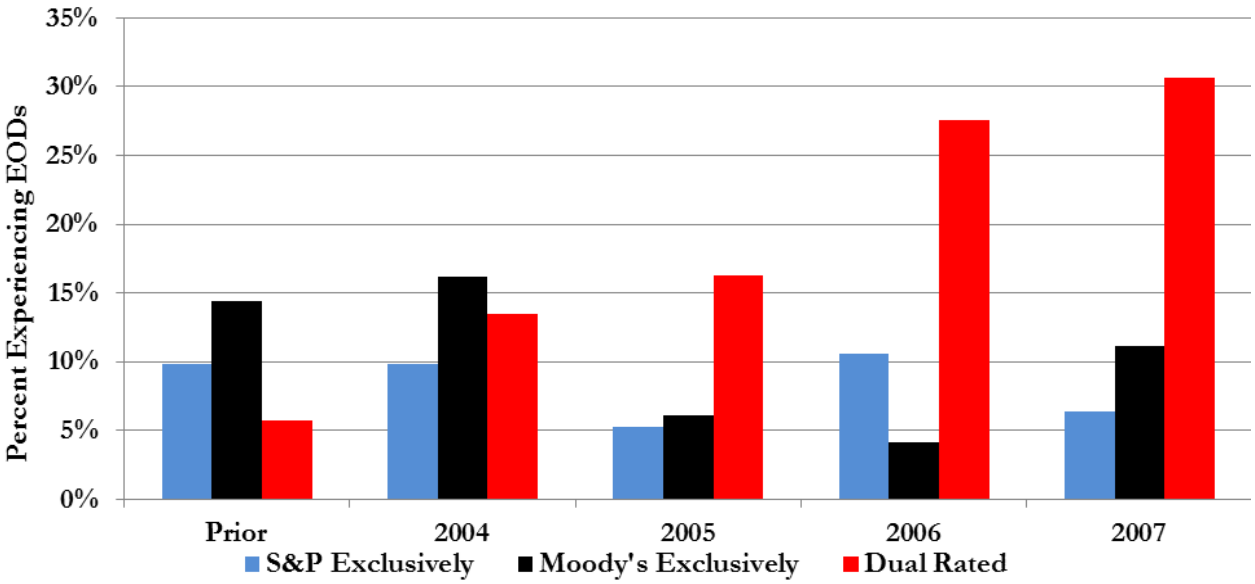


Figure 1
CDO Performance and Single vs. Dual Ratings
This figure illustrates the average number of notches tranches originally rated AAA are downgraded by S&P (Panel A) and Moody's (Panel B) and percentage of CDOs experiencing an event of default notice (Panel C) by year of issuance. The number of notches downgraded is computed as of June 30, 2010. Dual Rated refers to CDOs who receive a rating by both Moody's and S&P for at least one originally AAA tranche.

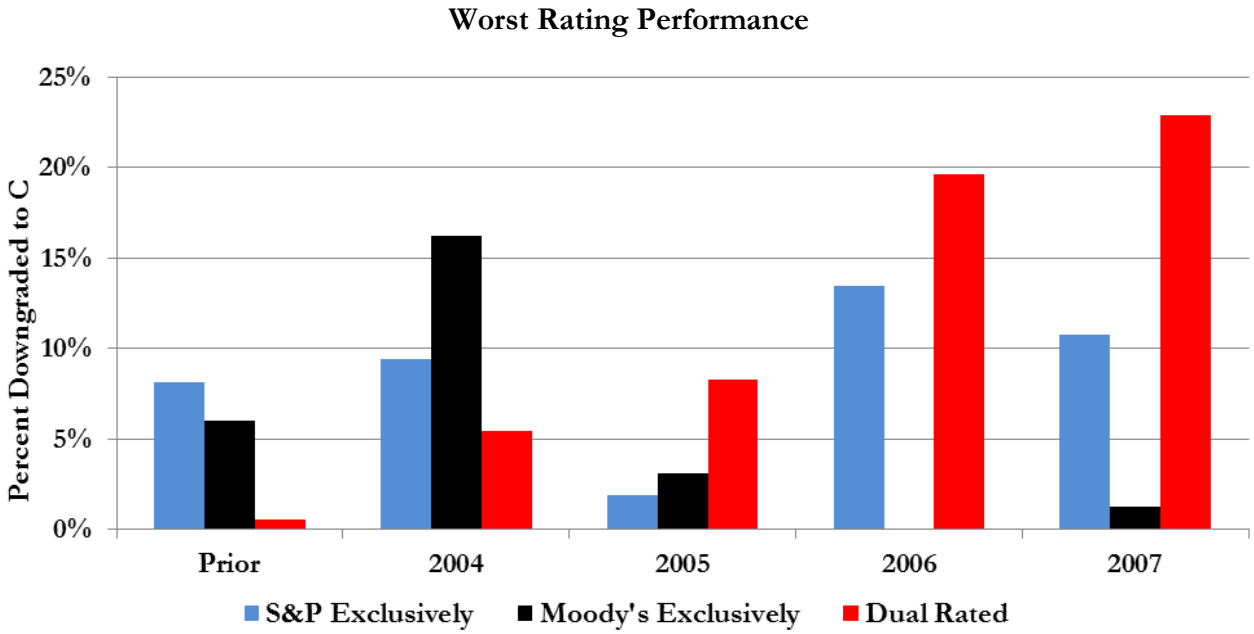
Panel B



Panel C



Panel D


Worst Rating Performance
Percent Downgraded to C
25%
20%
15%
10%
5%
0%
Prior
2004
2005
2006
2007
S&P Exclusively
Moody's Exclusively
Dual Rated

Panel A

Underlying Asset Default Measure

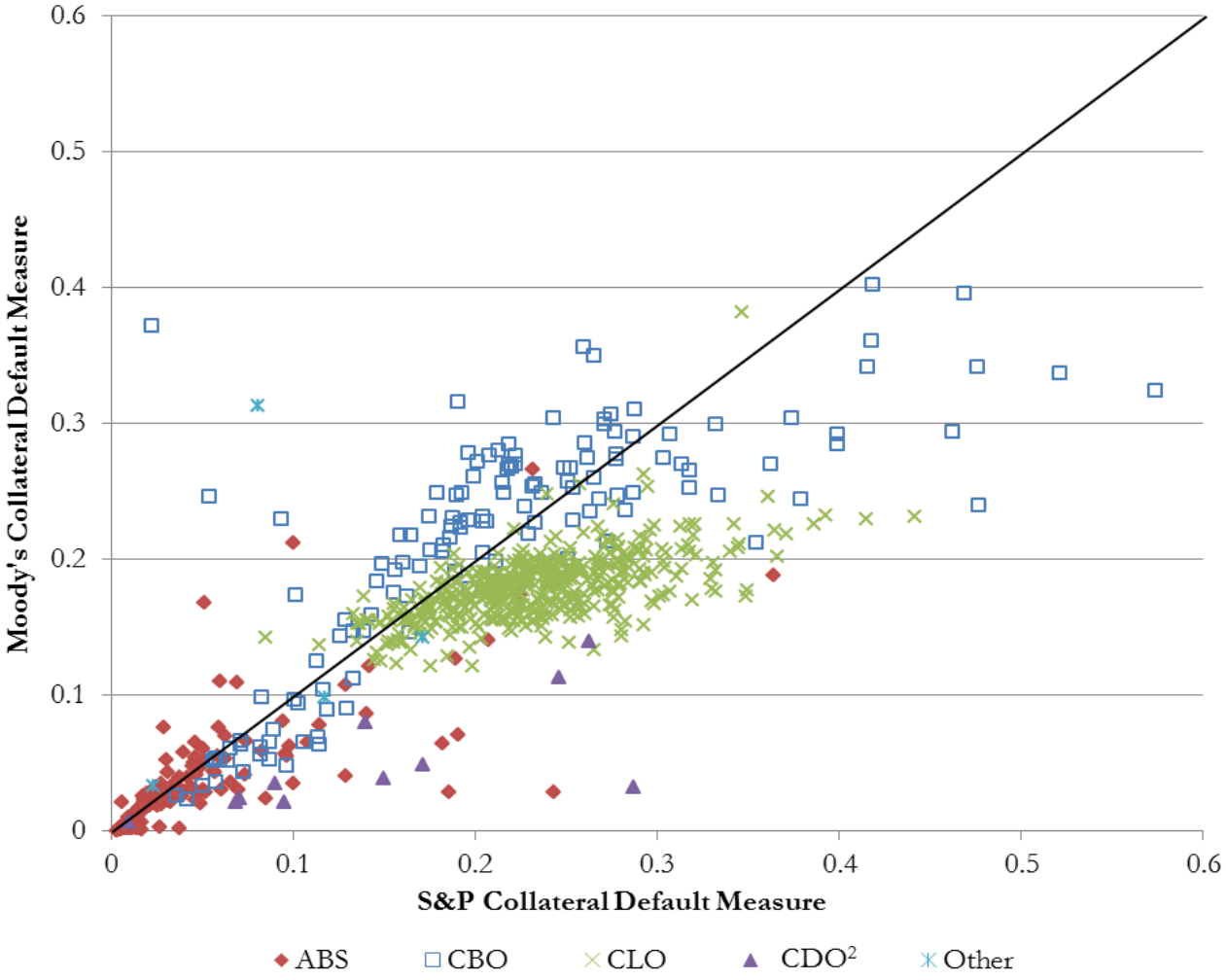


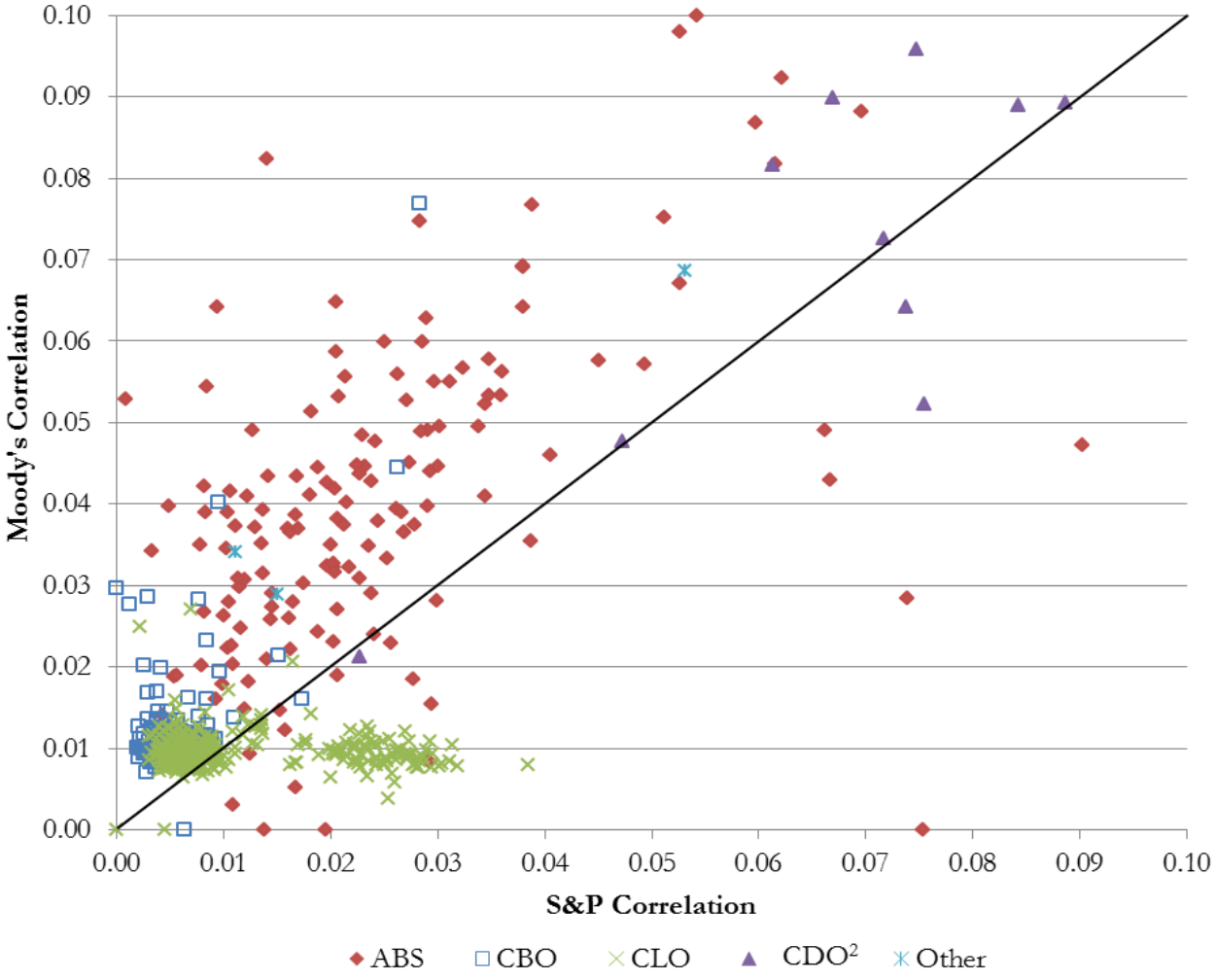
Figure 2

Collateral Probability of Default

This figure reports the scatter-plot of average probability of default (Panel A) and average pair-wise correlation (Panel B) for the underlying asset pool over the life of the security assumed by S&P and Moody's. The probability of default, denoted as 'Default Measure,' for S&P is calculated by multiplying the annualized average probability of default by the weighted average maturity (WAM) of the CDO. The probability of default for Moody's is based on a table of discrete values, acquired from Moody's, that maps weighted-average rating factor (WARF) and WAM to a probability of default. For CDOs that do not lie on one of these discrete values, it is estimated with a two-way interpolation between the nearest WAMs and WARFs. The WAM reported by S&P is used for both calculations. This figure reports the histogram (Panel A) and scatter-plot by type of collateral (Panel B) of the average pair-wise correlation between underlying assets' defaults assumed by S&P and Moody's. The correlations assumed by S&P and Moody's are estimated from surveillance reports issued by their respective rating agencies using the formulas in Internet Appendix IA 2.

Panel B

Underlying Asset Correlations



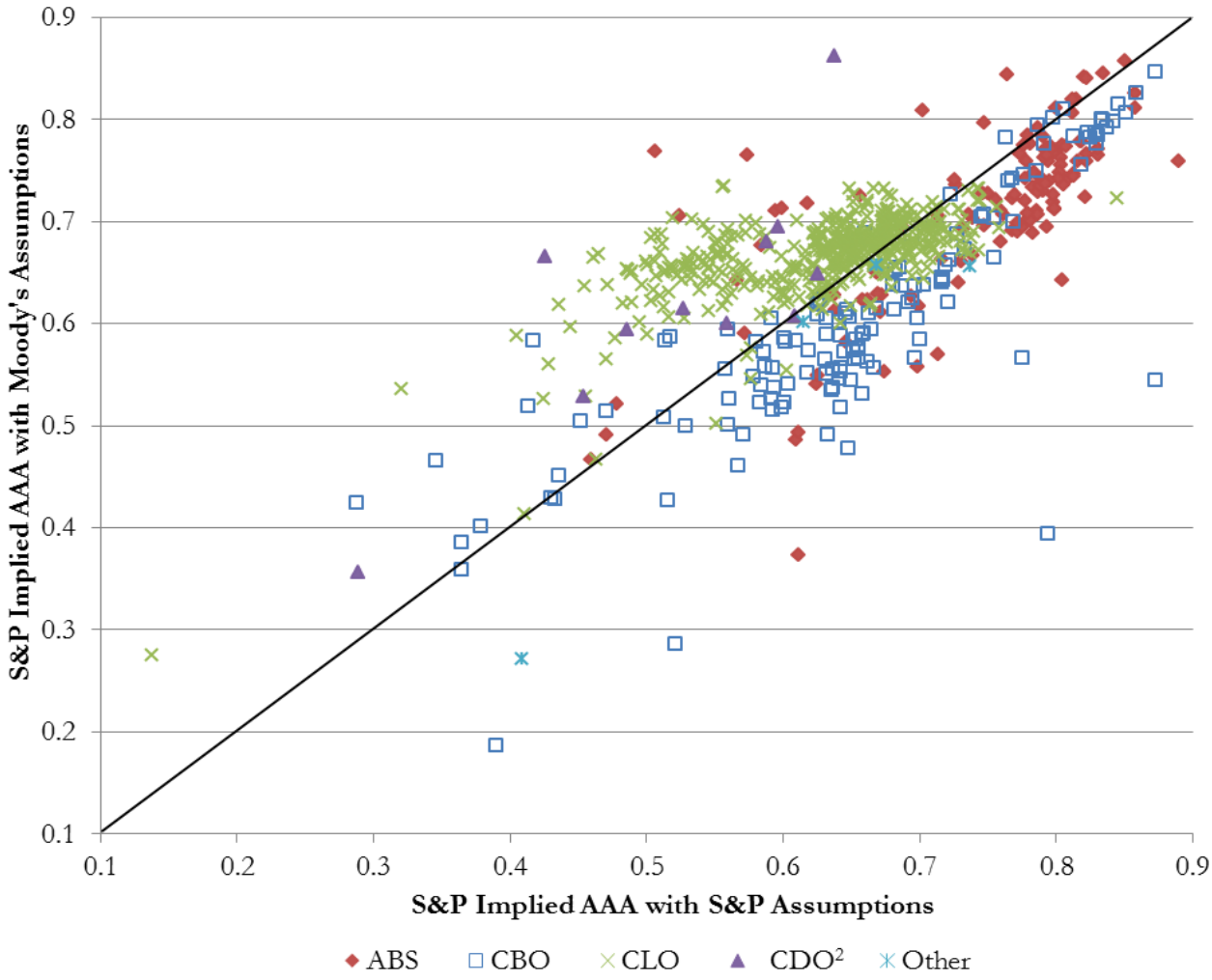


Figure 3

Implied AAA under S&P's assumptions (x-axis) and Implied AAA under Moody's assumptions (y-axis) both under S&P's Model

This figure graphs the size of the AAA tranche implied from the S&P model under the set of S&P assumptions and the size of the AAA tranche implied from the S&P model under the set of Moody's assumptions. The WAM reported by S&P is used for both calculations.

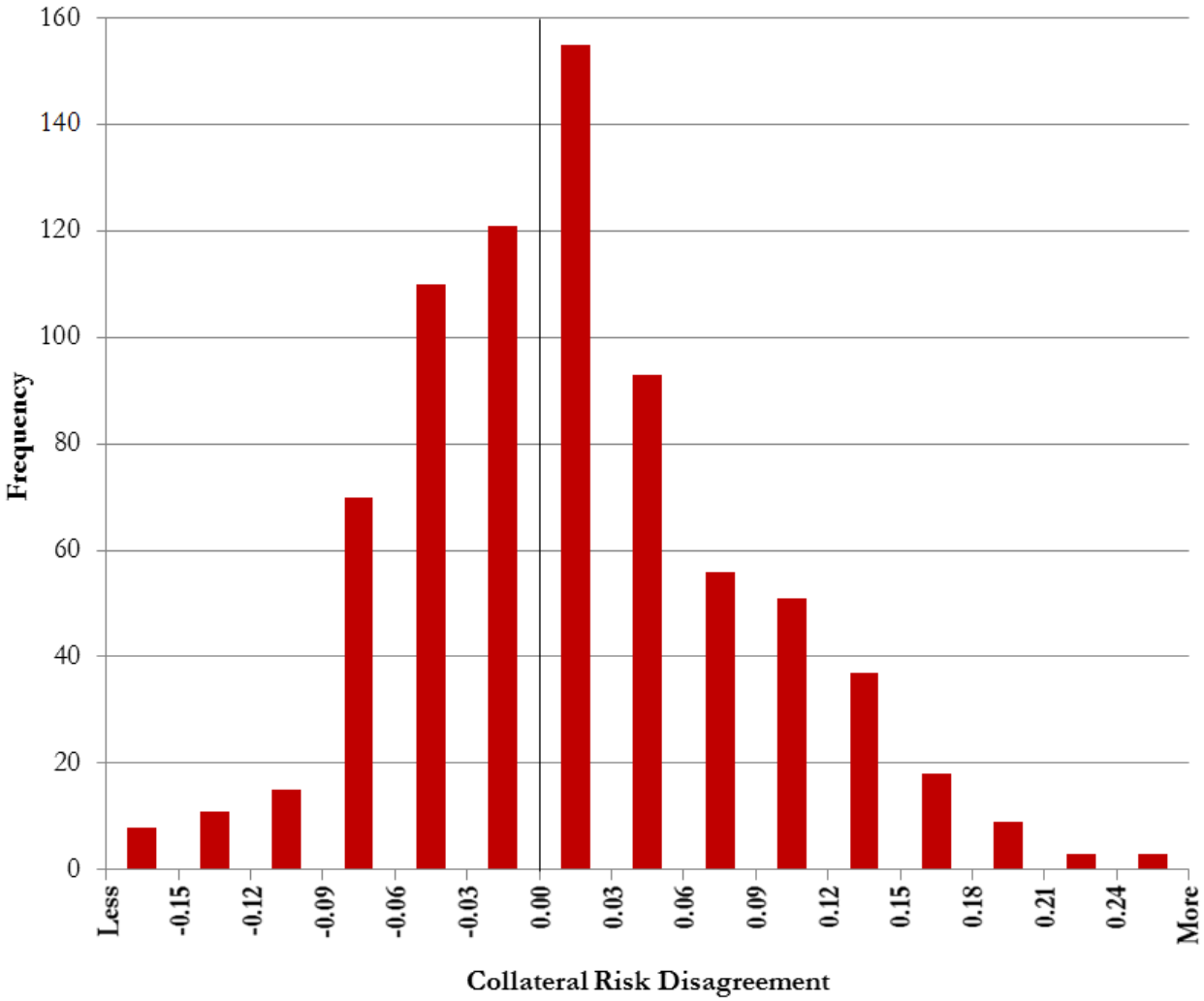


Figure 4
Collateral Risk Disagreement
This figure reports the histogram of the overall difference in underlying assumptions about collateral quality and correlation as represented by the SDR from the S&P model under S&P's assumptions minus the SDR from the S&P model under Moody's assumptions (Collateral Risk Disagreement). The WAM reported by S&P is used for both calculations.

Panel A

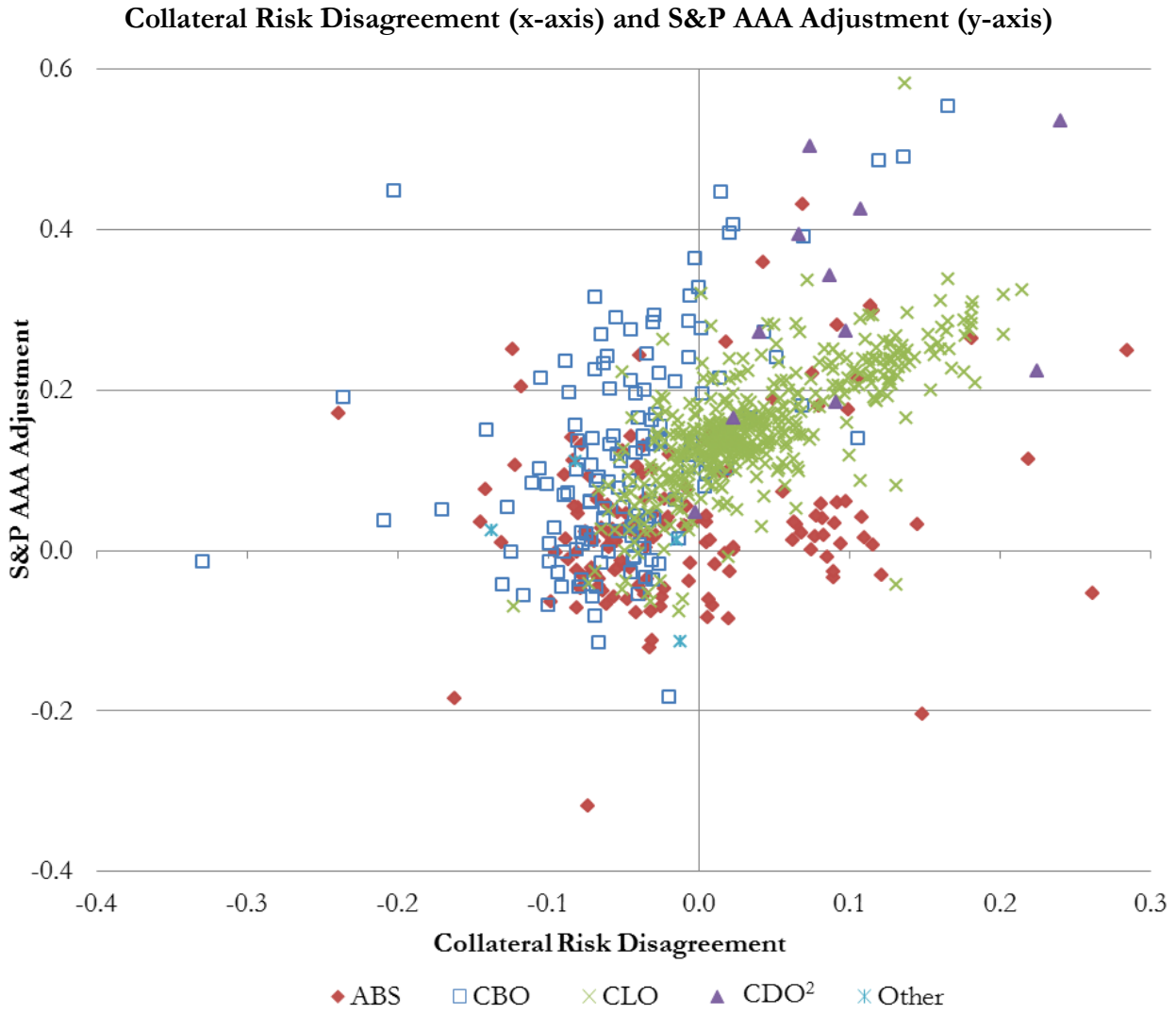


Figure 5

Panel A graphs the difference in SDRs from the S&P model under the different rating agency assumptions (Collateral Risk Disagreement) and the adjustment to the AAA size dictated by S&P reported SDR^{AAA}. The WAM reported by S&P is used to calculate the difference in SDRs. SDR^{AAA} is the SDR for the AAA scenario obtained directly from S&P's first surveillance report. Panel B graphs the difference in Moody's model implied AAA under Moody's assumptions and S&P's assumptions and Moody's adjustment to the AAA tranche size.

Panel B

Collateral Risk Disagreement (x-axis) and Moody's AAA Adjustment (y-axis).

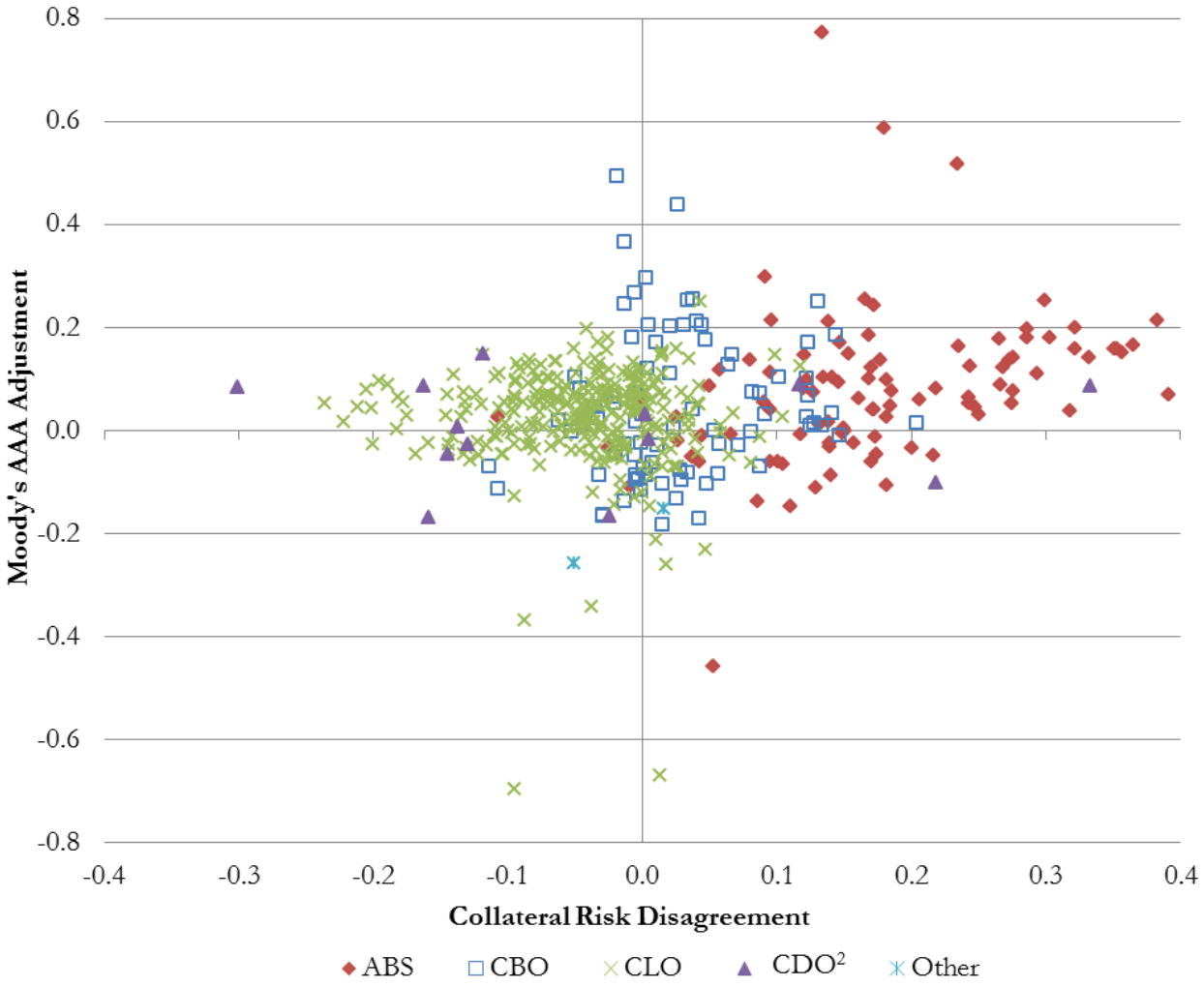


Table 1
Amount of Bloomberg CDO Universe Rated by the Rating Agencies

This table reports the ratings coverage of S&P, Moody's, and Fitch for all CDOs from January 1997 to December 2007 listed in the Bloomberg Database. Panel A reports the coverage by the three rating agencies on all AAA tranches. Only tranches that received a AAA rating by at least one rating agency are included in the sample. The first two rows are mutually exclusive groups; in addition, all remaining rows are mutually exclusive groups. Panel B reports the number of AAA tranches, total market capitalization, and percentage of tranches rated by both S&P and Moody's on a yearly basis. Panel C reports the percentage of AAA tranches that received the same rating by both S&P and Moody's. All tranches that received a AAA rating by at least one of these rating agencies were included in the analysis. Panel D reports the number of CDOs covered by Bloomberg that were rated by S&P and/or Moody's. *Both, S&P (Moody's) Favorable* denote deals that were rated by both agencies, but where S&P (Moody's) gave more tranches a AAA rating. *S&P (Moody's) Exclusive* denote deals where only S&P (Moody's) assigned ratings to the deal.

Panel A: AAA Tranche Level Rating Coverage

	Number	% Total	Capital ($B)	% Capital
Solo Rating	611	11.1	150.4	8.3
S&P	285	5.2	41.2	2.3
Moody's	300	5.4	106.8	5.9
Fitch	26	0.5	2.4	0.1
Multiple Ratings	4914	88.9	1654.5	91.7
SP & Moody's	3352	60.7	857.3	47.5
SP & Fitch	355	6.4	66.7	3.7
Moody's & Fitch	265	4.8	59.6	3.3
S&P, Moody's & Fitch	942	17.0	670.8	37.2
Total	5525	-	1804.8	-

Panel B: AAA Tranche Overlapping Rating Coverage by Year

	Total # of Tranches	Total Capital ($B)	% Tranches Rated by Both	% Capital Rated by Both
1997	20	13.0	50.0	63.4
1998	70	65.2	62.5	93.7
1999	131	43.0	75.7	89.0
2000	141	94.8	75.4	78.4
2001	178	190.5	80.5	96.3
2002	246	199.9	79.4	96.4
2003	290	140.5	76.9	92.3
2004	423	146.8	71.3	67.4
2005	590	132.6	72.2	80.3
2006	1154	259.5	83.2	88.7
2007	1051	242.3	80.4	77.6

Panel C: Degree of AAA Tranche Ratings Agreement

	Number	%	Capital ($B)	% Capital
Same Rating	4037	94.7	1462.2	96.3
S&P AAA only	192	4.5	13.2	0.9
Moody's AAA only	34	0.8	42.9	2.8

Table 1
Continued

Panel D: Universe Rated by Either S&P or Moody's						
	Total # of Deals	Both Rate Equally	Both, S&P Favorable	Both, Moody's Favorable	S&P Exclusive	Moody's Exclusive
Pre-2004	870	656	33	11	60	110
Year 2004	275	207	4	4	41	19
Year 2005	358	275	9	3	42	29
Year 2006	659	566	10	7	42	34
Year 2007	628	490	12	5	75	46
ABS	766	648	16	6	69	27
CDO²	101	82	0	0	18	1
CBO	154	119	11	1	19	4
CLO	992	842	10	5	42	93
Total	2790	2194	68	30	260	238

Table 2
Multiple Credit Ratings and Downgrades

This table reports the results of ordered logit regressions. The dependent variables are listed in the column headers. '*S&P Downgrades'* is the number of notches that the lowest tranche originally rated AAA was downgraded by S&P as of June 30, 2010. '*Moody's Downgrades'* is the number of notches that the lowest tranche originally rated AAA was downgraded by Moody's as of June 30, 2010. *'E.O.D.'* is a binary variable that takes on a value of one if the deal has issued an event of default notice, and zero otherwise. '*Worst Performance*' is a binary variable that takes on a value of one if an originally AAA rated tranche in the deal either a) holds a rating of 'C' or 'D' as of June 30, 2010 or b) has its rating withdrawn as of June 30, 2010 following sufficient downgrades to classify the deal as speculative grade. *S&P (Moody's) Exclusive* is a dummy variable that takes on a value of one on deals where only S&P (Moody's) assigned ratings to the deal. *Both, S&P (Moody's) Favorable* is a binary variable that assumes a value of one on deals that were rated by both agencies, but where S&P (Moody's) gave more tranches a AAA rating. *Fitch Rated* is a dummy variable that is set to one when Fitch rates at least one tranche in the CDO, and zero otherwise. Year 2004-2007 are dummy variables that indicate the year that the deal was originated. *'CDO²'* is a dummy variable that takes on a value of one when the security is a CDO of CDOs and zero otherwise. *'CBO'* is a dummy variable that takes on a value of one when the security is a collateralized bond obligation and zero otherwise. *'CLO'* is a dummy variable that takes on a value of one when the security is a collateralized loan obligation and zero otherwise. Reported are odds ratios with White (1980) heteroskedasticity-adjusted t-statistics are in the parentheses.

	S&P Downgrades	Moody's Downgrades	E.O.D.	Worst Performance
S&P Exclusively	0.34		0.18	0.60
	(-6.36)		(-6.79)	(-2.08)
Moody's Exclusively		0.41	0.21	0.83
		(-5.25)	(-4.61)	(-0.60)
Both, S&P Favorable	0.91	0.32	0.49	0.69
	(-0.42)	(-3.86)	(-1.76)	(-0.80)
Both, Moody's Favorable	0.45	0.51	0.28	0.48
	(-2.60)	(-2.51)	(-1.99)	(-0.98)
Fitch Rated	1.12	0.98	1.07	0.65
	(1.05)	(-0.18)	(0.51)	(-2.75)
Year 2004	11.34	11.86	4.41	4.06
	(13.23)	(14.59)	(5.81)	(4.07)
Year 2005	20.83	16.58	5.66	5.02
	(18.20)	(18.10)	(7.51)	(5.19)
Year 2006	31.92	20.16	10.98	14.36
	(21.08)	(20.33)	(12.27)	(10.27)
Year 2007	30.73	18.94	11.56	14.56
	(19.77)	(18.75)	(12.27)	(9.99)
CBO	1.83	2.65	1.48	2.28
	(2.71)	(4.87)	(1.65)	(3.51)
CLO	0.28	0.32	0.07	0.05
	(-4.98)	(-5.74)	(-3.63)	(-2.93)
CDO²	0.11	0.08	0.02	0.02
	(-21.09)	(-23.61)	(-12.73)	(-10.03)
No. Obs.	2536	2492	2790	2790
R-squared	0.131	0.129	0.319	0.284

Table 3
Multiple Credit Ratings and Downgrades of ABS CDOs

This table reports the results of ordered logit regressions for all CDOs with an underlying collateral pool comprised of ABS securities. The dependent variables are listed in the column headers. '*S&P Downgrades'* is the number of notches that the lowest tranche originally rated AAA was downgraded by S&P as of June 30, 2010. '*Moody's Downgrades'* is the number of notches that the lowest tranche originally rated AAA was downgraded by Moody's as of June 30, 2010. *'E.O.D.',* or Event of Default, is a binary variable that takes on a value of one if the deal has issued an event of default notice, and zero otherwise. '*Worst Performance*' is a binary variable that takes on a value of one if an originally AAA rated tranche in the deal either a) holds a rating of 'C' or 'D' as of June 30, 2010 or b) has its rating withdrawn as of June 30, 2010 following sufficient downgrades to classify the deal as speculative grade. *S&P (Moody's) Exclusive* is a dummy variable that takes on a value of one on deals where only S&P (Moody's) assigned ratings to the deal. *Both, S&P (Moody's) Favorable* is a binary variable that assumes a value of one on deals that were rated by both agencies, but where S&P (Moody's) gave more tranches a AAA rating. *Fitch Rated* is a dummy variable that is set to one when Fitch rates at least one tranche in the CDO, and zero otherwise. Year 2004-2007 are dummy variables that indicate the year that the deal was originated. Reported are regression coefficients with White (1980) heteroskedasticity-adjusted t-statistics are in the parentheses.

	S&P Downgrades	Moody's Downgrades	E.O.D.	Worst Performance
S&P Exclusively	0.27		0.43	0.40
	(-4.53)		(-2.46)	(-2.14)
Moody's Exclusively		0.37	0.18	1.22
		(-1.85)	(-2.65)	(0.29)
Both, S&P Favorable	0.67	0.29	0.67	1.42
	(-1.03)	(-2.15)	(-0.71)	(0.63)
Both, Moody's Favorable	1.64	3.20	0.81	3.35
	(0.52)	(1.28)	(-0.29)	(1.53)
Fitch Rated	0.52	0.37	0.59	0.49
	(-3.70)	(-5.93)	(-2.98)	(-3.46)
Year 2004	3.76	3.00	2.28	8.34
	(4.96)	(4.29)	(2.52)	(3.20)
Year 2005	5.62	5.29	2.19	6.64
	(7.77)	(7.19)	(2.61)	(2.92)
Year 2006	14.65	9.34	5.72	29.58
	(11.27)	(10.25)	(6.39)	(5.54)
Year 2007	17.18	13.14	8.68	43.95
	(10.27)	(10.01)	(7.38)	(6.09)
No. Obs.	737	688	766	766
R-squared	0.096	0.091	0.146	0.205

Table 4
Multiple Credit Ratings and Event of Default Notices

This table shows logit and probit regression results. The dependent variable is a binary variable that takes on a value of one if the deal has issued an event of default notice, and zero otherwise. Dashes, '-', denote the base case in the specification, when applicable. *'One Rater'* is a dummy variable that takes on a value of one when the deal is rated by one agency, and zero otherwise. Similarly, '*Two Raters'* and *'Three Raters*' are dummy variables that take on a value of one when the CDO is rated by 2 or 3 agencies, respectively, and zero otherwise. Year 2004-2007 are dummy variables that indicate the year that the deal was originated. '*CBO'*, '*CLO'*, and *'CDO²'* are dummy variables denoting the underlying collateral type of the CDO. Reported are odds ratios for specifications (1)-(4) and regression coefficients for specifications (5)-(8) with White (1980) heteroskedasticity-adjusted t-statistics are in the parentheses.

Dependent Variable: Event of Default Notice								
	Logit				Probit			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
One Rater	0.06	0.06			-1.46	-1.44		
	(-5.18)	(-5.31)			(-5.79)	(-5.93)		
Two Raters	1.00	-			-0.02	-		
	(-0.02)	-			(-0.25)	-		
Three Raters	-	1.00			-	0.02		
	-	(0.02)			-	(0.25)		
Only S&P			0.03	0.07			-1.91	-1.32
			(-3.64)	(-2.49)			(-4.67)	(-3.06)
Only Moody's			0.12	0.36			-1.09	-0.51
			(-3.32)	(-1.52)			(-3.46)	(-1.48)
S&P & Moody's				3.46				0.68
				(4.56)				(4.45)
Moody's & Fitch				1.10				0.12
				(0.20)				(0.47)
S&P & Fitch				-				-
				-				-
S&P, Moody's and Fitch				2.89				0.59
				(3.58)				(3.56)
Year 2004	4.46	4.46	4.52	4.55	0.81	0.81	0.82	0.82
	(5.96)	(5.96)	(6.00)	(5.89)	(5.88)	(5.88)	(5.92)	(5.81)
Year 2005	5.15	5.15	5.18	5.43	0.89	0.89	0.90	0.91
	(7.25)	(7.25)	(7.24)	(7.36)	(7.23)	(7.23)	(7.21)	(7.25)
Year 2006	11.21	11.21	11.27	10.69	1.34	1.34	1.34	1.29
	(12.45)	(12.45)	(12.35)	(12.13)	(12.96)	(12.96)	(12.85)	(12.55)
Year 2007	11.46	11.46	11.47	11.20	1.34	1.34	1.34	1.31
	(12.34)	(12.34)	(12.23)	(12.11)	(12.72)	(12.72)	(12.64)	(12.43)
CBO	0.08	0.08	0.08	0.07	-1.16	-1.16	-1.16	-1.23
	(-3.49)	(-3.49)	(-3.46)	(-3.61)	(-3.50)	(-3.50)	(-3.44)	(-3.72)
CLO	0.02	0.02	0.02	0.02	-1.95	-1.95	-1.95	-2.01
	(-12.42)	(-12.42)	(-12.43)	(-12.75)	(-14.53)	(-14.53)	(-14.63)	(-14.99)
CDO²	1.72	1.72	1.76	1.59	0.35	0.35	0.36	0.30
	(2.21)	(2.21)	(2.25)	(1.85)	(2.35)	(2.35)	(2.37)	(1.99)
No. Obs.	2790	2790	2790	2790	2790	2790	2790	2790
R-squared	0.308	0.308	0.309	0.322	0.304	0.304	0.305	0.317

Table 5
Regressing AAA Adjustment on Differences in Assumptions and Deal Characteristics

This table reports the results of OLS regressions. The dependent variable is the S&P AAA Adjustment (Panel A) and Moody's AAA Adjustment (Panel B). *'Positive (Negative) CRD'* is set equal to CRD when the value is positive (negative), and zero otherwise. *CRD,* or Collateral Risk Disagreement, is the SDR using S&P's assumptions minus the SDR using Moody's assumptions, under our version of S&P's model. *'SDR'* is the AAA SDR reported in S&P's surveillance report. *'CBO'* is a dummy variable that takes on a value of one when the security is a collateralized bond obligation and zero otherwise. *'CLO'* is a dummy variable that takes on a value of one when the security is a collateralized loan obligation and zero otherwise. *'CDO²'* is a dummy variable that takes on a value of one when the security is a CDO of CDOs and zero otherwise. *'Other'* is a dummy variable that takes on a value of one when the security is not any of the preceding types, or a ABS CDO, and zero otherwise. *'Fitch Rated'* is a dummy variable that takes on a value of one when Fitch also rated the AAA tranches and zero otherwise. *'Insured'* is a dummy variable that takes on a value of one when at least one of the AAA tranches was wrapped and zero otherwise. *'Log(Manager)'* is the log of the number of previous deals the collateral manager has been involved with. *'Log(Underwriter)'* is the log of the number of previous deals the lead underwriter has previously underwritten. *Year Controls* indicates specifications when year fixed effects were used for years 2003-2007. White (1980) heteroskedasticity-adjusted t-statistics are in the parentheses.

Panel A: S&P AAA Adjustment

	(1)	(2)	(3)	(4)	(5)	(6)
Positive CRD	0.790	0.823	0.697	0.700	0.310	0.366
	(7.40)	(7.30)	(4.75)	(4.97)	(4.17)	(3.43)
Negative CRD	0.561	0.536	0.462	0.428	0.393	0.440
	(4.16)	(3.82)	(2.75)	(2.52)	(4.11)	(3.26)
SDR					0.534	0.528
					(12.76)	(9.04)
CBO			0.082	0.081		0.004
			(4.61)	(4.32)		(0.27)
CLO			0.075	0.079		-0.003
			(7.09)	(6.94)		(-0.21)
CDO²			0.138	0.146		0.031
			(4.25)	(4.59)		(1.30)
Other			-0.063	-0.049		-0.142
			(-1.90)	(-1.51)		(-3.94)
Fitch Rated		-0.033		0.004		-0.006
		(-2.63)		(0.33)		(-0.51)
Insured		0.093		0.081		0.065
		(3.08)		(2.76)		(3.01)
Log(Manager)		-0.009		-0.008		0.002
		(-1.98)		(-1.94)		(0.55)
Log(Underwriter)		-0.003		-0.006		-0.002
		(-0.62)		(-1.40)		(-0.63)
Intercept	0.103	0.125	0.050	0.067	-0.085	-0.072
	(18.45)	(6.37)	(3.89)	(3.33)	(-6.00)	(-4.15)
Year Controls	N	N	Y	Y	N	Y
No. Obs.	724	724	724	724	724	724
R-squared	0.201	0.232	0.317	0.336	0.462	0.483

Table 5
Continued
Panel B: Moody's AAA Adjustment

	(1)	(2)	(3)	(4)	(5)	(6)
Positive CRD	0.403	0.445	0.428	0.439	0.470	0.407
	(7.69)	(8.55)	(5.92)	(5.89)	(8.37)	(5.04)
Negative CRD	-0.043	-0.061	0.069	0.079	-0.030	0.073
	(-0.49)	(-0.73)	(0.72)	(0.82)	(-0.34)	(0.75)
SDR					0.188	0.171
					(2.29)	(2.12)
CBO			0.009	-0.011		-0.042
			(0.34)	(-0.40)		(-1.44)
CLO			-0.006	-0.011		-0.040
			(-0.27)	(-0.44)		(-1.38)
CDO^2			-0.035	-0.033		-0.057
			(-0.95)	(-0.84)		(-1.42)
Other			-0.240	-0.243		-0.270
			(-4.79)	(-4.94)		(-4.95)
Fitch Rated		-0.039		-0.027		-0.030
		(-2.51)		(-1.60)		(-1.79)
Insured		0.125		0.126		0.118
		(3.34)		(3.31)		(3.34)
Log(Manager)		-0.003		-0.003		0.000
		(-0.40)		(-0.40)		(0.02)
Log(Underwriter)		0.001		-0.007		-0.005
		(0.12)		(-1.51)		(-1.14)
Intercept	0.020	0.021	0.017	0.048	-0.039	0.013
	(2.73)	(1.15)	(0.74)	(1.79)	(-1.53)	(0.43)
Year Controls	N	N	Y	Y	N	Y
No. Obs.	470	470	470	470	470	470
R-squared	0.117	0.163	0.169	0.216	0.138	0.226

Table 6
Regressing AAA Adjustment on Differences in Assumptions and Modeling Differences

This table reports the results of OLS regressions. The dependent variable is the S&P AAA Adjustment (Panel A) and Moody's AAA Adjustment (Panel B). *'Positive (Negative) CRD'* is set equal to CRD when the value is positive (negative), and zero otherwise. *CRD,* or Collateral Risk Disagreement, is the SDR using S&P's assumptions minus the SDR using Moody's assumptions, under our version of S&P's model. *'Collateral Modeling Difference'* is the collateral risk using Moody's assumptions under the Moody's model minus the collateral risk under the S&P model. *'Collateral Modeling Difference'* is the AAA size allowable using a deal's cash flow structuring under the Moody's model minus the AAA size allowable using a generic cash flow structure under the Moody's model. *'Moody's (S&P) Adjustment'* is the estimated adjustment Moody's (S&P) gave to the CDO. *'SDR'* is the AAA SDR reported in S&P's surveillance report. All other independent variables are defined in Table 5. White (1980) heteroskedasticity-adjusted t-statistics are in the parentheses.

Panel A: S&P AAA Adjustment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Positive CRD	0.927	0.842	0.843	0.487	0.872	0.336	0.586
	(9.09)	(8.95)	(8.28)	(5.41)	(8.57)	(5.15)	(6.42)
Negative CRD	1.230	1.060	0.627	0.680	1.363	0.873	0.908
	(6.27)	(7.61)	(3.74)	(5.12)	(7.27)	(6.40)	(5.29)
Collateral Modeling Difference	0.095				0.185	0.163	0.241
	(1.73)				(3.15)	(3.63)	(4.40)
Cash Flow Protection	0.117				0.460	0.319	0.372
	(0.80)				(3.53)	(3.49)	(3.53)
Moody's Adjustment		0.151	0.220	0.161	0.255	0.245	0.300
		(2.70)	(4.60)	(3.93)	(3.90)	(4.72)	(4.93)
SDR				0.523		0.560	0.408
				(12.48)		(18.29)	(7.28)
CBO			0.090	0.015			0.054
			(5.86)	(1.09)			(3.22)
CLO			0.106	0.011			0.057
			(9.04)	(0.83)			(3.05)
CDO2			0.164	0.026			0.064
			(5.41)	(1.25)			(2.01)
Other			0.003	-0.095			-0.048
			(0.11)	(-2.30)			(-1.38)
Fitch Rated			0.005	-0.009			-0.014
			(0.40)	(-0.93)			(-1.27)
Insured			0.065	0.044			0.037
			(2.47)	(2.32)			(1.90)
Log(Manager)			-0.012	-0.003			-0.003
			(-3.37)	(-1.28)			(-1.05)
Log(Underwriter)			-0.004	-0.002			0.000
			(-1.53)	(-0.72)			(0.14)
Intercept	0.106	0.104	0.04	-0.075	0.092	-0.101	-0.088
	(14.46)	(19.95)	(2.09)	(-4.70)	(12.83)	(-8.94)	(-4.48)
Year Controls	N	N	Y	Y	N	N	Y
No. Obs.	414	560	560	560	414	414	414
R-squared	0.426	0.393	0.588	0.716	0.476	0.741	0.776

Table 6
Continued
Panel B: Moody's AAA Adjustment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Positive CRD	0.573	0.568	0.502	0.510	0.657	0.653	0.606
	(8.17)	(9.88)	(4.84)	(4.79)	(9.00)	(9.04)	(6.74)
Negative CRD	-0.167	0.549	0.451	0.459	0.301	0.319	0.229
	(-1.91)	(4.74)	(4.14)	(4.37)	(2.79)	(3.05)	(2.25)
Collateral Modeling Difference	1.068				0.831	0.880	0.727
	(4.94)				(3.69)	(3.45)	(2.76)
Cash Flow Protection	-1.023				-0.874	-0.856	-0.869
	(-8.39)				(-6.82)	(-6.60)	(-6.29)
S&P's Adjustment		0.557	0.540	0.550	0.429	0.452	0.450
		(8.15)	(7.21)	(6.83)	(5.81)	(6.07)	(5.28)
SDR				-0.035		-0.060	-0.080
				(-0.39)		(-0.66)	(-0.82)
CBO			-0.035	-0.029			0.005
			(-1.29)	(-0.93)			(0.18)
CLO			-0.041	-0.035			-0.021
			(-1.43)	(-1.08)			(-0.76)
CDO2			-0.117	-0.114			-0.056
			(-2.99)	(-3.00)			(-1.58)
Other			-0.179	-0.173			-0.095
			(-5.03)	(-4.39)			(-2.42)
Fitch Rated			-0.024	-0.023			-0.027
			(-1.51)	(-1.46)			(-1.95)
Insured			0.067	0.068			0.054
			(2.38)	(2.38)			(2.11)
Log(Manager)			0.004	0.003			-0.002
			(0.58)	(0.53)			(-0.39)
Log(Underwriter)			-0.005	-0.005			-0.002
			(-1.13)	(-1.22)			(-0.62)
Intercept	0.044	-0.037	0.014	0.021	-0.005	0.011	0.043
	(5.22)	(-4.30)	(0.51)	(0.70)	(-0.49)	(0.38)	(1.38)
Year Controls	N	N	Y	Y	N	N	Y
No. Obs.	414	470	470	470	414	414	414
R-squared	0.329	0.297	0.348	0.348	0.434	0.436	0.471

Table 7
Collateral Risk Disagreement and Subsequent Disagreements in Credit Ratings

This table shows ordered probit (Panel A) and ordered logit (Panel B) regression results. The dependent variable is the number of notches an initially AAA tranche is downgraded by S&P minus the number of notches downgraded by Moody's. *'CRD'* is the SDR using S&P's assumptions minus the SDR using Moody's assumptions, under our version of S&P's model. *Shocks* represents the five dates where the most CDOs are downgraded and represents. For example, the first three occur when CDOs backed by various types of RMBS collateral are placed on credit watch or downgraded. All other variables are described in Table 5. Reported are the regression coefficients (Ordered Probit) and odds ratios (Ordered Logit) with White (1980) heteroskedasticity-adjusted z-statistics in parentheses.

Panel A: Ordered Probit Regressions

	(1)	(2)	(3)	(4)	(5)
CRD	1.46	1.425	1.503	1.891	1.557
	(2.56)	(2.41)	(2.54)	(3.13)	(2.57)
SDR		0.066	-0.018	0.008	0.003
		(0.16)	(-0.04)	(0.02)	(0.01)
ABS	-0.953	-0.943	-0.924	-0.933	-0.674
	(-6.96)	(-6.24)	(-5.26)	(-4.96)	(-3.96)
CDO^2	-0.863	-0.872	-0.869	-0.96	-0.731
	(-2.00)	(-1.98)	(-1.97)	(-2.19)	(-1.82)
ABS 2004			-0.177	-0.132	0.09
			(-0.83)	(-0.60)	(0.38)
ABS 2005			0.065	0.106	0.192
			(0.36)	(0.58)	(0.99)
ABS 2006			-0.238	-0.227	0.169
			(-1.03)	(-0.88)	(0.85)
ABS 2007			0.287	0.383	1.036
			(0.83)	(1.08)	(3.07)
Insured				-0.307	-0.287
				(-1.03)	(-1.00)
Log(Manager)				-0.031	-0.009
				(-0.71)	(-0.20)
Log(Underwriter)				-0.112	-0.116
				(-2.98)	(-3.25)
Fitch Rated				0.008	0.035
				(0.07)	(0.30)
Shocks	Y	Y	Y	Y	N
No. Obs.	706	706	706	706	706
R-squared	0.0276	0.0276	0.0283	0.0327	0.021

Table 7
Continued
Panel B: Ordered Logit Regressions

	(1)	(2)	(3)	(4)	(5)
CRD	11.635	13.295	15.199	27.81	11.189
	(2.40)	(2.53)	(2.66)	(3.17)	(2.20)
SDR		0.745	0.629	0.688	0.786
		(-0.43)	(-0.68)	(-0.53)	(-0.34)
ABS	0.195	0.186	0.185	0.182	0.321
	(-6.52)	(-6.03)	(-4.95)	(-4.68)	(-3.62)
CDO^2	0.351	0.369	0.376	0.312	0.387
	(-1.29)	(-1.20)	(-1.18)	(-1.37)	(-1.15)
ABS 2004			0.756	0.833	1.129
			(-0.69)	(-0.44)	(0.27)
ABS 2005			1.143	1.25	1.364
			(0.44)	(0.69)	(0.95)
ABS 2006			0.746	0.762	1.325
			(-0.74)	(-0.60)	(0.79)
ABS 2007			2.026	2.348	5.394
			(1.26)	(1.42)	(2.88)
Insured				0.678	0.70
				(-0.76)	(-0.72)
Log(Manager)				0.94	0.972
				(-0.79)	(-0.37)
Log(Underwriter)				0.824	0.805
				(-2.72)	(-3.27)
Fitch Rated				0.986	1.036
				(-0.08)	(0.19)
Shocks	Y	Y	Y	Y	N
No. Obs.	706	706	706	706	706
R-squared	0.0276	0.0276	0.0283	0.0327	0.021

Internet Appendix IA 1

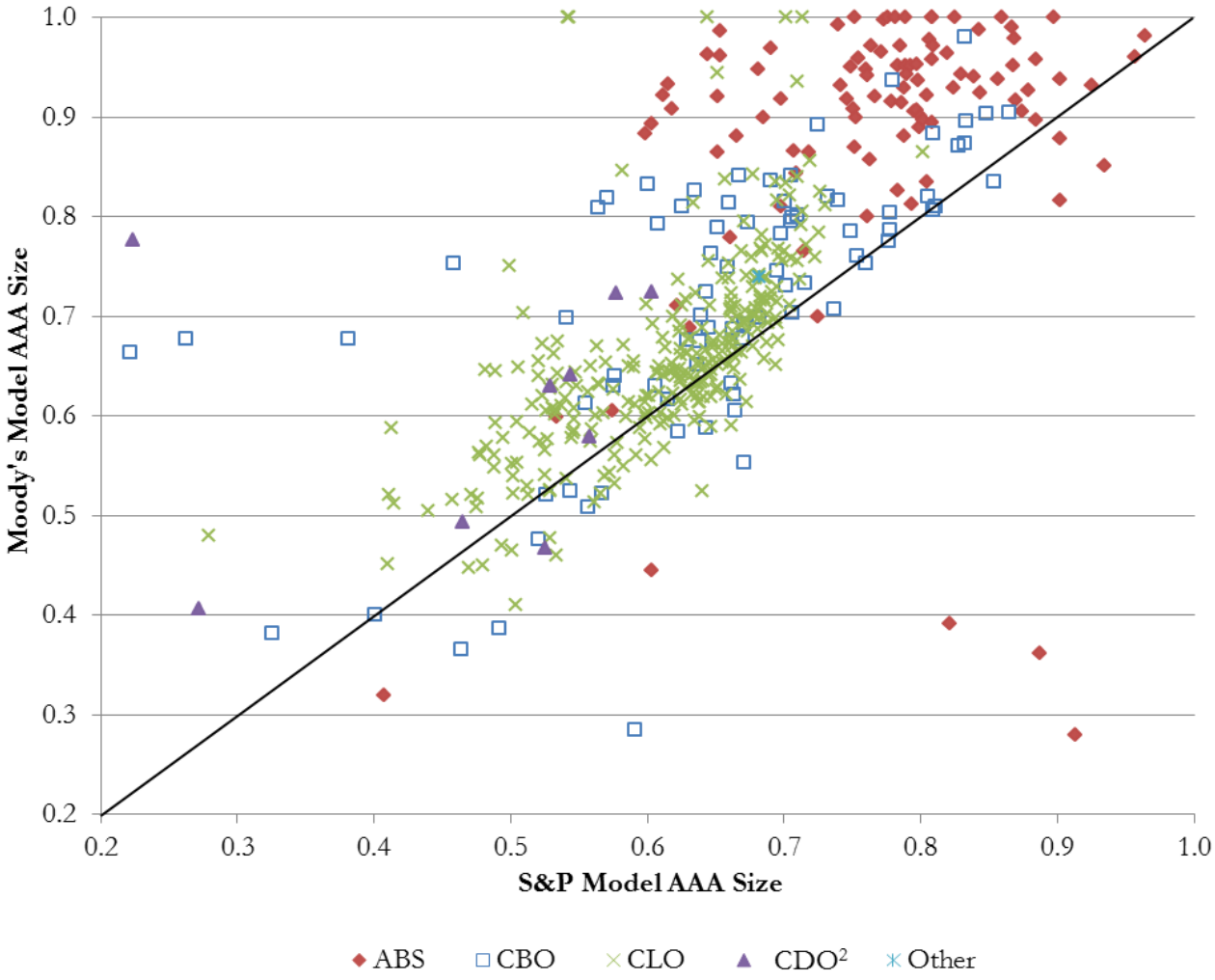


Figure IA.1
S&P Model AAA with S&P's Assumptions (x-axis) and Moody's Model AAA with Moody's Assumptions (y-axis)

This figure graphs the allowable percentage of AAA from S&P's model and Moody's model. S&P's allowable AAA is calculated using S&P's assumptions and Moody's allowable AAA is calculated using Moody's assumptions.

Table IA.1
Replication of S&P's Collateral Risk Model

Dependent Variable: S&P Reported SDR	
	(1)
Estimated SDR	1.13
	(118.34)
Intercept	-.006
	(-1.77)
No. Obs.	683
R-squared	.9536

This table reports the results of OLS regressions. The dependent is the SDR of the AAA tranches in the first surveillance report as published by S&P. *'Estimated SDR',* or Estimated Scenario Default Rate, is the SDR generated from our replication of S&P's collateral risk model. White (1980) heteroskedasticity-adjusted t-statistics are in the parentheses.

Table IA.2

Bloomberg Universe, Alternative Regression Models on CDO Performance

Panel A: Ordered Probit Regression

	S&P Downgrades	Moody's Downgrades	E.O.D.	Worst Performance
S&P Exclusively	-0.59		-0.96	-0.21
	(-6.19)		(-6.99)	(-1.54)
Moody's Exclusively		-0.47	-0.80	-0.01
		(-4.68)	(-4.45)	(-0.05)
Both, S&P Favorable	-0.02	-0.67	-0.42	-0.19
	(-0.14)	(-3.90)	(-1.87)	(-0.71)
Both, Moody's Favorable	-0.36	-0.28	-0.77	-0.43
	(-1.67)	(-1.41)	(-2.19)	(-1.11)
Fitch Rated	0.11	0.01	0.07	-0.24
	(1.90)	(0.19)	(0.94)	(-2.83)
Year 2004	1.23	1.28	0.80	0.67
	(13.47)	(14.38)	(5.70)	(4.00)
Year 2005	1.59	1.48	0.93	0.80
	(19.39)	(18.15)	(7.44)	(5.35)
Year 2006	1.86	1.62	1.31	1.38
	(23.83)	(21.92)	(12.64)	(11.51)
Year 2007	1.82	1.56	1.32	1.37
	(22.04)	(19.94)	(12.50)	(11.10)
CBO	0.39	0.62	0.24	0.46
	(3.11)	(5.67)	(1.72)	(3.34)
CLO	-0.76	-0.69	-1.22	-1.45
	(-5.80)	(-6.17)	(-3.78)	(-3.61)
CDO^2	-1.19	-1.38	-2.00	-1.86
	(-21.64)	(-24.11)	(-15.03)	(-12.20)
No. Obs.	2536	2492	2790	2790
R-squared	0.125	0.124	0.313	0.28

Table IA.2
Continued
Panel B: OLS Regression

	S&P Downgrades	Moody's Downgrades	E.O.D.	Worst Performance
S&P Exclusively	-2.84		-0.20	-0.06
	(-5.35)		(-9.48)	(-2.91)
Moody's Exclusively		-1.60	-0.12	-0.01
		(-3.24)	(-6.47)	(-0.66)
Both, S&P Favorable	-0.53	-2.88	-0.08	-0.03
	(-0.67)	(-3.43)	(-2.02)	(-0.92)
Both, Moody's Favorable	-2.99	-1.81	-0.16	-0.08
	(-2.82)	(-1.79)	(-2.90)	(-1.85)
Fitch Rated	0.73	0.79	0.01	-0.04
	(2.34)	(2.52)	(0.57)	(-2.84)
Year 2004	4.97	5.90	0.12	0.06
	(10.22)	(12.30)	(5.18)	(3.28)
Year 2005	7.47	7.45	0.15	0.08
	(17.51)	(17.80)	(7.12)	(4.70)
Year 2006	8.77	7.89	0.25	0.19
	(24.93)	(22.50)	(13.99)	(12.08)
Year 2007	8.13	7.23	0.24	0.19
	(21.88)	(19.24)	(13.78)	(11.58)
CBO	2.30	4.31	0.08	0.14
	(3.26)	(7.29)	(1.77)	(3.17)
CLO	-4.14	-5.04	-0.19	-0.13
	(-8.23)	(-11.68)	(-12.04)	(-10.51)
CDO^2	-9.58	-10.03	-0.31	-0.21
	(-37.91)	(-39.70)	(-24.39)	(-18.69)
Intercept	6.47	7.38	0.18	0.12
	(20.95)	(23.46)	(15.06)	(11.46)
No. Obs.	2536	2492	2790	2790
R-squared	0.452	0.481	0.236	0.172

This table reports the results of ordered probit (Panel A) and OLS (Panel B) regressions. The dependent variables are listed in the column headers. '*S&P Downgrades'* is the number of notches that the lowest tranche originally rated AAA was downgraded by S&P as of June 30, 2010. *'Moody's Downgrades'* is the number of notches that the lowest tranche originally rated AAA was downgraded by Moody's as of June 30, 2010. *'E.O.D.',* or Event of Default, is a binary variable that takes on a value of 1 if the deal has issued an event of default notice, and zero otherwise. '*Worst Performance*' is a binary variable that takes on a value of 1 if an originally AAA rated tranche in the deal either a) holds a rating of 'C' or 'D' as of June 30, 2010 or b) has its rating withdrawn as of June 30, 2010 following sufficient downgrades to classify the deal as speculative grade. *S&P (Moody's) Exclusive* is a dummy variable that takes on a value of 1 on deals where only S&P (Moody's) assigned ratings to the deal. *Both, S&P (Moody's) Favorable* is a binary variable that assumes a value of 1 on deals that were rated by both agencies, but where S&P (Moody's) gave more tranches a AAA rating. *Fitch Rated* is a dummy variable that is set to 1 when Fitch rates at least one tranche in the CDO, and zero

otherwise. All other variables are described in Table 5. Reported are regression coefficients with White (1980) heteroskedasticity-adjusted t-statistics are in the parentheses.

Table IA.3

Regressing S&P AAA Adjustment on Differences in Assumptions and Deal Characteristics

	(1)	(2)	(3)	(4)	(5)	(6)
Positive CRD	0.845	0.908	0.770	0.786	0.356	0.468
	(7.77)	(8.08)	(5.41)	(6.02)	(5.23)	(4.63)
Negative CRD	0.620	0.623	0.470	0.439	0.436	0.463
	(4.47)	(4.48)	(3.05)	(2.88)	(4.34)	(3.97)
SDR					0.575	0.570
					(17.41)	(12.31)
CBO			0.079	0.080		0.004
			(4.87)	(4.95)		(0.30)
CLO			0.083	0.091		0.000
			(7.78)	(8.00)		(0.01)
CDO^2			0.143	0.154		0.014
			(4.19)	(4.70)		(0.66)
Other			-0.085	-0.066		-0.144
			(-2.31)	(-2.78)		(-3.07)
Fitch Rated		-0.033		0.009		-0.004
		(-2.53)		(0.71)		(-0.39)
Insured		0.087		0.078		0.058
		(2.95)		(2.76)		(3.10)
Log(Manager)		-0.014		-0.015		-0.003
		(-3.44)		(-4.04)		(-1.06)
Log(Underwriter)		-0.004		-0.009		-0.005
		(-1.19)		(-2.77)		(-2.05)
Intercept	0.106	0.139	0.046	0.075	-0.095	-0.075
	(19.51)	(9.26)	(3.54)	(4.39)	(-7.91)	(-4.73)
Year Controls	N	N	Y	Y	N	Y
No. Obs.	643	643	643	643	643	643
R-squared	0.279	0.327	0.426	0.467	0.635	0.660

This table reports the results of OLS regressions. The dependent variable is the S&P AAA Adjustment (Panel A) and Moody's AAA Adjustment (Panel B). *'Positive (Negative) CRD'* is set equal to CRD when the value is positive (negative), and zero otherwise. *CRD,* or Collateral Risk Disagreement, is the SDR using S&P's assumptions minus the SDR using Moody's assumptions, under our version of S&P's model. *'SDR'* is the AAA SDR reported in S&P's surveillance report. *'CBO'* is a dummy variable that takes on a value of one when the security is a collateralized bond obligation and zero otherwise. *'CLO'* is a dummy variable that takes on a value of one when the security is a collateralized loan obligation and zero otherwise. *'CDO^2'* is a dummy variable that takes on a value of one when the security is a CDO of CDOs and zero otherwise. *'Other'* is a dummy variable that takes on a value of one when the security is not any of the preceding types, or a ABS CDO, and zero otherwise. *'Fitch Rated'* is a dummy variable that takes on a value of one when Fitch also rated the AAA tranches and zero otherwise. *'Insured'* is a dummy variable that takes on a value of one when at least one of the AAA tranches was wrapped and zero otherwise. *'Log(Manager)'* is the log of the number of previous deals the collateral manager has been involved with. *'Log(Underwriter)'* is the log of the number of previous deals the lead underwriter has previously underwritten. *Year Controls* indicates specifications when

year fixed effects were used for years 2003-2007. 81 additional reports lack the initial AAA scenario SDR needed to calculate the AAA adjustment and are excluded from the sample. White (1980) heteroskedasticity-adjusted t-statistics are in the parentheses.

Internet Appendix IA 2

A. Bloomberg Universe of CDOs.

For the majority of the analysis we rely on CDOs rated by both S&P and Moody's and use information reported by these two agencies as our primary data source. The biggest exception is the use of Bloomberg to gather the ratings history for the deals in our sample. In addition, we perform a broader set of analysis on all securities classified as CDOs by Bloomberg. Included in the Bloomberg data is deal level information related to each deal's characteristics as well as tranche level data including the full rating history of each agency rating the tranche. While Bloomberg contains data on a large number of securities, steps must be taken to prepare the raw information for analysis.

The first step in the cleaning process is identifying and removing any duplicate entries that relate to the same underlying CDO. Each deal in the Bloomberg universe is assigned a ticker, however there is not a one-to-one relationship between a ticker and a CDO. Instead, due to regulations and reporting requirements, CDOs are often listed under multiple tickers.[1] Luckily, the tickers are constructed in such a way that that identifying multiple tickers that correspond to the same CDO can be done quite effectively. Specifically, a CDO that is registered under two different names will have tickers that only differ in their final letter. Therefore, duplicate entries can be easily identified and removed, using the effective date and relative tranche sizes of the security as a secondary check to verify that multiple tickers do in fact represent the same deal.

After removing duplicate entries from the database, the deal level characteristics such as the year of origination and the type of underlying collateral used in the deal are gleaned from

[1] An example of this is 1888 Fund, Ltd. In Bloomberg, this CDO is represented by both GUGG 2002-1A and GUGG 2002-1X.

Bloomberg. When type information is unavailable, the data is collected by performing hand searches on the rating agency websites, matching on the issuer name and effective date reported by Bloomberg for the CDO.

Following this, we supplement the dataset with a list of Event of Default (EOD) notifications received from deal managers as reported by S&P. The report used contains a comprehensive list of all CDOs that were rated by S&P that experienced an EOD notice. This list was linked back to the previous data by searching Bloomberg for the CDO name and collecting the tickers associated with the deal. While the report contains a comprehensive list of all CDOs rated by S&P (and possible Moody's as well), it does not include CDOs that were rated by Moody's but not S&P. For the 272 deals that fall into this category, hand searches were performed on the internet to identify any EOD notices that would be posted on financial websites such as Reuters or Bloomberg, as well as press releases issued by the deal's collateral manager or underwriter. It should be noted that it is possible that not all CDOs that experienced an Event of Default notice would be caught by such a methodology. However, since only deals rated by Moody's and not S&P would be affected by such steps, any EOD notices not caught would bias against finding evidence of deals rated solely by Moody's underperforming other groups, an relationship that we still find in our sample.

Finally, when classifying deals as having the worst possible performance we rely solely on the ratings issued by Moody's and S&P. Deals which either get downgraded to the lowest possible level, are listed as being in default, or, in some cases, have their ratings withdrawn, fall into this category. However, deals which are fully paid off would also have their ratings withdrawn after the deal closes. Therefore, we require that a deal contain a AAA tranche that has been previously downgraded to speculative grade and is not upgraded back to investment grade prior to its rating being withdrawn to be considered in default, therefore placing it in the badly performing category.

B. Missing Data from a Portion the Dataset.

In our sample, the data we use is gathered almost exclusively from documents published from the rating agencies themselves. However, for a small subset of the CDOs that we study we must rely on preliminary reports that do not contain all the information needed. However, we can estimate these missing values based on the data that the rating agencies do provide.

While the surveillance reports in our sample do list the aggregate number of obligors in the underlying collateral pool, they do not contain asset level data. Beyond that, we do not have any information on the number of obligors for the 24 CDOs where the New Issue report was used as a data source. Because the sizes of the underlying assets are important when computing the correlation, we estimate the number of equal weighted assets that the pool is equivalent to using information on the loss distribution provided by S&P. The derivation for the number of assets is provided below. When comparing the estimated number of assets to the actual number reported by S&P, the two numbers exhibit a correlation of 0.85. However, the Monte Carlo simulations are not sensitive to this fact—the correlation between the model outputs when the estimated number of assets is used and when the reported number of obligors is used is 0.9807 in our sample.

C. Representative Number of Obligors

Given the variance of an asset pool, the amount of this variance that asset correlation contributes, and probability of default of the underlying assets, one can easily estimate the number of obligors that the pool should be composed of. In particular, given the probability of default for any given asset in the pool, p, and the number of assets that comprise the pool, n,the variance of the defaults in the pool will be:

$$Var(Correlated\ Asset\ Pool) = \frac{p \cdot (1-p)}{n}$$

When taking correlation of the underlying assets into consideration and using the definition of Correlation Measure, CM, provided by S&P, the variance becomes:

$$Var(Correlated\ Asset\ Pool) = \frac{p \cdot (1-p)}{n} \cdot CM^2$$

In S&P's case, they report the annualized standard deviation of the defaults for the asset pool with correlation, VM. Therefore, the variance of the pool over the life of the deal (WAM) is equivalent to:

$$Var(Correlated\ Asset\ Pool) = VM^2 \cdot WAM$$

Finally, given that the annual probability of default is reported as the Default Measure, DM, one can calculate the probability of default of the average asset in the pool as $DM \cdot WAM$ and substitute this value in for p. Therefore, setting the two equations above equal to each other, one will get that:

$$VM^2 \cdot WAM = \frac{(DM \cdot WAM) \cdot (1 - (DM \cdot WAM))}{n} \cdot CM^2$$

or alternatively, given all the other metrics, one can calculate the number of assets the underlying pool represents as:

$$n = \frac{DM \cdot (1 - DM \cdot WAM)}{VM^2} \cdot CM^2$$