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Global Methodologies And Assumptions For Corporate Cash Flow And Synthetic CDOs

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Global Methodologies And Assumptions For Corporate Cash Flow And Synthetic CDOs

*(**Editor's Note:** This version of this criteria article has been retired and is replaced by "Global Methodologies And Assumptions For Corporate Cash Flow And Synthetic CDOs," published Aug. 8, 2016.)*

1. Standard & Poor's Ratings Services is publishing its methodologies and assumptions for rating corporate cash flow and synthetic collateralized debt obligations (CDOs).
2. This criteria addresses the "credit quality of the securitized assets" principle as described in "Principles Of Credit Ratings," published Feb. 16, 2011.

SCOPE OF THE CRITERIA

3. This article concerns cash flow CDOs backed by corporate debt (loans and bonds) and synthetic CDOs that reference pools of corporate obligations. It also applies to CDO transactions that are backed by corporate assets consisting of a mix of cash and synthetic instruments. Additionally, it is relevant for CDOs of corporate CDOs, CDOs of hybrid trust preferred securities (TruPS), and CDOs backed by sovereign securities. For ease of reference, we refer to these transactions as "corporate CDOs."
4. These criteria do not cover CDOs of structured finance securities, CDOs of mixed pools of corporate and structured finance securities that have very small concentrations of corporate debt, CDOs of municipal debt, market value CDOs, and structured counterparties.
5. These criteria apply to all new and existing corporate CDO transactions that contain well-diversified pools of corporate credits and have fairly uniform exposure to all the credits. Exposure refers to a number of parameters affecting the potential performance of the asset portfolio, including asset size, rating distribution, spread/premium distribution, and recovery prospects.
6. We believe that, in most cases, these criteria address the objectives discussed in paragraph 5. However, particular transactions may call for additional types of stress testing and analysis--for example, novel or unusual transactions that contain concentrated or "bar-belled" asset portfolios. We may apply these criteria as a starting point for our analysis and will likely make specific modifications or apply additional stresses according to our evaluation of the structure and the associated credit risks.
7. Our primary focus is not on any individual input assumption or stress test, but rather on the combination of assumptions and stresses that, in our opinion, would generate an appropriate targeted level of credit protection against future defaults.
8. We believe that quantitative and qualitative elements in our analysis--apart from the Monte Carlo default simulations run in Standard & Poor's CDO Evaluator--provide a more robust analysis than using only simulation models. We also

believe that by calibrating CDO Evaluator to specific "targeted portfolio default rates," we have made it easier and more transparent for investors to understand our ratings and analysis and to relate them to their investment objectives.

9. In summary, the criteria include:

- Quantitative and qualitative tests, including certain stress tests, concentration limits, and minimum capital (equity) levels;
- Targeted 'AAA' default rates that we consider are commensurate with conditions of extreme macroeconomic stress, such as, for example, the Great Depression (see "Understanding Standard & Poor's Rating Definitions");
- Targeted corporate 'BBB' default rates consistent with the highest actual corporate defaults that have occurred since 1981;
- Tiering of recoveries;
- Recovery assumptions based on the expected stress levels for CDO tranches, commensurate with their ratings;
- Cash flow stress parameters, such as the starting time of defaults and tranche break-even default rate (BDR) analysis;
- Credit stability as a consideration in our CDO analysis; and
- Sensitivity to modeling parameters as a consideration in our CDO analysis.

10. In considering a proposed rating for a particular tranche, we look to see whether it passes (i) all applicable supplemental tests, such as concentration limits and minimum equity, (ii) the standard CDO Evaluator tests, and, if applicable, (iii) the cash flow stresses. Any of these three analyses may constrain the tranche's rating.

11. Additionally, the criteria include the calibration of our CDO Evaluator model to specific targeted stressed default scenarios at each of our rating categories. The criteria also include the asset default rates, correlation, and other model parameters to produce asset portfolio default results for 'AAA' rated CDO tranches that reflect conditions that we consider to be of extreme stress, such as, for example, the Great Depression. Like other securities in the 'AAA' rating category, we believe 'AAA' rated corporate CDO tranches should be able to withstand extreme macroeconomic stress without defaulting.

12. Finally, the criteria include a scenario analysis to test what effects changes in key portfolio parameters (correlation, recovery, spreads, and default bias) would have on tranche ratings. This aspect of the criteria is intended to further address the issue of credit stability (see "General Criteria: Standard & Poor's To Explicitly Recognize Credit Stability As An Important Rating Factor," published Oct. 15, 2008) by identifying CDO tranches that exhibit a greater-than-expected effect from parameters other than asset defaults.

IMPACT OF 2015 CRITERIA UPDATE ON OUTSTANDING RATINGS

13. We expect minimal impact on the ratings of our existing transactions. Subordinate tranches from some earlier vintage CLO transactions may see upgrades if the ratings were lowered under the prior supplemental test approach.

EFFECTIVE DATE AND TRANSITION

14. These criteria become effective Sept. 30, 2015 for all new and outstanding corporate CDO transactions.

METHODOLOGY AND ASSUMPTIONS

Supplemental Stress Tests

15. The criteria include supplemental tests intended to address both event risk and model risk that may be present in rated transactions.

16. ***The first test is a "largest obligor default test."*** This test assesses whether a CDO tranche has sufficient credit enhancement to withstand specified combinations of underlying asset defaults based on the ratings on the underlying assets, with a flat recovery of 5%. For sovereign assets, the recovery rate used to calculate the largest obligor default test is 25%.

17. ***The second test is a "largest industry default test."*** This test consists of two parts: the "primary largest industry default test" and the "alternative largest industry default test." Together, they assess whether a CDO tranche rated 'AAA', 'AA+', 'AA', or 'AA-' has sufficient credit enhancement to withstand the default of all obligors in the transaction's largest industry, with a flat recovery of 17%, or otherwise meet an alternative largest industry default test. Either of the tests may be a limiting factor for our rating on a CDO tranche. The largest industry default test does not apply to sovereign assets.

Applicability of the supplemental tests

18. Typically, we run all applicable tests when assessing the rating on a CDO tranche. For example, in considering a proposed 'AAA' rating, we assess whether the CDO tranche has sufficient credit enhancement to pass the supplemental tests and meet the standards associated with CDO Evaluator and the relevant cash flow stresses.

19. Exceptional circumstances may warrant an adjustment of these supplemental tests. For example, it is possible that small CDO tranche balances and expected tranche amortization profiles may call for the use of alternative supplemental tests. For these tests we use the same obligor ratings that we use in CDO Evaluator. For ease of implementation and transparency, we have programmed these tests into CDO Evaluator. The tests are separate and distinct from the Monte Carlo simulation of defaults and, as such, we refer to them as supplemental tests.

Largest obligor default test

Table 1

Largest Obligor Default Test

Event risk test: Survive a number of defaults with 5% recoveries

	CDO liability rating*						
Obligor rating	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**
'AAA' to 'CCC-'	2	1	-	-	-	-	-
'AA' to 'CCC-'	3	2	1	-	-	-	-
'A' to 'CCC-'	4	3	2	1	-	-	-
'BBB' to 'CCC-'	6	4	3	2	1	-	-
'BB' to 'CCC-'	8	6	4	3	2	1	-
'B' to 'CCC-'	10	8	6	4	3	2	1

Table 1

Largest Obligor Default Test (cont.)

Event risk test: Survive a number of defaults with 5% recoveries

	CDO liability rating*						
Obligor rating	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**
'CCC' to 'CCC-'	12	10	8	6	4	3	2

*In all tables used throughout this article, unless otherwise noted, CDO tranche or liability rating categories below 'AAA' include rating subcategories, e.g., the 'AA' column also applies to CDO tranches rated 'AA+' and 'AA-'.

20. For example, under our criteria, a 'AAA' rated tranche should have sufficient credit enhancement to survive the highest level of losses associated with the defaults of each of the following combinations of underlying obligors, assuming 5% recovery (for sovereign assets, the recovery rate used for the purpose of this test is 25%):

- The two largest obligors rated between 'AAA' and 'CCC-';
- The three largest obligors rated between 'AA+' and 'CCC-';
- The four largest obligors rated between 'A+' and 'CCC-';
- The six largest obligors rated between 'BBB+' and 'CCC-';
- The eight largest obligors rated between 'BB+' and 'CCC-';
- The 10 largest obligors rated between 'B+' and 'CCC-'; and
- The 12 largest obligors rated between 'CCC+' and 'CCC-'.

21. For transactions that employ excess spread, we typically apply this test by running our cash flow modeling using the forward interest rate curve, including the highest of the losses from the largest obligor default test net of their respective recoveries. We deem the test to have passed if cash flows show that the tranche that is subject to the test receives timely interest and ultimate principal payments.

22. For transactions that allocate principal pro rata, the default rate derived from the application of the largest obligor or industry tests may be applied at different times during the life of the transaction on a prospective basis.

23. For transactions that do not employ excess spread, such as synthetic CDOs, we consider whether the attachment point is set sufficiently high to allow the highest losses from the obligor test without breaching the rated tranche's loss attachment point.

24. For this test, the criteria deem all assets rated below 'CCC-' and still included in the CDO asset pool to be defaulted. Also, under these criteria, the value we assume for defaulted assets already held by the CDO is the lower of the recovery value shown in table 10, or in table 12 if the assets have a recovery rating, or the current market value. For defaulted synthetic reference obligors, the value we assume is the respective recovery value shown in table 10 until the actual recoveries are determined through the International Swaps and Derivatives Association (ISDA) protocol or the applicable valuation mechanism detailed in the transaction's documents. If the transaction documents specify fixed recoveries, we use the fixed recovery amounts.

25. If looking at a 'BBB' tranche rating, the tranche should have sufficient credit enhancement to survive the highest losses associated with the defaults of each of the following combinations of underlying obligors, assuming 5% recovery:

- The largest obligor rated between 'A+' and 'CCC-';

- The two largest obligors rated between 'BBB+' and 'CCC-';
- The three largest obligors rated between 'BB+' and 'CCC-';
- The four largest obligors rated between 'B+' and 'CCC-'; and
- The six largest obligors rated between 'CCC+' and 'CCC-'.

26. We would treat as defaulted any assets rated below 'CCC-' as described in paragraph 30 (in the 'AAA' test) for all tranche ratings.

27. Because this test specifically attempts to capture event risk not addressed by the Monte Carlo default simulation in CDO Evaluator, we have deliberately included defaults of assets rated higher than the issuer's target rating on a CDO tranche. The larger the numbers of assets, the more likely it is that defaults of highly rated assets may occur. This test applies to transactions that had actual asset pools purchased at closing, as well as transactions with proposed asset pools that ramp up--or acquire new assets--after closing. Appendix A presents an example of how this test works.

28. In these criteria, the term "obligor" includes entities to which the CDO has direct exposure either (i) in the asset pool or (ii) as a third party. Direct third-party risk may exist where a default by a third party could cause a CDO to suffer a direct loss. For example, a CDO might allow 5% loan participations with a financial intermediary where the intermediary is not obligated to post collateral or replace itself on a rating downgrade. In participations, the intermediary retains the legal title to the subject loan, but transfers an economic interest to the CDO. In this case, the criteria treat the entire 5% to be an exposure to one obligor, because if the intermediary defaults, the CDO's rights in the loan could be impaired.

29. The criteria apply the same treatment to similar types of exposures, including unhedged or unmodeled emerging markets sovereign risk, uncollateralized securities lending, and any other risks where an intermediary's default could impair the performance of the asset or the CDO's rights in the asset. If, in our view, the trustees' information on how much direct third-party exposure exists in the portfolio isn't clear, we ask the trustee and the collateral manager for this information. If this is not provided, we use the maximum concentrations allowed as per the transaction documents.

Largest industry default test

30. Corporate CDO tranches rated 'AAA' or 'AA' should be able to withstand the default of all obligors in the largest single industry in the asset pool with 17% recoveries. For this test we use the same industry classification as used in CDO Evaluator. For example, assume a transaction has a 12% concentration in the largest industry. Under the test, a tranche rated 'AAA', 'AA+', 'AA', or 'AA-' in such a transaction should have sufficient credit enhancement to survive the default of 9.96% (12% industry concentration * [1-17% recovery]) of the asset pool. This is even if the CDO Evaluator simulation model indicates that a lower level of credit enhancement would be sufficient.

31. The 17% assumption is the same recovery we assign to senior secured debt from Group 4 countries (see the "Asset Recovery Assumptions" section later in this article). This test applies a higher recovery assumption than the largest obligor default test because recoveries across a whole industry imply an averaging effect. So, industrywide recoveries are necessarily higher than the lowest recovery within the group.

32. Although defaults of all companies in a given industry would be extremely unlikely, that is not relevant for the test in CDOs. It is important to highlight that actual CDO transactions do not have exposures to all the companies from any given industry, but rather just to a more concentrated subset of companies from each industry. Thus, it is within the

realm of possibility that when an industry experiences stress, all the members of that industry represented in a given CDO may face higher stresses.

33. The mechanics of this analysis are the same as for the largest obligor default test. We consider whether there are sufficient assets remaining to support the rated tranches once we apply the largest industry default test and recoveries from this test.

34. However, we may still assign a rating of 'AAA' or 'AA' to a tranche even though it fails the primary largest industry test, if it passes the following alternative largest industry default test. A 'AAA' rated tranche should have sufficient credit enhancement to survive the highest level of losses associated with the defaults of each of the following combinations of underlying assets within each industry, assuming a 5% recovery:

- The four largest obligors rated between 'AAA' and 'CCC-';
- The six largest obligors rated between 'AA+' and 'CCC-';
- The eight largest obligors rated between 'A+' and 'CCC-';
- The 12 largest obligors rated between 'BBB+' and 'CCC-';
- The 16 largest obligors rated between 'BB+' and 'CCC-';
- The 20 largest obligors rated between 'B+' and 'CCC-'; and
- The 24 largest obligors rated between 'CCC+' and 'CCC-'.

35. A 'AA' rated tranche should have sufficient credit enhancement to survive the highest level of losses associated with the defaults of each of the following combinations of underlying assets within each industry, assuming a 5% recovery:

- The two largest obligors rated between 'AAA' and 'CCC-';
- The four largest obligors rated between 'AA+' and 'CCC-';
- The six largest obligors rated between 'A+' and 'CCC-';
- The eight largest obligors rated between 'BBB+' and 'CCC-';
- The 12 largest obligors rated between 'BB+' and 'CCC-';
- The 16 largest obligors rated between 'B+' and 'CCC-'; and
- The 20 largest obligors rated between 'CCC+' and 'CCC-'.

36. The alternative industry test is an adaptation of the largest obligor default test. It is intended to capture gradations of obligor credit quality while applying somewhat higher default intensity than the largest obligor test.

37. The largest industry test is not applicable to CDOs of hybrid trust preferred securities. Even though these securities use corporate asset default rates for the underlying assets, for the purposes of our criteria, they may be viewed as a single industry. In such transactions, we address the industry risk as explained in "Global Methodology For Rating Trust Preferred/Hybrid Securities Revised," published Nov. 21, 2008. Also, for sovereign securities, the largest industry default test does not apply.

38. (For additional examples relating to the largest obligor and industry tests, see Appendix A.)

CDO Evaluator Calibration

Background

39. The criteria embody a calibration of the Monte Carlo default simulation in CDO Evaluator, which is intended to reduce the limitations associated with calibrating the model based solely on historical data. We believe that the model reflects our views of the expected defaults under different levels of stress, commensurate with our ratings definitions. Additionally, the experience of the 2008-2009 financial disruptions has highlighted the value of employing analytical tools in addition to Gaussian copula models (see "How A Formula Ignited Market That Burned Some Big Investors," M. Whitehouse, Wall Street Journal, p. A1 (Sept. 12, 2005) (http://www.nowandfutures.com/download/credit_default_swaps_WSJ_news20050912.pdf) and "Testing The Gaussian Copula Hypothesis For Financial Assets Dependences," Y. Malevergne and D. Sornette, University of California (Nov. 16, 2001) (https://hal.inria.fr/hal-00520539/document). We are sensitive to the possibility that any model may not fully capture real-world dynamics as it transforms input variables into outputs, especially since individual CDOs contain only a subset of the obligors from the rated corporate universe. In the process of moving from inputs to outputs, a model can lose some realism because of its imperfect ability to reproduce the nuance of the real world. As such, in deciding to continue to use such a model in our corporate CDO analysis, we focused on recalibrating the CDO Evaluator model to produce output results as close as possible to our view of what the real-world results would likely be at each rating stress level.

40. The actual process of calibrating CDO Evaluator, therefore, started with the construction of a table of minimum targeted portfolio default rates that 'AAA' rated CDO tranches should, in our opinion, be able to withstand over various time horizons, supported by underlying pools of assets of uniform credit quality and having the widest possible diversification. The table of targeted portfolio default rates functions as the desired output of the model. As such, it also influences some level of adjustments to the model inputs beyond the historically observed parameters. By allowing us to adjust input values that produce the targeted results through the Gaussian copula framework, we reduce the dependence of our analysis on the modeled inputs. The output expresses our view of likely outcome, regardless of the modeling framework. Before discussing the calibration, it is important to highlight that we do not ascribe "default probabilities" to each rating category. Rather, our credit ratings express a relative ranking of creditworthiness and may encompass not only relative likelihood of default but also payment priorities, recoveries, credit stability, and additional stress factors. However, for modeling purposes, we sometimes use the somewhat artificial and simplifying assumption that each rating category has a specific associated default probability.

41. The first consideration in establishing the targeted default table was an analysis of Standard & Poor's CreditPro database of corporate defaults since 1981 (see Appendix D for an explanation of the methodology used to compute defaults). From the CreditPro database (for the U.S., Canada, Western Europe, Australia, and New Zealand), we extracted the maximum observed default rates for different rating categories over varying time horizons (see table 2). Comparing the default rates of corporate credits rated in different rating categories, according to our CreditPro data, we observed that 'BBB' has historically been the cusp category: Corporate obligations rated lower had much higher default rates and those rated higher had significantly lower default rates. We also noted two distinct waves of default of 'BBB' rated corporate credits, one in the wake of the 1982 recession and one in the wake of the early 2000s tech bubble

and corporate governance scandals. Accordingly, we concluded that for corporate credits, the worst observed performance since 1981 generally represents a 'BBB' level of stress for the purposes of our CDO criteria, meaning that, in general, we expect 'BBB' rated CDO issuers or issues to withstand this stress without defaulting.

42. This is consistent with our view of corresponding stress levels across different recessions and financial crises. Since the early 1980s, there have been the 1982 recession in the U.S., the 1989 Japanese bubble, the early 1990s U.K. recession, and the early 1990s Nordic banking crisis, each of which, in our view, is generally commensurate with a 'BBB' stress level for corporate CDOs (see "Understanding Standard & Poor's Rating Definitions" for additional details). Therefore, our targeted default table for the 'A' stress would have to reflect somewhat higher default rates, one for the 'AA' stress would have to reflect substantially higher default rates, and one for the 'AAA' stress would have to reflect still higher default rates than observed since 1981. While for corporate CDOs we view the worst observed corporate default levels as representing a 'BBB' stress, we note that other asset classes may have experienced different levels of stress during the same time frame.

Table 2

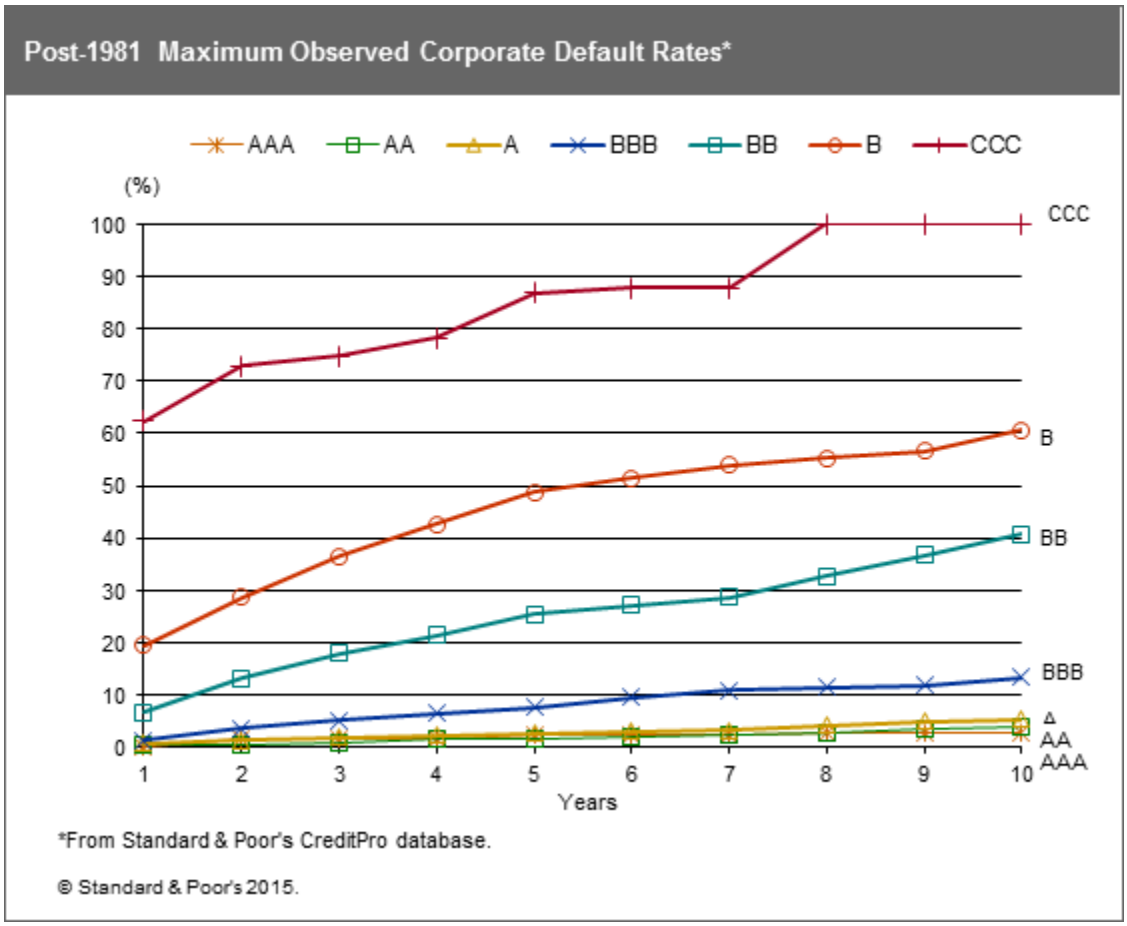
Post-1981 Maximum Observed Corporate Default Rates*

(%)

	CreditPro asset pool ratings						
Year	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**
1	0.0	0.4	0.7	1.4	6.6	19.5	62.3
2	1.4	0.6	1.3	3.5	13.1	28.7	73.0
3	1.4	0.9	1.8	5.2	17.9	36.5	74.8
4	1.5	1.4	2.2	6.5	21.4	42.6	78.3
5	2.2	1.7	2.7	7.7	25.4	48.7	86.9
6	2.2	2.1	3.1	9.5	27.2	51.5	87.8
7	2.4	2.5	3.2	10.8	28.7	54.0	87.8
8	2.7	2.8	4.1	11.4	32.7	55.4	100.0
9	2.7	3.5	5.0	11.8	36.7	56.7	100.0
10	2.7	3.7	5.3	13.4	40.7	60.7	100.0

*From Standard & Poor's CreditPro database.

Chart 1



43. Examination of the post-1981 maxima reveals clustering of observed default rates for assets rated in the three highest rating levels (see chart 1). This could be explained by the fact that economic stress never reached a sufficient level in the post-1981 period for credit quality differences among corporate assets rated in those higher rating levels to become manifest. In addition, although the default rates for 'BBB' rated corporate assets are somewhat higher, the separation appears slight compared with the default rates for the lower rating categories. If the historical stress was more severe, we would expect to see more separation related to 'BBB' corporate defaults.

44. Next, as additional points of reference, we considered historical studies of bond defaults from earlier periods. These studies naturally reported higher default rates during earlier times of greater stress, such as during the Great Depression and around the time of World War I. For example, Hickman (1958) reported four-year default rates for bonds rated in each of the top four rating categories (see table 3).

Table 3

Four-Year Default Rates For Corporate Bonds Rated In The Top Four Rating Categories

(%)

Category	I	II	III	IV
1912-15	3.8	2.7	15.8	13.1

Table 3

Four-Year Default Rates For Corporate Bonds Rated In The Top Four Rating Categories (cont.)				
1916-19	0.0	1.7	1.9	9.7
1920-23	0.0	0.0	4.0	0.0
1924-27	1.7	0.0	0.0	1.8
1928-31	0.0	0.2	0.3	3.6
1932-35	0.5	0.1	8.4	10.5
1936-39	0.0	2.2	4.6	5.1
1940-43	0.0	0.0	0.0	0.7
-	-	-	-	-
1920-27	0.9	0.0	3.7	6.3
1920-31	0.0	0.1	2.6	4.7
1920-39	2.3	2.0	8.0	8.8
1924-39	2.0	2.8	4.3	4.7
1928-39	2.7	4.1	6.1	8.6
1932-39	0.2	1.4	6.8	10.6

Source: Hickman, B.W., Corporate Bond Quality and Investor Experience, National Bureau of Economic Research, Princeton U. Press, p. 190 (1958) (http://www.nber.org/books/hick58-1).

From special tabulations of the National Bureau of Economic Research: par-amount data for large issuers in the periodic experience sample. Default rates for other than four-year periods are reduced to quadrennial basis: e.g., one-half of the default rated from 1920-1927 was entered for that period.

Categories I through IV correspond to median agency ratings coded as follows

Category	Standard Statistics	Poor's	Moody's	Fitch
I	A1+	A**	Aaa	AAA
II	A1	A*	Aa	AA
III	A	A	A	A
IV	B1+	B**	Baa	BBB

45. Because our default studies are based on issuer counts, while Hickman's calculations are based on par amounts, there are inherent limits on how precisely one can compare the two in comparing performance over time. In addition, for much of the period that Hickman's study covers, the asset mix was quite different than in the current market, with railroad bonds comprising a large share of the subject population in the Hickman study. The concentration in railroads was a reflection of that industry's prominence in the overall national economy and not an accident of adverse selection. Nevertheless, Hickman's study remains, in our opinion, the most illuminating view of corporate credit default performance during the first half of the 20th century, and serves as one of our key reference points in calibrating CDO Evaluator.

46. Hickman also compared four-year default rates of investment-grade and speculative-grade corporate bonds and, years later, Moody's reported analogous findings based on its own data (see table 4). Equipped with the post-1981 CreditPro data and studies of defaults from earlier periods to serve as reference points, we started to construct an initial table of minimum targeted portfolio default rates that 'AAA' rated CDO tranches should, in our view, be able to withstand.

Table 4

Four-Year Default Rates: Hickman Vs. Moody's

(%)

	Investment-grade		Speculative-grade	
Year	**Hickman**	**Moody's**	**Hickman**	**Moody's**
1912-15	7.0	N/A	49.3	N/A
1916-19	3.4	N/A	21.6	N/A
1920-23	1.0	1.5	18.2	7.9
1924-27	1.1	1.9	23.5	11.6
1928-31	1.4	2.0	22.6	13.6
1932-35	6.2	11.3	48.9	33.9
1936-39	3.3	2.8	21.7	9.9
1940-43	0.4	0.6	8.9	5.4

Sources: Hickman, B.W., Corporate Bond Quality and Investor Experience, National Bureau of Economic Research, Princeton U. Press, p. 189 (1958) (http://www.nber.org/books/hick58-1); Carty, L. and Lieberman, D., Historical Default Rates of Corporate Bond Issuers, 1920-1996, Moody's research report, p. 10 (Jan 1997). N/A-Not available.

47. In constructing our targeted default table, we applied a few basic guidelines, or conditions, that are consistent with our rating framework. We required that cumulative default rates increase as a function of the time horizon because bonds that have defaulted in earlier periods continue to be counted in the default rate over longer time horizons. Also, we wanted the progression of default rates from one rating category to the next to follow a sensible progression, with meaningful differences between adjacent rating categories.

48. The spacing of default rates between adjacent rating categories was a very important issue in our analysis. We believe that there should be meaningful differences between the default rates associated with adjacent rating categories at each time horizon. We decided to retain this requirement despite some very apparent anomalies in the historical data for bonds rated in the 'A' and 'BBB' categories. To do otherwise would amount to distorting the calibration exercise by overemphasizing the difference in creditworthiness associated with certain pairs of adjacent rating categories (e.g., 'BB' and 'BBB') while underemphasizing the difference in creditworthiness associated with other pairs (e.g., 'BBB' and 'A').

49. We started the table of minimum targeted portfolio default rates that 'AAA' rated CDO tranches are intended to withstand by first focusing on the three-year time horizon (see table 5).

Table 5

Targeted Minimum Corporate Asset Default Rates For 'AAA' Rated CDO Tranches

Time horizon (years)	AAA	AA	A	BBB	BB	B	CCC
1							
2							
3	$d_{3,AAA}$	$d_{3,AA}$	$d_{3,A}$	$d_{3,BBB}$	$d_{3,BB}$	$d_{3,B}$	$d_{3,CCC}$
4							
5							

50. By using post-1981 CreditPro data as a reference (see table 2), we wanted to find default values for differently rated asset pools so that:

$d_{3,AAA}$>>1.4%, $d_{3,AA}$>>0.7%, $d_{3,A}$>>2.1%, $d_{3,BBB}$>>5.1%, $d_{3,BB}$>>17.6%, $d_{3,B}$>>36.6%, and $d_{3,CCC}$>>72.6%.

('AAA' asset defaults for three years have to be significantly greater than 1.4%, etc.)

51. However, notwithstanding that the CreditPro data reported a maximum three-year default rate for 'AAA' rated bonds that was actually higher than the three-year default rate for 'AA' rated bonds, we determined that:

$d_{3,AA}$>$d_{3,AAA}$

52. Next, we expanded along the columns from the starting row. We compared default rates in adjacent rows and columns, and adjusted (and readjusted) them to promote smooth progressions across the underlying asset rating categories and over different time horizons.

53. We preserved the roughly geometric progression across the rating categories displayed in the CreditPro data (subject, of course, to an upper limit of 100%). However, we imposed increased differentiation among the rating categories at the higher end of the rating scale. We implicitly rejected an arithmetic progression because, we believe, it would have produced unreasonably high targeted portfolio default rates for underlying assets in the rating categories just below 'AAA'. Table 6 shows the results of our targeted default rates for corporate assets for 'AAA' rated CDO tranches.

Table 6

Minimum Targeted Portfolio Default Rates For 'AAA' Rated CDO Tranches*

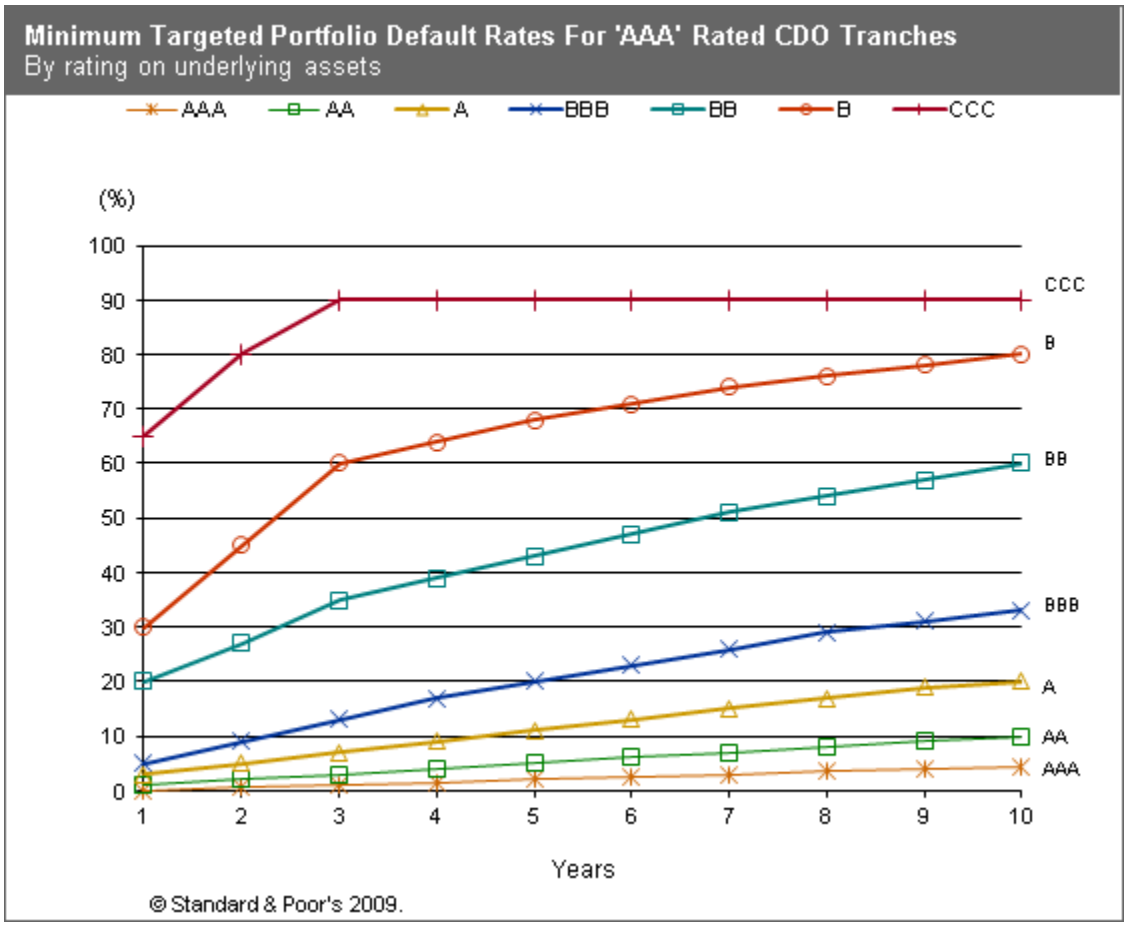
(%)

Weighted-average life of assets (years)	AAA	AA	A	BBB	BB	B	CCC
1	0.1	1.0	3.0	5.0	20.0	30.0	65.0
2	0.5	2.0	5.0	9.0	27.0	45.0	80.0
3	1.0	3.0	7.0	13.0	35.0	60.0	90.0
4	1.5	4.0	9.0	17.0	39.0	64.0	90.0
5	2.0	5.0	11.0	20.0	43.0	68.0	90.0
6	2.5	6.0	13.0	23.0	47.0	71.0	90.0
7	3.0	7.0	15.0	26.0	51.0	74.0	90.0
8	3.5	8.0	17.0	29.0	54.0	76.0	90.0
9	4.0	9.0	19.0	31.0	57.0	78.0	90.0
10	4.5	10.0	20.0	33.0	60.0	80.0	90.0

*The value in each cell reflects the targeted minimum default rate for a CDO tranche to be rated 'AAA', assuming (i) that the underlying asset pool has the best possible diversification, (ii) that the pool is composed entirely of assets rated at the level in the header row, and (iii) the asset pool's weighted-average life indicated in the left-most column. There are important relationships among all the cells in the table: The value in each cell is greater than the value in the cell above, lower than the value in the cell below, greater than the value in the cell to the left, and lower than the value in the cell to the right.

54. The values in table 6 can be represented graphically as follows.

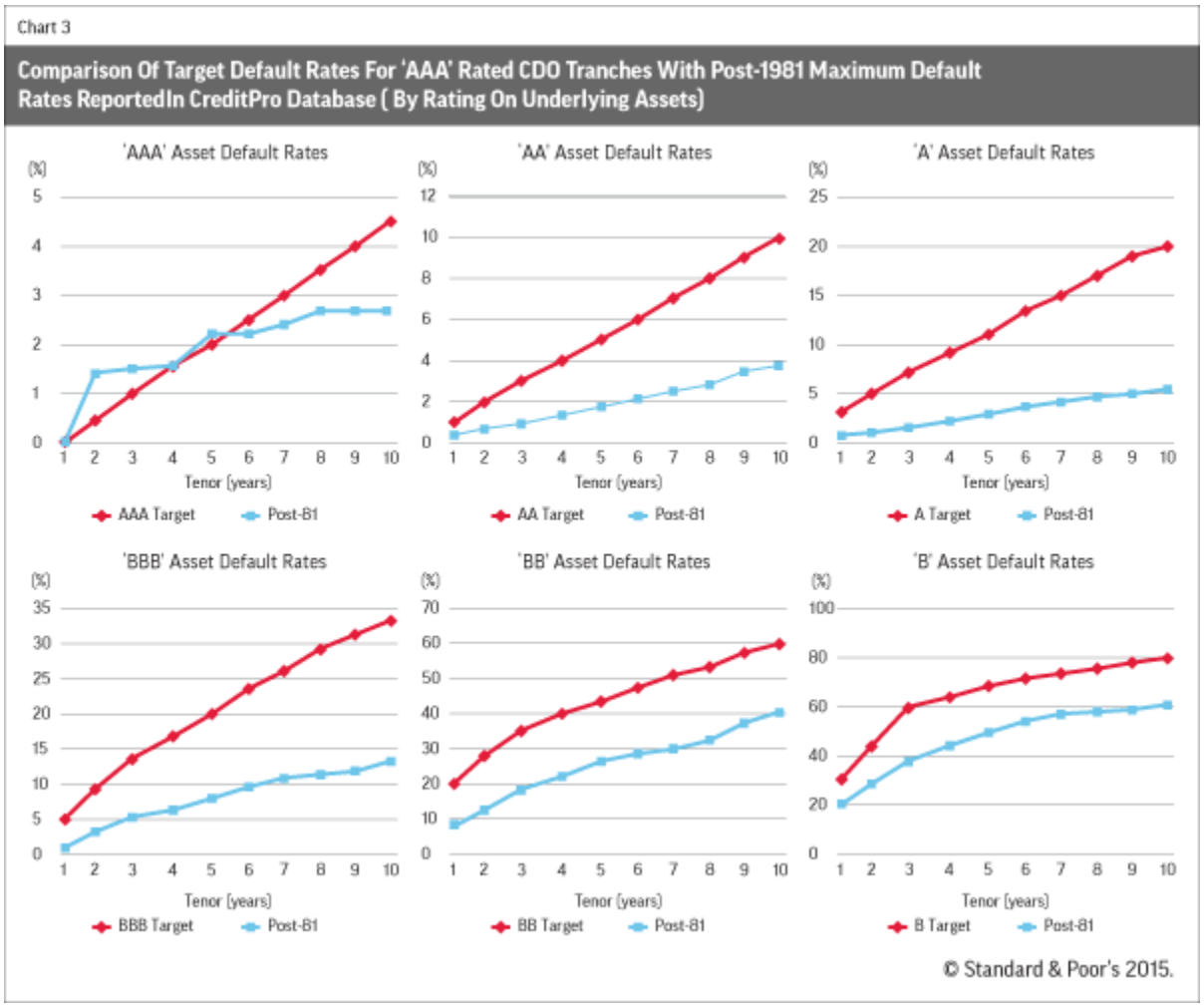
Chart 2



55. Note the orderly progression of default rates within each underlying asset rating category and among the different underlying asset rating categories without clustering.

56. It is instructive to compare the targeted portfolio default rates in table 6 to the post-1981 maxima reported in the CreditPro data. Chart 3 shows the comparisons.

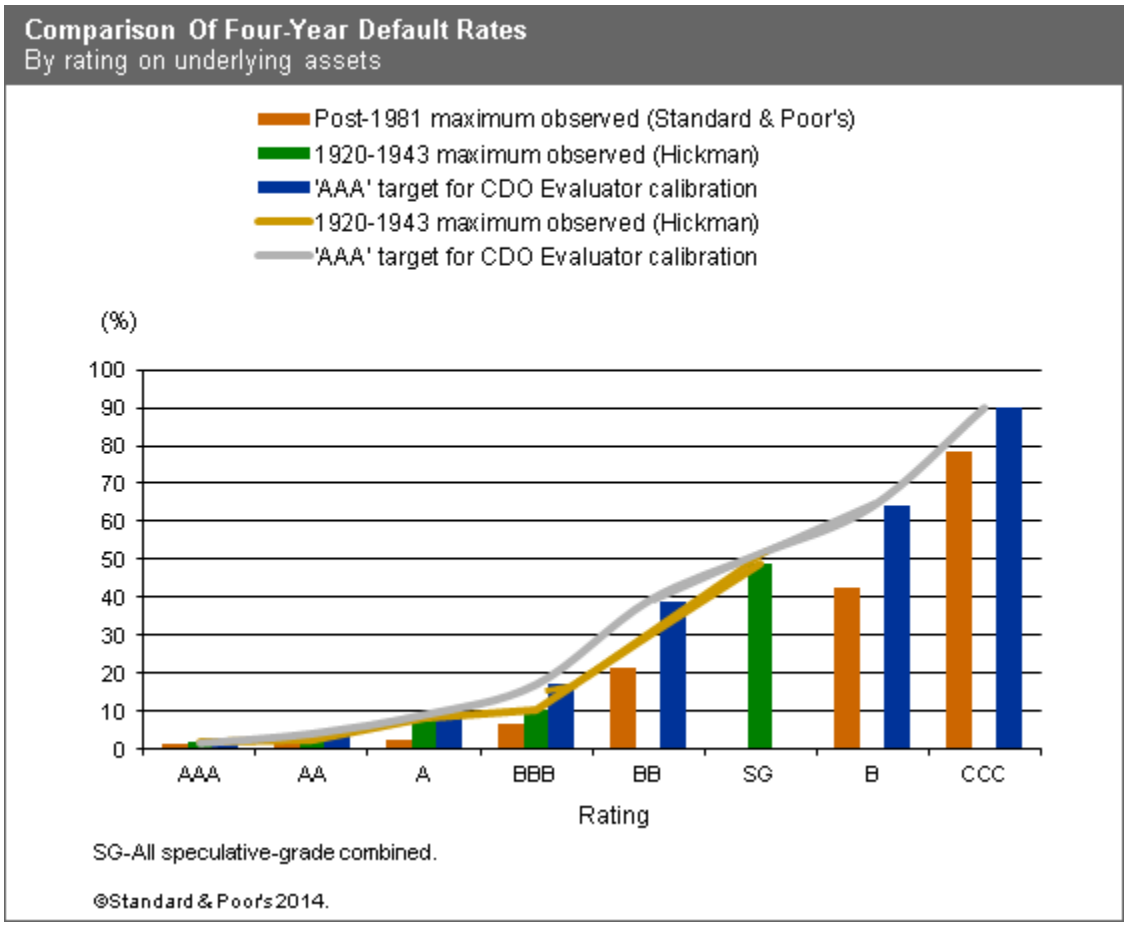
Chart 3



57. As expected, most of the targeted portfolio default rates provide a substantial cushion above the post-1981 observed maximum rates. However, there is some compression at the very top and bottom of the rating scale, especially for short time horizons. This shows that the real-world experience reflected in the CreditPro data to date lacks the idealized order of the targeted values (as shown in table 6 and chart 2)--a further demonstration that the real world is never as tidy or predictable as one might like it to be. This may also reflect that the economic stresses after 1981 have not exceeded a 'BBB' stress. We certainly would expect to see more differentiation in the performance of assets rated between 'AA' and 'BBB' if we were to experience a 'AA' type of economic scenario.

58. It is also instructive to compare the targeted four-year default rates with both the post-1981 maxima and the maxima that Hickman reported for earlier periods. This is shown in chart 4.

Chart 4



59. In our view, this comparison further confirms that the targeted portfolio default rates for the four-year time horizon are at appropriate levels compared with both the lower-stress levels of the post-1981 period and the higher-stress levels of the 1920-1943 period.

60. Hickman found only slight differences in default rates for bonds rated in categories III and IV (in table 3), corresponding to Standard & Poor's ratings of 'A' and 'BBB'. Nonetheless, we do not treat those rating categories as being only slightly different. Accordingly, in constructing table 6, we maintained a roughly geometric progression of default rates across rating categories. This produces a larger difference in the targeted portfolio default rates for obligations rated at the 'A' and 'BBB' levels than Hickman reported in his findings.

CDO Evaluator input: Asset default rates

61. We used the targeted portfolio default rates that 'AAA' rated CDO tranches should be able to withstand (table 6) to create modeling parameters for the CDO Evaluator simulation model. Those parameters include (i) asset default rates for pool assets, (ii) correlation factors to address the interdependency of defaults of separate credits within an asset pool, and (iii) rating quantile points to relate defaults to CDO tranche ratings.

62. Once again, it is important to highlight that our ratings are not probabilities of default, but, rather, address creditworthiness that reflects many factors. In limited cases, such as in the corporate CDO analyses, we use ratings in

a unidimensional way as a proxy for an asset's default rate, solely for modeling purposes.

63. The modeling parameters for asset default rates are shown in table 7. Appendix E presents the full 30-year asset default table for all the ratings without ratings modifiers. We produced starting values for table 7 based on a methodology similar to the one we use to produce our annual default studies. We then adjusted those values slightly, primarily as a function of the default scenario targets given in table 6.

Table 7

Asset Default Rate Inputs For CDO Evaluator Simulation Model

(%)

	Rating						
Tenor (years)	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**
1	0.003	0.018	0.198	0.462	2.109	7.848	20.495
2	0.016	0.074	0.452	1.092	4.644	14.782	34.623
3	0.041	0.172	0.771	1.896	7.476	20.935	44.486
4	0.085	0.318	1.159	2.868	10.488	26.397	51.603
5	0.150	0.514	1.622	3.995	13.587	31.246	56.923
6	0.240	0.763	2.162	5.258	16.698	35.560	61.036
7	0.361	1.069	2.780	6.639	19.767	39.406	64.313
8	0.514	1.433	3.476	8.116	22.758	42.850	66.996
9	0.704	1.856	4.246	9.669	25.645	45.945	69.243
10	0.933	2.339	5.088	11.281	28.413	48.740	71.164

Note: The above percentages are rounded to three decimal places.

64. We assume that rating transitions generally follow a homogeneous Markov process. In this framework, we derive the cumulative transition probabilities by raising the one-year transition matrix to iterative powers. We adjusted the one-year transition matrix further to ensure monotonicity across rating levels to obtain proper and coherent behavior of the transition probabilities as a function of the 19 refined rating categories. We further adjusted it to better fit observed empirical cumulative default rates.

65. Ratings, however, also incorporate CreditWatch placements, which indicate a possible rating change according to the type of modifier employed: CreditWatch negative or CreditWatch positive. To account for the potential downward ratings transition risk inherent in issuer credit ratings that are on CreditWatch negative, we treat them as if they were one notch lower to provide more conservative rating inputs into CDO Evaluator (e.g., BB+/Watch Neg becomes 'BB'). For credits on CreditWatch positive, we give a one-notch upward adjustment to the rating.

CDO Evaluator input: Correlation

66. Correlation parameters are key assumptions in portfolio default simulation models. For the limited purposes of using CDO Evaluator, we make certain assumptions about correlation, including the assumption that correlation is likely to remain constant over time, as well as being uniform across many industries within our classification system. While these simplifying assumptions are, by their nature, qualitative, we believe that they are reasonable for reducing the complexity of the modeling process and enhancing its transparency.

67. As previously described, to enhance the overall analysis and lessen dependence on input parameters, we added the supplemental tests and calibrated the CDO Evaluator model with targeted outputs. We are also aware of the experience of CDOs of structured finance securities during the credit crisis. The degree of correlation observed among the assets in these transactions' underlying portfolios since 2006 has been far higher than the correlation observed in earlier times.

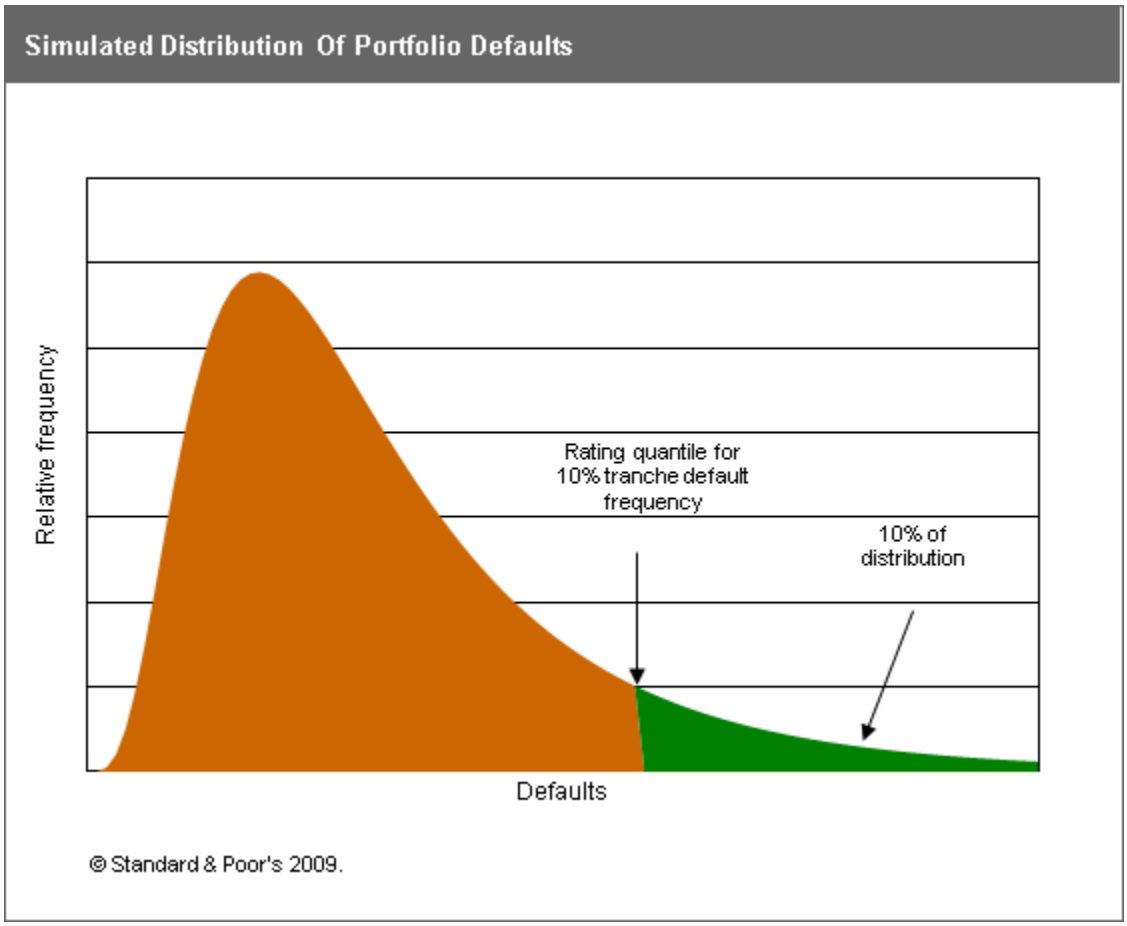
68. The correlation parameters under the criteria are 0.20 for two firms in the same corporate industry and 0.075 for two firms in different corporate industries. In addition, the criteria provide for correlation of 0.05 between assets from different industries in different geographic regions. By increasing correlation, the criteria fatten the tails of the simulated default frequency distribution and move the expected level of defaults closer to the aforementioned CDO Evaluator default targets. Appendix F shows the correlation assumptions by asset type.

Ratings quantiles and results calibration

69. The model needs rating quantiles (cut-off points) associated with each rating level so that the simulated level of asset defaults can be related to a CDO tranche rating. Chart 5 shows that, given a ratings quantile, it is possible to determine the amount of simulated defaults and thus the credit support appropriate for the corresponding rating level for corporate CDO tranches (before the effect of the supplemental tests).

70. However, in brief, the concept behind the rating quantiles and how they affect our rating results is as follows: CDO Evaluator first runs a Monte Carlo simulation of defaults, which produces a simulated distribution of defaults as shown in chart 5. This distribution, however, does not automatically relate to the specific creditworthiness of a CDO tranche. To do this, one must relate portfolio defaults to CDO tranche ratings.

Chart 5



71. To achieve this, the criteria adjust the rating quantiles so that the model reflects the targeted benchmarks given in table 6. In other words, we set the rating quantiles for 'AAA' rated tranches at a level where the tranches can withstand the gross asset simulated defaults specified in table 6. Accordingly, the rating quantiles are a principal device for calibrating the CDO Evaluator model.

72. As chart 5 shows, the modeled default frequency for a CDO tranche corresponds to the area of the default distribution to the right of a specified rating quantile. Moving the quantile point to the right amounts to strengthening the tranche's credit quality since it has to withstand more defaults, while moving the rating quantile to the left amounts to weakening the tranche's credit quality since it has to withstand fewer defaults.

73. Because the model targets minimum asset default rates that a 'AAA' rated CDO tranche should be able to withstand, the criteria allow the model's rating quantile parameters to be different from the corresponding asset default rate parameters. Indeed, doing so is necessary for achieving calibration outputs with appropriate differentiation between default frequencies of adjacent rating categories. Appendix G presents the rating quantiles table.

CDO Evaluator output: calibration results

74. To calibrate CDO Evaluator to the targeted portfolio default rates in table 6, we used highly diversified portfolios of corporate credits. We ran these pools of assets using the CDO Evaluator assumptions--as given in this section--to

produce the projected scenario default rates (SDRs) shown in table 8 for 'AAA' rated corporate CDO liabilities. SDRs are the modeled level of gross defaults that CDO Evaluator estimates for every CDO liability rating. For a CDO tranche to be assigned a particular rating, it should at a minimum withstand a level of gross simulated defaults that is higher than the SDR that CDO Evaluator estimates for that rating, plus the applicable cash flow stresses. We will also look for the tranche to pass the supplemental tests.

75. For the calibration, the pools were composed of 258 assets uniformly distributed across all the CDO Evaluator industry categories. All the assets had the same credit rating (without any plus or minus ratings qualifiers).

Table 8

'AAA' Scenario Default Rates For Different Asset Pools

(%)

	Asset rating						
Tenor (years)	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**
1	0.8	1.6	4.7	8.1	20.9	41.5	65.9
3	1.6	3.1	8.1	14.7	34.1	59.7	83.3
5	2.3	5.0	10.9	20.2	43.0	68.2	88.4
7	3.5	7.4	14.0	25.2	50.4	73.3	90.7
9	4.7	9.7	17.1	30.2	56.2	77.1	91.9

76. Next we compared the modeled SDRs to the minimum targeted portfolio default rates that CDO tranches should withstand to qualify for a rating of 'AAA' (table 6). Table 9 shows the ratio of the modeled SDR in table 8 to the corresponding minimum targeted portfolio default rate in table 6. This shows a "coverage ratio" of model results relative to the targets.

Table 9

New 'AAA' CDO Evaluator SDR Divided By Targeted 'AAA' Output

(%)

	Asset rating						
Tenor (years)	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**
1	775.2	155.0	155.0	162.8	104.7	138.2	101.4
3	155.0	103.4	116.3	113.3	97.5	99.5	92.6
5	116.3	100.8	98.7	100.8	100.1	100.3	98.2
7	116.3	105.2	93.0	96.9	98.8	99.0	100.8
9	116.3	107.7	89.8	97.5	98.6	98.9	102.1

77. Table 9 shows that, in some cases, CDO Evaluator results diverge slightly from the targeted portfolio default rates. This is a result primarily of (i) the complexities related to optimizing a multivariate problem across different parameters, (ii) the requirement that cumulative default curves for different rating levels do not intersect (i.e., cumulative defaults regardless of tenor should always be higher as ratings decrease), and (iii) the requirement that multiyear default rates be derivable from one-year default rates.

78. While there were some variations in the results, we believe the results are sufficiently close such that continued use of

the CDO Evaluator model is analytically appropriate for the following reasons:

- There are very few corporate CDOs where the average collateral ratings are above 'A' or the maturities are less than three years. Most rated transactions have assets in the 'BBB' to 'B' range and maturities of five to nine years. Model results are quite close to their corresponding targets in that range.
- The absolute default rates for the pools where higher ratios occur are relatively small, and the transaction ratings in such cases would likely be driven by the supplemental stress tests.
- The hypothetical pools we used in recalibrating the model were highly diversified. Actual CDO pools are generally more concentrated and are likely to produce SDRs higher than the hypothetical pools produce. This would increase the coverage relative to the targeted outcomes.

79. For 'CCC' rated asset pools, given that the actual default rates are very high, it is mathematically impossible to get coverage ratios much above 100%.

Asset Recovery Assumptions

80. For both cash flow and synthetic corporate CDOs, we tier expected recovery levels based on the tranche rating. Our analytical framework differentiates corporate recoveries based on asset type (loans vs. bonds) and on the priority/seniority of the asset (senior secured, senior unsecured, subordinated) in an insolvency of the company. We introduced this framework in 1996 and subsequently refined it based on the information in our LossStats database, which tracks recoveries on defaulted assets.

81. In addition to using recoveries based on asset type, we use our asset recovery ratings and other information, where available, to determine recovery rates for assets in cash flow CLOs.

82. Our recovery methodology tiers recoveries based on the rating on the CDO tranche. This reflects empirical evidence that recovery rates are inversely related to default rates. For both cash flow CDOs and synthetic CDOs, the recoveries in table 10 reflect a downward adjustment in expected recoveries under more stressful scenarios that senior rated tranches of CDOs should withstand. The lower recoveries are in line with the expectations for the credit cycle, where higher defaults and a lack of liquidity will likely increase the number of businesses that liquidate rather than restructure, thus putting a stress on recoveries.

Recoveries based on asset type

83. Table 10 shows the recovery assumptions for corporate and sovereign assets held in a CDO, based on the different corporate asset types (loans/bonds, seniority, and security) and country groupings. For synthetic CDOs, we use the "senior unsecured bonds" asset type as our base case recovery assumption, and we apply additional haircuts--or deductions--for "old restructuring." See the "Country Recovery Groupings" section of this article (below) for the countries in each different group. Table 10 will also apply to assets that have a mid-market evaluation ("MME") rating; however, these recoveries could be lowered if the MME rating indicates that recovery prospects in the event of a default may be lower than the recovery rates included in Table 10.

Table 10

Standard & Poor's Corporate Asset Recovery Rates For CDOs

(%)

Instrument/country grouping	CDO liability rating					
	AAA	AA	A	BBB	BB	B/CCC
Senior secured loans first-lien						
Group 1	50	55	59	63	75	79
Group 2	45	49	53	58	70	74
Group 3	39	42	46	49	60	63
Group 4	17	19	27	29	31	34
Senior secured cov-lite loans/senior secured bonds						
Group 1	41	46	49	53	63	67
Group 2	37	41	44	49	59	62
Group 3	32	35	39	41	50	53
Group 4	17	19	27	29	31	34
Mezzanine/second-lien/senior unsecured loans/senior unsecured bonds						
Group 1	18	20	23	26	29	31
Group 2	16	18	21	24	27	29
Group 3	13	16	18	21	23	25
Group 4	10	12	14	16	18	20
Subordinated loans/subordinated bonds						
Group 1	8	8	8	8	8	8
Group 2	10	10	10	10	10	10
Group 3	9	9	9	9	9	9
Group 4	5	5	5	5	5	5

	CDO liability rating					
Instrument/country grouping	**AAA**	**AA**	**A**	**BBB**	**BB**	**B/CCC**
Sovereign debt	37	38	40	47	49	50

Country recovery groupings

84. For different asset types' recoveries, we have grouped different countries based on our analyses of their insolvency legal frameworks. We believe this framework is a good indication of the varying rights creditors have to secure their claims and realize a recovery. Countries in Group 1 have legal frameworks that give the senior lenders more control and likely higher recoveries for senior lenders, but lower for subordinated lenders. Countries in Group 3 have a legal framework that gives less priority to senior claims relative to the other creditors. The country groupings shown in table 11 are generally based on the article, "Insolvency Regime Jurisdictions Ranked By Standard & Poor's," published May 6, 2014.

85. Table 11 shows our country classifications for the purposes of CDO recoveries.

Table 11

CDO Country Groupings For Recovery

CDO Group 1	CDO Group 2	CDO Group 3	CDO Group 4
Australia	Austria	Brazil	Kazakhstan
Denmark	Belgium	France	Russia
Finland	Canada	Greece	Ukraine
Hong Kong	Germany	Italy	Others
Ireland	Israel	Mexico	
The Netherlands	Japan	South Korea	
New Zealand	Luxembourg	Spain	
Norway	Portugal	Taiwan	
Singapore	South Africa	Turkey	
Sweden	Switzerland	United Arab Emirates	
U.K.	U.S.		

86. Table 12 presents our assumptions for assets with recovery ratings. In addition to the recovery rating, we may provide further delineation on whether a loan's expected recovery resides in the upper or lower end of the range for a given recovery rating. This more granular delineation will generally apply for assets with recovery ratings of '2' through '5'. If we indicate that a loan's expected recovery resides in the upper end of the range, we will use the recovery rates in the upper range in table 12 for a given recovery rating and CDO target rating. Absent any such information, we will use the lower range in table 12.

Table 12

Recovery Rates For Assets With Recovery Ratings (%)

Recovery rating	Range from published reports*	AAA	AA	A	BBB	BB	B/CCC
1+	100	75	85	88	90	92	95
1	90-100	65	75	80	85	90	95
2	80-90	60	70	75	81	86	90
2	70-80	50	60	66	73	79	80
3	60-70	40	50	56	63	67	70
3	50-60	30	40	46	53	59	60
4	40-50	27	35	42	46	48	50
4	30-40	20	26	33	39	40	40
5	20-30	15	20	24	26	28	30
5	10-20	5	10	15	20	20	20
6	0-10	2	4	6	8	10	10

*From Standard & Poor's published reports. If a recovery range is not available for a given loan with a recovery rating of '2' through '5', the lower range for the applicable recovery rating should be assumed.

87. If an asset doesn't have a recovery rating, then the criteria call for assessing whether it is pari passu or subordinate to other debt that does have a recovery rating. This is necessary because it is possible, for example, that the CDO holds subordinated debt of a company that has senior secured debt with negligible recovery prospects (e.g., a recovery rating of '6'). Because the debt with a recovery rating is senior to the instrument that the CDO holds, the recovery prospects for the instrument held by the CDO will very likely be less than the recovery prospects for the senior secured debt with

the recovery rating.

88. If the CDO holds senior unsecured debt that doesn't have a recovery rating, and is subordinate to debt that has a recovery rating, then the recovery of the instrument can be determined using the tables shown in Appendix H.

Cash Flow Modeling Assumptions

Default timing for 'A' to 'B' rated cash flow CDO tranches

89. A cash flow analysis and the associated cash flow stresses are key components of these criteria. The criteria apply different default timing scenarios based on the weighted average life of the portfolio. Although we run each of the standard default patterns beginning in year one, we also delay the start of these patterns by a longer period to capture the effect of later defaults at the higher tranche ratings. Certain transactions have structural features that limit reinvestments and effectively turn the transactions into static pools if such triggers are hit. In such cases, we would adjust our default pattern starting times to reflect the remaining life of the asset pool. In applying the cash flow test, the criteria consider the remaining exposure period for each rated CDO tranche.

90. The examples provided in table 13 illustrate the starting years. For fractions of years, the determining point is the half-year mark. Table 13 does not apply to CDOs of hybrid trust preferred securities.

Table 13

Starting Years Of Standard Default Patterns For 'AAA' To 'B' Rated Corporate CDOs

Portfolio weighted-average life (years)	Starting years
8.0	1-4
8.3	1-4
9.0	1-5
10.0	1-6
10.7	1-7
11.0	1-7
12.0	1-8

Interest rate patterns

91. To assess whether a transaction will be able to perform in varying interest rate environments, we apply five interest rate scenarios to each default pattern. Each interest rate scenario's severity depends on the rating level, and the five scenarios are as follows:

- Forward curve,
- Rising interest rates (up curve),
- Falling interest rates (down curve),
- Rising then falling interest rates (up/down curve), and
- Falling then rising interest rates (down/up curve).

Break-even result analysis for cash flow CDOs

92. Under the criteria, part of the cash flow analysis remains the consideration of a tranche's BDR. This is a measure of the maximum level of gross defaults that a tranche can withstand and still fully repay the noteholders, given the

transaction structure, asset characteristics, payment mechanics, and proposed credit enhancement. To analyze a tranche, we run a number of cash flow scenarios using different starting times for defaults, different patterns of how the defaults will occur once defaults start, and different interest rate scenarios.

93. At the transaction's effective date, we typically would not consider upgrades to the rated tranches in the CDO transaction because the transaction typically would allow the collateral manager to have a few years to reinvest and change the credit risk profile of the transaction.

94. After the reinvestment period or in the case of static transactions, after a period of time, when the collateral in the transaction starts to amortize and pay down the notes, the assets' weighted-average life also compresses. During this phase, the application of the standard four- and five-year default patterns and timings on transactions may not be appropriate, as the majority of assets in the transaction may have already paid down before the application of the default vector and stresses. Accordingly, as the assets' weighted-average life continues to shrink, we adjust the default patterns to three years. Table 14 shows the different default patterns that we use for corporate CDOs, excluding CDOs of hybrid trust preferred securities.

Table 14

Annual Defaults As A Percentage Of Cumulative Defaults

	(%)				
	Year 1	**Year 2**	**Year 3**	**Year 4**	**Year 5**
Pattern I	15	30	30	15	10
Pattern II	40	20	20	10	10
Pattern III	20	20	20	20	20
Pattern IV	25	25	25	25	-
Short I	50	25	25	-	-
Short II	25	50	25	-	-
Short III	25	25	50	-	-
Short IV	40	30	30	-	-
Short V	33	33	34	-	-

95. For asset pools that have a shortened maturity profile typically less than three years, we construct specific asset default curves based on the maturity profile of the assets.

96. Each cash flow run produces a different "scenario BDR" for that tranche based on the structural mechanics of the transaction and the amount of losses covered using excess spread. We then rank the scenario BDRs from the lowest to the highest. Next, we apply the percentiles in table 15 to select (or interpolate) a "tranche BDR" from the list of scenario BDRs. If the tranche BDR is lower than the SDR calculated in CDO Evaluator, the tranche might not under our criteria be assigned the rating accompanying that stress scenario.

Table 15

Break-Even Percentiles By Rating

CDO tranche rating	**Percentile (%)**
AAA	5
AA	5

Table 15

Break-Even Percentiles By Rating (cont.)

CDO tranche rating	Percentile (%)
A	10
BBB	10
BB	20
B	30
CCC	40

97. Table 16 shows a hypothetical example of how this analysis works. In a real transaction the difference in BDRs between the 'AAA' tranche and the 'B' tranche is typically much greater. We would first run all the applicable cash flow runs for each tranche to determine the scenario BDRs for each rating level. Next we would sort the BDR from high to low for each potential tranche rating. We would then apply the appropriate percentile to the BDR distribution to determine the tranche BDR. We use a percentile function similar to Microsoft® Excel® for this. If the tranche BDR is higher than the SDR given by CDO Evaluator for the potential tranche rating (and the tranche also passes the largest obligor and industry default tests), then we can assign that rating to the tranche. If this is not the case, then we might assign a lower rating to the tranche at which it passes all applicable tests.

Table 16

Sorted Break-Even Default Rates: Hypothetical Example

Tranche	A	B	C
Rating	AAA	A	B
Default pattern (years)	**Sorted break-even default rates (%)**		
1	50	45	40
2	48	42	35
3	46	39	30
4	44	36	25
5	42	33	23
6	40	30	21
7	38	27	20
8	36	24	18
9	34	21	17
10	32	18	16
11	30	17	12
12	28	15	11
13	26	14	10
14	24	14	9
15	22	13	8
Break-even calculation			
Rating	AAA	A	B
Percentile	5th	10th	30th
Break-even rate (%)	23.4	14.0	12.8

98. The BDR analysis discussed in paragraph 97 assesses whether a transaction can withstand different patterns of defaults. However, we also focus on:

- The distribution of scenario BDRs to consider whether the results are skewed;
- Whether BDR "failures" are associated with certain default patterns and timings;
- The distribution of BDRs obtained by percentiles relative to the distribution of expected default rates under the different sensitivity analyses; and
- The comparison of scenario BDRs to our forecast of corporate default rates over the coming three years.

Modeling management fees

99. When rating CDO transactions, if the management fees are capped at a level that, in our view, is likely insufficient to attract a substitute collateral manager in the event that the current collateral manager is removed from the transaction, higher management fees may be applied in the cash flow analysis. Furthermore, in such an instance, the issuer should be able to accommodate the management fee at a level higher than the capped fee to attract a replacement servicer, if necessary. (See "Criteria Methodology Applied To Fees, Expenses, And Indemnifications," July 12, 2012.)

Additional Rating Considerations

100. Rating committees may consider certain factors in assigning ratings to CDO tranches, in addition to the supplemental tests, the Monte Carlo default simulation results, and the associated cash flow modeling. As a general matter, the rating committees consider both the risks and the risk mitigants on a transaction-by-transaction basis. Additionally, they also consider the factors listed below. Based on our view regarding the relationship between the various risks and the risk mitigants, the committees may qualitatively adjust ratings from the rating level that may be indicated by the various quantitative results. We provide the rationale for such adjustments in the associated rating action media releases.

Credit stability

101. We published criteria addressing credit stability (see "Methodology: Credit Stability Criteria," May 3, 2010). The stability guidelines specify for each rating level the maximum degree of projected credit deterioration under conditions of moderate stress for time horizons of one and three years. For example, we intend for 'AAA' ratings not to change more than one rating category in one year or three rating categories in three years under what we consider to be a moderate stress environment. A tranche's projected rating stability determines the maximum rating that it can achieve.

102. A key aspect of the targeted portfolio default rates for the calibration process was the spacing of targeted portfolio default rates between adjacent rating levels. In a similar vein, we consider whether the modeled default frequencies for actual CDO tranches at different rating levels also display appropriate spacing. In our opinion, this has the benefit of moderating undesirable volatility of modeled creditworthiness. That is, appropriate spacing of modeled default frequency between adjacent rating categories helps reduce the problem of tranches flipping repeatedly between adjacent categories because of small changes in underlying asset quality.

103. We tested various asset portfolios and changed their ratings using a rating transition matrix as derived under our opinion of a moderate stress scenario. We then ran the resulting transition pools through the recalibrated CDO Evaluator to see the resulting changes in the CDO tranche ratings. These analyses show that the resultant CDO

tranche ratings would perform within the allowable credit stability guidelines. Thus, in our view, the analytical framework presented in this article meets the credit stability guidelines.

Rating sensitivity to modeling parameters

104. We further apply sensitivity testing to three model parameters: Asset correlation, spread, and recoveries. These sensitivity analyses are different from the analyses of credit stability described above. The goal of these analyses is to further test the sensitivity of a transaction relative to key model parameters and to illustrate the effect that varying these parameters would have on model results. Given the diversified nature of the asset portfolios and similar structural mechanics, one would expect most transactions to respond similarly to different changes in stresses, absent idiosyncratic factors.

105. The salient issue is whether the model results and transaction structure display exceptionally high sensitivity to changes in input parameters. If they do, then it is our view that there must be some explanatory factor either in the transaction structure or in the portfolio construction that is causing such distinct behavior.

106. We may modify some of the modeling assumptions or applied stresses for portfolios that show heightened sensitivity to the following analyses:

107. ***Changes to correlation.*** The criteria call for consideration of sensitivity to correlation assumptions by running portfolios with the three correlation scenarios shown in table 17.

Table 17

Correlation Scenarios

	Within industry	Between industries
Below base case	0.150	0.050
Base case	0.200	0.075
Above base case	0.250	0.100

108. The above scenarios are for industries that display the 0.200 intra-industry and 0.075 inter-industry correlations. As part of this scenario analysis, we also make adjustments to the industry correlation override tables for both above and below the base case scenarios.

109. In order to adjust correlation for above the base-case scenario, if the original correlation is less than 0.10, we would increase it by 0.025, and if it is greater than or equal to 0.10, we would increase it by 0.05. If the original correlation is less than or equal to 0.99, we would cap the adjusted correlation at 0.99. If the original correlation was greater than 0.99, we would set the adjusted correlation to the same value as the original correlation.

110. In order to adjust correlation for below the base-case scenario, if the original correlation is less than 0.10, we would decrease it by 0.025, and if it is greater than or equal to 0.10, we would decrease it by 0.05. If the adjusted correlation is less than zero, we would floor the correlation at zero.

111. ***Changes in recoveries.*** Empirical evidence suggests that recovery levels for corporate assets are influenced by the level of defaults in the economy and the lending standard employed before entering the economic/default cycle. We have also observed considerable variance in recoveries within a given origination or default vintage. Therefore, the criteria call for assessing additional scenarios with 10% positive and negative adjustments to recoveries relative to a

transaction's weighted-average recovery.

112. ***Bias defaults toward largest assets, or assets with widest spread or lowest recoveries.*** While asset composition in CDO pools tends to be fairly uniform around the mean, some portfolios are lumpy or skewed. To address this and assess whether the portfolios are sufficiently diversified, the criteria focus on specific default scenarios:

- The largest assets in the pool;
- The assets in the pool with the highest spread; and
- The assets in the pool with the lowest base-case recoveries.

113. Some transactions may require additional credit support, in our view, or their tranches may receive lower ratings if their modeled performance is substantially weaker under the specific default scenarios compared with similar transactions.

114. The purpose of these specific default scenarios is to identify outliers that could potentially exhibit different performance. We compare transactions against other CDO transactions that have similar asset pool characteristics and similar structural features. The transactions serve as benchmarks for expected rating transition performance under the above-mentioned stresses to correlation, recoveries, and default biases. Based on this analysis, it is possible that the rating committee may assign lower ratings to CDO tranches that exhibit unusually high sensitivities to the three modeling parameters.

Focus on minimum portfolio standards

115. Most cash flow CLOs and some synthetic CDO transactions allow for reinvestments and asset trading. These transactions have asset eligibility criteria and contractual provisions that govern the type of trading allowed and the requirements for maintaining the asset portfolio within certain boundaries. Often, however, sponsors or asset managers may select a transaction's initial portfolio with characteristics that are stronger than the minimum requirements of the governing documents. However, in our experience, an asset manager may commit (barring credit deterioration of the assets) to manage a transaction's portfolio and maintain the original level of asset quality even though the transaction's governing documents allow for a weaker asset portfolio composition.

116. The criteria allow for rating a CDO transaction based on the manager either (i) managing the transaction to maintain the portfolio's original credit quality (the "stable quality" approach), or (ii) managing the transaction within the eligibility criteria of the governing documents (the "stressed portfolio" approach).

117. For us to apply the "stable quality" approach in rating a CDO transaction, we look for the manager to commit in the transaction's governing documents to apply Standard & Poor's CDO Monitor test or the synthetic rated overcollateralization (SROC) test within the constraints of not breaching or maintaining the CDO Monitor or SROC tests (note that for "credit risk" trades, the manager is not constrained by these tests.) The CDO Monitor and SROC tests detect possible changes in an asset pool's credit quality when the manager carries out discretionary trading or trading of credit-improved assets.

118. For credit-risk trades (defined as trades where the credit is at risk of default or impairment) the CDO Monitor test is designed so that the manager may reinvest in any asset that fits within the minimum portfolio eligibility criteria without maintaining or improving the test results with the trade.

119. Alternatively, some transactions are structured from the start based on the "stressed portfolio" approach, even though the initial portfolios may be stronger. For such a transaction, the criteria deem the portfolio to comprise the minimum number of obligors concentrated in the minimum number of industries permitted in the documents. In addition, the criteria further apply the assumption that the largest obligors are all in the same industry and have the lowest ratings allowed by the eligibility criteria. Also, the criteria continue to assume that the portfolio has the minimum weighted-average spread and coupon allowed, and that it has the longest weighted-average life and lowest projected recoveries allowed under the eligibility and reinvestment criteria. Certain transactions may have more precisely defined characteristics for the hypothetical "stressed portfolio" by mandating more precise and definitive asset eligibility, pool concentration, and reinvestment guidelines.

120. If sponsors and managers structure a transaction based on the hypothetical stressed portfolio approach, and we rate it on that basis, then the sponsor, trustee, or manager could, on the "effective date," simply confirm that the trades and portfolio ramp-up meet the asset eligibility, quality, and reinvestment guidelines specified in the applicable transaction documents.

121. The "stressed portfolio" approach applies whenever a collateral manager does not commit in the transaction documents to maintain portfolio credit quality by using CDO Monitor, or whenever a manager breaches or repudiates such a prior commitment.

Small interest shortfalls

122. The cash flows of a given transaction may be insufficient to pay full interest on nonpayment-in-kind tranches. If we believe this is due to the portfolio amortization profile, and if such model shows the tranche being able make the interest payment within the next payment period, the rating committee may choose to give weighting to such scenarios. This is based on observations that collateral managers typically forecast and manage cash flows by adjusting portfolio maturities, holding back on reinvestments, and selling assets to avoid such shortfalls. Historically, we understand that managers have not invested 100% of their available cash and have maintained small amounts of cash on hand. However, the modeling assumptions limit such nonconsecutive instances to no more than five.

Treatment of CDOs of corporate CDOs ("CDO-squared" transactions)

123. The treatment of corporate CDOs within a CDO portfolio should follow the criteria provided in the global CDO of pooled structured finance assets (see "Global CDOs Of Pooled Structured Finance Assets: Methodology And Assumptions," Feb. 21, 2012).

124. Additionally, the criteria generally assume zero recoveries for junior CDO tranches held as assets (i.e., those tranches that we identify as subordinated to senior noteholders, which have controlling rights to liquidate the transaction if an event of default occurs from a coverage test failure).

Forward-looking rating transition

125. For static asset portfolios, all else being equal, the SDR of the portfolio decreases as the portfolio maturity gets shorter. This is due to the asset defaults rates decreasing as a function of time. Thus, all else being equal, and assuming that the level of credit support is constant, it is possible that the rating on a CDO tranche supported by a static asset portfolio will improve as the maturity gets shorter. To avoid the possibility of downgrading a tranche only to upgrade it shortly thereafter, the rating committee may consider a forward-looking analysis. If the analysis shows that the tranche may be

the same rating as its present rating, then the rating committee may determine not to downgrade the tranche.

126. When reviewing synthetic CDO tranches, we may incorporate qualitative aspects in our analysis, such as:

- Applying cushions above the scenario loss rates generated by CDO Evaluator based on the transaction's time to maturity;
- Taking a forward look at the credit quality of the reference portfolio; or
- Considering the CreditWatch listing or other attributes of the reference obligations.

Correlation between corporate assets and CDO assets

127. From 2005-2007, corporate CDOs increased the concentration of CDO assets they hold in their asset pools. We believe this occurred because, in part, of the difficulties that collateral managers had in sourcing new corporate loans. As such, to stay fully invested and minimize negative carry, more and more managers purchased mezzanine tranches of other corporate CDOs. The criteria apply a correlation of 0.10 between corporate assets and corporate CDO tranches.

Correlation between corporate CDO tranches

128. Events in 2007-2009 also highlighted that, because many corporate CDOs hold similar assets, there can accordingly be a greater degree of correlation than previously thought. The criteria apply a correlation of 0.70 between corporate CDO tranches. This will affect CDOs of CDOs ("CDO-squared") transactions. Also, we now assume asset default rates for corporate CDOs to be the same as for corporate assets.

Correlation override table in CDO Evaluator

129. Table 20 shows the correlation assumptions used in CDO Evaluator.

Treatment of other asset types in corporate CDOs

130. These criteria apply to CDOs of corporate assets. However, some corporate CDO collateral pools may also contain structured finance securities and municipal debt securities. If CDO transactions have a mixed portfolio of asset types, we may consider applying a combination of criteria, giving more weight to the dominant asset type in the transaction's portfolio. We deem pools where the default amounts are predominantly driven by the noncorporate assets as CDOs of structured finance assets, CDOs of sovereign debt, or CDOs of municipal debt. These are subject to our criteria for such assets and not to this corporate CDO criteria. If the structured finance assets in the corporate CDO are themselves junior tranches of CDOs of structured finance assets, and if senior noteholders have controlling rights to cause the liquidation of the transaction collateral due to an event of default from a coverage test failure, then we deem all such tranches as having a zero recovery.

Debt issuance relative to asset value

131. We believe that the market dislocation and liquidity squeeze in 2007-2009 made it more difficult to differentiate between market discounted (but fundamentally attractive) assets and assets that are distressed. The criteria for CDOs of distressed debt (see "Distressed Debt CDOs," published May 7, 2001) limit the issuance of rated CDO liabilities to what we believe to be the arm's-length purchase price of the assets, or to the amount of a third-party valuation. We believe this mitigates concerns about ratings arbitrage or managers attempting to exploit "loopholes." We do, however, have continuing concerns where:

- Deeply discounted collateral (of any type) is given par credit;

- Principal proceeds are recharacterized as interest proceeds;
- Structures allow large leakage of principal proceeds to equity investors; and
- Structures look to issue significantly more debt than the amount of money used to purchase the assets.

132. For transactions that display any of those features, we consider the sources and uses for funds to better understand the economic benefit to all investors. If such information is not provided, or if there is more than a moderate difference between the proposed purchase price of the assets plus the money retained in the transaction relative to the proposed amount of rated debt, then the rating committee would likely cap (barring other mitigating factors) the amount of rated note issuance to the economic value retained in the transaction. This analysis factors in the payment priorities of the transaction and the manner in which interest and principal proceeds can be recharacterized.

APPENDICES

A: Application Of Largest Obligor Test And Largest Industry Test

Largest obligor default test

133. To demonstrate how we use this test, consider a hypothetical transaction (the "example CDO") that has the capital structure shown in table 18 and a sequential-pay structure.

Table 18

Example CDO--Liability Structure

Class	Rating	Issuance ($)
A	AAA	5,500
B	A	1,000
C	BB	1,000
Equity	NR	2,500

NR--Not rated.

134. An asset pool, consisting of the 16 assets in table 19, supports the example CDO's liabilities. In this example, we assume that one of the assets defaults after the transaction has closed, and that at closing, the transaction has met all tests allowing the tranches to be rated as shown in table 18.

Table 19

Example CDO Portfolio

Obligor ID	Industry*	Rating	Balance ($)
1	20	AA	1,000
2	21	AA	200
3	22	A	600
4	23	A	400
5	24	A	300
6	25	BBB	800
7	32	BBB	800
8	27	BBB	600

Table 19

Example CDO Portfolio (cont.)

Obligor ID	Industry*	Rating	Balance ($)
9	28	BBB	600
10	30	BBB	500
11	31	BBB	200
12	32	BB	600
13	33	B	1,000
14	34	B	800
15	35	CCC	600
16	36	D	1,000

*Industry code in CDO Evaluator.

135. We have limited the number of assets in the example pool to 16 for ease of understanding. We have also skewed the portfolio, with three obligors making up 30% of the pool. All obligors are in different industries, other than obligors 7 and 12, which are in the same industry (32). Solely for this example, we assume that the pool is well diversified.

136. As previously noted, under the largest obligor default test, a 'AAA' rated tranche must have sufficient credit enhancement to survive the highest level of losses associated with defaults of each of the following combinations of underlying obligors, assuming a flat 5% recovery rate:

- The two largest obligors rated between 'AAA' and 'CCC-';
- The three largest obligors rated between 'AA+' and 'CCC';
- The four largest obligors rated between 'A+' and 'CCC-';
- The six largest obligors rated between 'BBB+' and 'CCC-';
- The eight largest obligors rated between 'BB+' and 'CCC
- The 10 largest obligors rated between 'B+' and 'CCC-'; and
- The 12 largest obligors rated between 'CCC+' and 'CCC-'.

137. The largest obligor default test under these criteria factors in the credit quality of the underlying obligors (see table 20), and assumes a flat 5% recovery rate for all defaults. Both the ratings on the obligors in the asset pool and the rating on the CDO tranche drive this test.

Table 20

Largest Obligor Default Test

Event risk test: Survive a number of defaults with 5% recoveries

	CDO liability rating*						
Obligor rating	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**
'AAA' to 'CCC-'	2	1	-	-	-	-	-
'AA' to 'CCC-'	3	2	1	-	-	-	-
'A' to 'CCC-'	4	3	2	1	-	-	-
'BBB' to 'CCC-'	6	4	3	2	1	-	-
'BB' to 'CCC-'	8	6	4	3	2	1	-
'B' to 'CCC-'	10	8	6	4	3	2	1

Table 20

Largest Obligor Default Test (cont.)

Event risk test: Survive a number of defaults with 5% recoveries

	CDO liability rating*						
Obligor rating	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**
'CCC' to 'CCC-'	12	10	8	6	4	3	2

*In all tables used with respect to largest obligor test, unless otherwise noted, CDO tranche or liability rating categories below 'AAA' include rating subcategories (e.g., the 'AA' column also applies to CDO tranches rated 'AA+' and 'AA-').

138. To see how this works, let's look at the example CDO. First, for this test, the criteria deem all assets rated below 'CCC' and still included in the CDO asset pool to be nonperforming. Thus, we include only the 15 performing assets. Based on table 20, we have sorted the assets by rating and applied the criteria for 'AAA' tranches. Table 21 shows the results.

Table 21

'AAA' Largest Obligor Default Test

Obligor ID	Rating	Balance ($)	Two largest 'AAA' to 'CCC' ($)	Three largest 'AA' to 'CCC' ($)	Four largest 'A' to 'CCC' ($)	Six largest 'BBB' to 'CCC' ($)	Eight largest 'BB' to 'CCC' ($)	10 largest 'B' to 'CCC' ($)	12 largest 'CCC' ($)
1	AA	1,000	1,000	1,000	-	-	-	-	-
2	AA	200			-	-	-	-	-
3	A	600				-	-	-	-
4	A	400				-	-	-	-
5	A	300				-	-	-	-
6	BBB	800		800	800	800	-	-	-
7	BBB	800			800	800	-	-	-
8	BBB	600				600	-	-	-
9	BBB	600				600	-	-	-
10	BBB	500					-	-	-
11	BBB	200					-	-	-
12	BB	600					600	-	-
13	B	1,000	1,000	1,000	1,000	1,000	1,000	1,000	-
14	B	800			800	800	800	800	-
15	CCC	600					600	600	600
16	D	1,000	-	-	-	-	-	-	-
Portfolio total		10,000	-	-	-	-	-	-	-
Total gross largest obligor			2,000	2,800	3,400	4,600	3,000	2,400	600
Total net largest obligor			1,900	2,660	3,230	4,370	2,850	2,280	570

139. As shown, the biggest amount under this test is captured by the six largest obligors rated 'BBB' and below. The amount is $4,370 after applying the 5% recovery rate.

140. The largest obligor default test is passed if, after applying the highest net losses from the obligor test in the cash flow

runs, the tested tranche receives timely interest and ultimate principal payments.

Largest industry default test

141. Under the criteria, corporate CDO tranches rated 'AAA', 'AA+', 'AA', or 'AA-' are intended to be able to withstand the default of all obligors in the largest industry in the asset pool with 17% recoveries. For this test, we use the same industry classification used in CDO Evaluator. A 'AAA' or 'AA' rated tranche of such a transaction must have sufficient credit enhancement to pass this test. If the tranche doesn't pass the primary industry test, we next consider an alternative industry test that defaults a specific number of obligors in each industry. The alternative industry test assesses if the industry exposure is sufficiently diversified for the purposes of our criteria. The alternative industry test is similar to the largest obligor default test, but we apply it within each industry, as described below.

142. Under our criteria, a tranche may still receive a rating of 'AAA' or 'AA' despite failing the primary industry test if it passes the following alternative industry test: A 'AAA' tranche must have sufficient credit enhancement to survive the highest level of losses associated with the defaults of each of the following combinations of underlying assets within each industry, assuming a 5% recovery rate:

- The four largest obligors rated between 'AAA' and 'CCC-';
- The six largest obligors rated between 'AA+' and 'CCC-';
- The eight largest obligors rated between 'A+' and 'CCC-';
- The 12 largest obligors rated between 'BBB+' and 'CCC-';
- The 16 largest obligors rated between 'BB+' and 'CCC-';
- The 20 largest obligors rated between 'B+' and 'CCC-'; and
- The 24 largest obligors rated between 'CCC+' and 'CCC-'.

143. A 'AA' rated tranche must have sufficient credit enhancement to survive the highest level of losses associated with the defaults of each of the following combinations of underlying assets within each industry, assuming a 5% recovery rate:

- The two largest obligors rated between 'AAA' and 'CCC-';
- The four largest obligors rated between 'AA+' and 'CCC-';
- The six largest obligors rated between 'A+' and 'CCC-';
- The eight largest obligors rated between 'BBB+' and 'CCC';
- The 12 largest obligors rated between 'BB+' and 'CCC-';
- The 16 largest obligors rated between 'B+' and 'CCC-'; and
- The 20 largest obligors rated between 'CCC+' and 'CCC-'.

144. The alternative industry test is an adaptation of the largest obligor default test. It is intended to capture gradations of obligor credit quality while applying somewhat higher default intensity than the largest obligor default test.

145. We apply this test to each industry to capture some of the industry concentration risk that may not be otherwise obvious in light of different nuances of portfolio constructions. For instance, a portfolio may contain two industries that constitute about the same percentage of the portfolio, but one is much more diversified than the other. As an example, in looking at a 'AAA' rating, assume that industry A is the largest industry at 10% of the portfolio, and consists of 30 different equally sized corporate exposures. The same portfolio also has exposure to industry B, which is 9% of the portfolio, but is made up of only three different corporate exposures. If we applied the alternative industry test only to industry A, which in this example is the largest and most diversified, it may not fully capture the risk associated with a

different industry in the portfolio, such as the concentrated industry B exposure.

146. The results obtained from the alternative industry test depend on the size of each industry exposure, the number and size of individual exposures in each industry, and the rating distribution of the exposures in each industry. Considering that the assumed recovery rate is only 5% in the alternative industry test--versus 17% when we default the entire industry--it is possible that the results obtained under the alternative industry test may be more onerous than if we assume the entire industry defaults. This is caused by the number of exposures in the industry and their rating distribution.

147. To illustrate how the primary industry test and the alternative industry test work, assume we have a CDO portfolio that has only five industries with a total balance of $10,000. This is a different portfolio than shown above in the largest obligor default test. Again, this would not be considered to be a well-diversified portfolio for a CDO, and we are using it only to simplify the example. In running the primary industry test for this example, assume that we get the results in table 22 when we default the entire industry.

Table 22

Primary Largest Industry Default Test

		(A)
Industry	**Total assets ($)**	**Default entire industry with 17% recovery ($)**
1	1,500	1,245
2	3,000	2,490
3	2,000	1,660
4	2,500	2,075
5	1,000	830
Total	10,000	

148. As shown, the largest industry is industry 2 with a $3,000 exposure. Defaulting this with 17% recoveries would yield an assumed loss of $2,490. The CDO tranche must be able to withstand this level of loss to be rated 'AAA' or 'AA' under our criteria.

149. If the CDO tranche doesn't pass this test, it may be able to pass the alternative industry test. In this example, the alternative industry test may yield the results in table 23, based on the specific composition of the asset pool.

Table 23

Alternative Largest Industry Default Test Example

		(A)	(B)
Industry	**Total assets ($)**	**Default entire industry with 17% recovery ($)**	**Alternative test with 5% recovery ($)**
1	1,500	1,245	1,425
2	3,000	2,490	2,010
3	2,000	1,660	1,460
4	2,500	2,075	2,200
5	1,000	830	600
Total	10,000		

150. Because of the difference in recoveries between the two tests, it is possible that the alternative industry test yields a higher loss than when we assume that the entire industry defaults. Table 24 shows the example results.

Table 24

Alternative Largest Industry Default Test Example 2

			(A)	(B)
	Industry	**Total assets ($)**	**Default entire industry with 17% recovery ($)**	**Alternative test with 5% recovery ($)**
1		1,500	1,245	1,425
2		3,000	2,490	2,650
3		2,000	1,660	1,460
4		2,500	2,075	2,200
5		1,000	830	600
	Total	10,000		

151. In this case, the alternative industry test shows a loss of $2,650. This can occur in instances where the two default tests (primary and alternative) default roughly the same gross amounts, but due to the smaller recovery assumption in the alternative industry test, the alternative test results in a higher net loss number.

152. Another possibility may occur where the alternative industry test for industry 2 gives a lower loss amount than when defaulting an entire other industry in the portfolio. Table 25 shows such an example.

Table 25

Alternative Largest Industry Test Example 3

			(A)	(B)
Industry		**Total assets ($)**	**Default entire industry with 17% recovery ($)**	**Alternative test with 5% recovery ($)**
1		1,500	1,245	1,425
2		3,000	2,490	2,010
3		2,000	1,660	1,460
4		2,500	2,075	2,200
5		1,000	830	600
	Total	10,000		

153. In this case, defaulting industry 4 gives a higher net loss than the alternative industry test for industry 2. If we were to assign the rating purely on the results of the alternative industry test for industry 2, it is possible that a default of the entire industry 4 would affect the rating. In our view, it is possible that the credits in an entire industry in a CDO portfolio could default because the CDO holds a sub-segment of all the credits in that particular industry.

154. Because the composition of every portfolio varies in regard to each industry's concentration and number of credits, it is possible to get different results when applying the primary industry test and the alternative industry test. To facilitate this analysis, CDO Evaluator calculates all of these tests, and shows the relevant exposure.

155. CDO Evaluator calculates the largest industry default test as follows:

- It defaults each individual industry and applies a 17% recovery rate to calculate the net loss.
- It calculates net losses from the alternative industry test for each industry.

- It then compares the results of these two calculations and selects the lower number for each industry. This is because the alternative industry test applies if the transaction cannot withstand the default of the entire industry.
- Next, it looks at the results from this comparison for each industry, and selects the highest amount for both the 'AAA' and 'AA' liability ratings.

156. Under our criteria, this is the minimum level of default the transaction must withstand for us to assign a 'AAA' or 'AA' rating. Based on each portfolio's composition, it is possible under our criteria that any one of four outcomes can control the primary industry test and the alternative industry test, as shown below.

157. ***Outcome 1.*** The default of the largest entire industry with 17% recoveries is the controlling test, as the alternative industry test yields higher defaults (see table 26).

Table 26

Largest Industry Test Outcome 1

		(A)	(B)	(C)
Industry	**Total assets ($)**	**Default entire industry with 17% recovery ($)**	**Alternative test with 5% recovery ($)**	**Lower of (A) or (B) for the all industries ($)**
1	1,500	1,245	1,425	1,245
2	3,000	2,490	2,650	2,490
3	2,000	1,660	1,460	1,460
4	2,500	2,075	2,200	2,075
5	1,000	830	600	600
Total	10,000		Max of (C)=>	2,490

158. ***Outcome 2.*** The alternative industry test for the largest industry in the portfolio yields the largest net loss (see table 27).

Table 27

Largest Industry Test Outcome 2

		(A)	(B)	(C)
Industry	**Total assets ($)**	**Default entire industry with 17% recovery ($)**	**Alternative test with 5% recovery ($)**	**Lower of (A) or (B) for the all industries ($)**
1	1,500	1,245	1,425	1,245
2	3,000	2,490	2,300	2,300
3	2,000	1,660	1,460	1,460
4	2,500	2,075	2,200	2,075
5	1,000	830	600	600
Total	10,000		Max of (C)=>	2,300

159. ***Outcome 3.*** The default of an entire industry smaller than the largest industry, with 17% recoveries, is the controlling test because the alternative industry test on the largest industry yields lower defaults (see table 28).

Table 28

Largest Industry Test Outcome 3

		(A)	(B)	(C)
Industry	**Total assets ($)**	**Default entire industry with 17% recovery ($)**	**Alternative test with 5% recovery ($)**	**Lower of (A) or (B) for the all industries ($)**
1	1,500	1,245	1,425	1,245

Table 28

Largest Industry Test Outcome 3 (cont.)

		(A)	(B)	(C)
Industry	**Total assets ($)**	**Default entire industry with 17% recovery ($)**	**Alternative test with 5% recovery ($)**	**Lower of (A) or (B) for the all industries ($)**
2	3,000	2,490	2,010	2,010
3	2,000	1,660	1,460	1,460
4	2,500	2,075	2,200	2,075
5	1,000	830	600	600
Total	10,000		Max of (C)=>	2,075

160. ***Outcome 4.*** The alternative industry test for an industry that is not the largest industry in the portfolio yields the largest net loss if net losses from the default of the entire industry cannot be supported (see table 29).

Table 29

Largest Industry Test Outcome 4

		(A)	(B)	(C)
Industry	**Total assets ($)**	**Default entire industry with 17% recovery ($)**	**Alternative test with 5% recovery ($)**	**Lower of (A) or (B) for the all industries ($)**
1	1,500	1,245	1,425	1,245
2	3,000	2,490	2,010	2,010
3	2,000	1,660	1,460	1,460
4	2,500	2,075	2,050	2,050
5	1,000	830	600	600
Total	10,000		Max of (C)=>	2,050

161. In summary, for the primary industry test and the alternative industry test, the criteria first default the entire largest industry with 17% recoveries. Then the criteria apply the alternative industry test for each industry. It then compares the two amounts and selects the minimum result for each industry. The governing amount for the test is the highest minimum loss across all industries.

B: Additional Cash Flow Assumptions

162. The following provides insight into additional analytics that we employ in the cash flow modeling of CDO transactions. It expands upon the assumptions already described in these corporate CDO criteria.

163. CDO transaction structures and collateral eligibility can vary significantly from transaction to transaction. We modify the general assumptions that follow to fit the unique circumstances of each transaction. While comprehensive, this appendix does not attempt to cover all the cash flow modeling stresses that might be applied to any particular transaction.

Default Bias For Interest Mismatches

164. Most CDO transactions are modeled based on the general pool characteristics, with pro rata defaults applied across all assets. However, when there is a significant mix of fixed- and floating-rate assets, the bias of defaults makes it more

appropriate to stress the shift of portfolio composition over time. The bias of default that follows is applied at the 'AAA' through 'A-' rating levels.

165. In a high interest-rate environment, obligors paying a floating rate might be under greater pressure to meet their payment obligations due to rising interest rates. In this scenario, a larger percentage of floating-rate obligors might default. Conversely, in a low interest-rate environment, obligors that pay high fixed-interest rates might be more likely to default. In this second scenario, a larger proportion of the fixed-rate obligors might default.

166. To test for this phenomenon, we usually request certain cash flow runs where defaults are biased toward the fixed-rate assets during low interest-rate environments and, conversely, towards floating-rate assets during high interest-rate environments. The goal of this analysis is to test the rated class's ability to pay out even if defaults shift within the collateral pool. The results of these cash flow runs are then compared against results assuming no default bias to understand the sensitivity in break-even default rates.

167. For all ratings where the mix is greater than 10%, the formula generally applied for biasing defaults is as follows:

Default Bias = $2x/(1+x)$

(where x is the initial percentage of fixed-rate bonds or floating-rate loans in a pool).

168. For example, if the collateral portfolio has a mix of 30% fixed-rate assets and 70% floating-rate assets, the applicable fixed-rate default bias would be:

Fixed-Rate Default Bias = $2(0.3)/(1+0.3) = 0.46$

In this case, the cash flow model would be adjusted to default 46% of the fixed-rate assets and 54% of the floating-rate assets, instead of the actual 30%/70% split. This fixed-rate default bias is generally applied only to the dominant run in the Index Down interest-rate stresses.

169. In the same example, the applicable floating-rate default bias would be:

Floating-Rate Default Bias = $2(0.7)/(1+0.7) = 0.82$.

In this case, the cash flow model would default 18% of the fixed-rate assets and 82% of the floating-rate assets. This floating-rate default bias is generally applied only to the dominant run in the Index Up interest-rate stresses.

Foreign currency risk

170. Some CDO transactions, particularly those issued out of Europe, allow for a bucket of assets denominated in a currency different from that of the notes issued. The currency mismatch introduced is best hedged with a balance-guaranteed foreign exchange swap, but the cost of entering into these swaps is often prohibitive. The most common way to address this risk is to use a natural hedge, or asset-specific foreign exchange swaps based on set notional balances. In both of these cases, the foreign exchange risk is not fully hedged throughout the life of the

transaction, thus necessitating additional cash flow stresses to capture the foreign exchange risk.

171. A natural foreign exchange hedge exists when both the assets and liabilities denominated in each currency make up the same proportion of a given pool. For instance, the collateral pool may have 70% euro-denominated and 30% U.S. dollar-denominated assets matched to 70% euro-denominated and 30% U.S. dollar-denominated liabilities, thereby creating a natural hedge. However, this natural hedge often does not immunize the CDO against foreign exchange risk. This hedge remains perfectly balanced so long as defaults to the assets occur pro rata across the currency denominations. If defaults do not occur in proportion (the more likely scenario), the resultant imbalance would throw the natural hedge askew. The balance of the natural hedge could also be upset by prepayments on the assets or diversion of principal proceeds to pay down liabilities in a sequential pay structure triggered by the breach of a coverage test.

172. The effectiveness of a natural hedge is also dependent upon its position in the capital structure. Segregating the most senior class of notes across the currencies is more effective than segregating a more junior class.

173. The other common strategy for addressing foreign exchange risk is to use asset-specific foreign exchange swaps. The issuer of the securities enters into a foreign exchange swap, often for a set notional balance or a schedule of notional balances. This hedging strategy is likewise susceptible to hedging imbalances due to the bias of defaults or prepayments on the asset balance.

174. In the absence of a strategy that adequately addresses foreign exchange risk over the life of the transaction, we typically employ a two-part analysis to test for the potential effect of this risk. First, the cash flow is subjected to additional stresses that bias defaults toward each of the currency denominations. The magnitude of the bias is dictated by factors that include the position of the natural hedge in the capital structure, the proportion of assets denominated in each currency, and the disparity of the credit risk profiles between each currency-denominated sub-portfolio. Currency devaluation factors, calculated using a currency devaluation model, are then applied to the resultant hedge imbalance to size the extent of the currency mismatch.

175. The presence of different indices (e.g., LIBOR and EURIBOR) in transactions with multiple currencies might also necessitate additional analysis to capture the mismatch of indices. The empirical relative movement of the indices and the magnitude of the mismatch determine this need.

176. We should be consulted for the default bias, currency devaluation stresses, and index mismatch stresses applicable to each particular transaction.

177. In addition to hedging the periodic payments, the foreign exchange strategy should remain in place to cover the recoveries realized on defaulted securities. Automatic termination of the foreign-exchange swap upon default of an asset exposes the recoveries to foreign-exchange risk. We typically adjust the recovery rate assigned when the swap is required to terminate before the base recovery delay assumptions. The magnitude of this adjustment is determined according to factors such as the length of time the defaulted asset is exposed to foreign-exchange risk and the particular currencies involved.

178. Foreign-exchange risk also arises when an asset is sold, but the asset-specific foreign-exchange swap is not

automatically retired or, conversely, the foreign-exchange swap terminates before the asset matures. In the first instance, the collateral manager is likely to include the economic effect of the swap in making its sell decision and, in the latter, the manager might sell the unhedged asset to eliminate foreign-exchange concerns. In both cases, noncredit-based considerations are factored into the decision process, and we consider adjusting the recovery rate assigned.

Interest income on eligible investments

179. Proceeds received from assets in the form of scheduled principal and interest payments and recovery proceeds are held in eligible investments before being reinvested in substitute collateral or being used to pay liabilities on a payment date.

180. In the cash flow model, the analysis assumes that scheduled principal and interest proceeds are held in eligible investments for one-half of the payment period of the collection before it is reinvested in substitute collateral. Also, in the analysis, recoveries are assumed to occur at the end of a payment period. Therefore, interest is not earned on recovery proceeds held as eligible investments during the period in which it is recovered.

181. Interest earned on the regular payments received from the eligible investments is modeled at the index referenced minus 100 basis points.

Payment timing mismatch

182. It is common for transactions to include a bucket for assets that pay less frequently than the payment terms of the liabilities. In many instances, the transaction uses an interest reserve mechanism or enters into a basis swap to address this mismatch. In the absence of an adequate mitigant, the modeling should reflect the mismatches in payment timing as they actually occur, to allow for accurate testing of cash flows. There should be no "smoothing" of asset payments to match liability payments.

Pay-in-kind (PIK) assets

183. When more than 5% of the assets in a portfolio by par balance have the ability to pay in kind, we apply a PIK stress test to ensure that the liquidity facility can cover interest shortfalls from the assets. The PIK stress applied is determined after taking into account the transaction structure and targeted portfolio profile. This is typically done only for the most severe stress case to verify if it can pass; BDRs may be set without this stress.

184. Some transactions treat assets that pay in kind for a defined time period as defaulted assets. The defaulted balance of the PIK assets are marked as the original par principal balance, not its principal plus accrued interest balance.

Long-dated corporate assets

185. The inclusion of corporate assets that mature on a date beyond the legal final maturity date of the liabilities requires that the CDO transaction sell these assets before this date. This exposes the transaction to the noncredit-related risk of loss of par and is particularly troublesome for corporate bonds and other types of instruments that return all or substantially all of the par balance at the asset's legal final maturity date.

186. We address this concern by limiting the concentration of assets in the long-dated bucket to 5%. When the allowance for this bucket exceeds 5%, the par credit for each long-dated asset is reduced by applying a present value of 10% per year to each principal payment due on the asset beyond the legal final maturity date of the transaction. This

adjustment reflects a potential par loss incurred for the forced sale of the asset under less than ideal market conditions.

187. This approach applies only to corporate assets. Long-dated structured finance assets raise different issues that are beyond the scope of this article.

Corporate mezzanine loans

188. Corporate mezzanine loans are common to many European leveraged loan CDO transactions. These loans have a junior secured position and typically have two components to their interest payments--a current-pay coupon and a PIK coupon. The latter coupon is structured in the loan documents to pay in kind from day 1 and accrues to principal; in effect, it behaves like a zero coupon bond.

189. Although a mezzanine loan typically has a 10-year tenor, it is quite likely that it will be refinanced within two to three years. The ability of a CDO manager to reinvest in new mezzanine loans depends on the length of the reinvestment period, the ability of the manager to reinvest unscheduled principal proceeds after the end of the reinvestment period, and any maturity restriction imposed on each new loan. Given the current lack of a secondary market for European mezzanine loans, it is unlikely that a manager will be able to maintain its desired/covenanted mezzanine loan balance throughout the transaction.

190. We give credit to the accrued portion of the PIK coupon component in the cash flow modeling, subject to the following conditions:

- Credit for the accrual of the PIK coupon is typically allowed for the reinvestment period plus an additional 2.5 years. The amount of credit would have to be reduced if the maturity of the CDO notes or the WAL test of the assets prevents reinvestment of mezzanine loans during the reinvestment period. Conversely, if the CDO transaction is structured with a long note maturity and unscheduled proceeds can be reinvested after the reinvestment period, then we consider extending the credit given to the PIK coupon.
- For the purpose of the coverage tests, credit is extended to the accrued PIK interest in the overcollateralization test so long as the accrued interest is treated as principal proceeds; credit is not given in the interest coverage test because no interest is received in cash during the payment periods.
- The asset eligibility guidelines for the transaction should include covenants for a minimum mezzanine loan bucket and a minimum PIK interest rate for the mezzanine loans. This is needed to size aggregate credit to extend to the accrued PIK interest.
- For purposes of default and recovery, the defaulted balance is calculated as the product of the default probability and the par balance inclusive of the accrued PIK interest. The recovery balance is calculated as the product of the recovery rate and the base par. Accrued PIK balance is excluded.

191. The recovery range for corporate loans is used in the assignment of recovery rates to mezzanine loans.

Combination notes

192. One challenge confronted in the cash flow analysis for rating combination notes that include equity as an asset is the sizing of unknown and uncapped administrative expenses senior in the priority of payments. For the purposes of cash flow modeling, we assume that these additional expenses are equal to the capped expenses located near the top part of the priority of payments.

193. In addition, the cash flows are also stressed with the three additional default patterns employed for low credit quality

portfolios. These patterns are applied to the equity analysis even if the credit quality of the portfolio is not necessarily low.

Haircut for low-rated collateral

194. While a certain concentration of 'CCC' rated assets is not necessarily bad, especially if factored into the original class sizing of the transaction, 'CCC' rated assets have a tendency to be downgraded more quickly. Most transactions include a value haircut to 'CCC' rated assets to capture this increased proclivity to default in the overcollateralization test. This causes it to breach earlier as the 'CCC' asset concentration increases, allowing for faster paydown of the rated debt. We generally look for the overcollateralization test haircut when the percentage of assets in the pool with a rating of 'CCC' or less exceeds the original amount by 5%. Any amount over the original amount plus the 5% threshold is then carried at either 70% of its par value or at the market value of the asset in the numerator of the test. The collateral manager, before the closing date of the transaction, makes the choice between treatment at 70% of par or market value. When the market value treatment is chosen, the rating analyst should be consulted to determine the proper market value treatment.

Value of defaulted securities

195. Other than the current-pay securities valuation, all defaulted securities are carried at the lower of their assigned recovery rate or current market value for the purpose of the overcollateralization test. In certain instances, however, we may assign instrument-specific recovery assumptions. Equity securities received as part of a workout can be held in the CDO transaction, but are given no value.

C: How We Determine A Rating Input For A Security For The Purpose Of Its Inclusion In CDO Evaluator

196. Standard & Poor's has developed several options to allow an asset's creditworthiness to be assessed and a rating input to be determined for the purpose of modeling CDO transactions. The following is a brief description of different methodologies used to quantify a portfolio's credit risk (in a given transaction, there can be a combination of methods applied to different pieces of the portfolio):

(i) If there is a Standard & Poor's long-term credit rating on the issuer--or on an obligor in the same organizational hierarchy, as appropriate--then that rating is the Standard & Poor's rating input.

(ii) If a mid-market evaluation rating from Standard & Poor's is available, then the rating input is the lowest corresponding Standard & Poor's rating level as described in table 14 of "Mid-Market Evaluation Rating Methodology," published Nov. 20, 2014. For instance, for MM1 and above, the rating input is 'BBB'; for MM7, the rating input is 'CCC-'.

(iii) If a credit estimate from Standard & Poor's is available, then the credit estimate is the Standard & Poor's rating input.

(iv) If no issuer credit rating or credit estimate is available, but any of the issuer's obligations are rated by Standard & Poor's, then the Standard & Poor's rating input is determined by notching up or down from the issue rating as follows: (A) If the rated issue is senior unsecured, the rating input is the Standard & Poor's issue rating on the unsecured

obligation. (B) If the rated issue is senior secured, the rating input is one notch below the Standard & Poor's issue rating on the senior secured obligation. (C) If the rated issue is subordinated, the rating input is one notch above the Standard & Poor's issue rating on the subordinated obligation.

(v) If a mapping has been provided by Standard & Poor's for the collateral, the corresponding Standard & Poor's rating input is determined pursuant to such mapping (see "Mapping A Third Party's Internal Credit Scoring System To Standard & Poor's Global Rating Scale," published May 8, 2014).

(vi) If there is another NRSRO rating on the issuer and (1) it is a public rating and (2) it is unqualified, then the corresponding Standard & Poor's rating input is determined by applying the statistical analysis described in our mapping criteria to the credit rating scale of the other NRSRO. The output of the analysis ("notched rating") is used to derive an adjustment to the other NRSRO's credit ratings. When the issuer or issue has ratings from multiple NRSROs, the lowest of all the notched ratings is used. The portion of the principal balance of the collateral that has Standard & Poor's equivalent rating inputs assigned in this way may not exceed 15%.

(vii) If (1) neither the issuer nor any of its affiliates is subject to reorganization, bankruptcy, or similar proceedings and (2) all the issuer's obligations are current and the collateral manager believes they will remain current, then the corresponding Standard & Poor's rating input for such an obligation is 'CCC-'.

(viii) With respect to collateral obligations whose rating input cannot be determined using any of the steps described in subparagraphs (i) through (vii) above, then the corresponding Standard & Poor's rating input is 'CC'.

(ix) For debtor-in-possession (DIP) financings, the issue level's point-in-time rating may be used as the Standard & Poor's rating input for a maximum of 12 months from its initial assignment. However, we may further limit the use of the point-in-time rating if we believe that the credit quality of the DIP loan has deteriorated since its assignment. In order to make this assessment, we may request the collateral manager to provide information related to the DIP loan, such as amortization modifications, extensions of maturity, reductions of its principal amount owed, or nonpayment of timely interest or principal due. The collateral manager will also provide any other information that, in his or her reasonable business judgment, may have a material adverse impact on the credit quality of the DIP asset.

(x) For the purpose of determining the Standard & Poor's rating input: (1) If the rating assigned by Standard & Poor's to an obligor or its obligations is on CreditWatch positive, such rating input will be treated as being one subcategory above the assigned rating. (2) If the applicable rating assigned by Standard & Poor's to an obligor or its obligations is on CreditWatch negative, such rating input will be treated as being one subcategory below the assigned rating.

D: Explanation Of Cohort Methodology For Asset Defaults

197. We conduct our default studies based on static pools or cohort groupings, and create static pools by grouping corporate issuers by rating category at the beginning of each period covered by the study. We observe the default and rating transition behavior of each static pool from that point forward. We assigned all corporate issuers included in the study to one or more static pools. When an issuer defaults, a default is realized in every cohort to which that obligor is included.

198. We use the static pool methodology to avoid certain pitfalls in estimating default rates. This enables default rates to account for rating migration and allows for default rates to be calculated across multi-period time horizons. Some methods for calculating default and rating transition rates might assign defaults against only the initial rating on the corporate asset while ignoring more recent rating changes that supply more current information. Other methods may calculate default rates using only the most recent year's default and rating data; however, this method may yield comparatively low default rates during periods of high rating activity, as it ignores prior years' default activity.

199. The pools are static in the sense that their membership remains constant over time. Each static pool can be viewed as a buy-and-hold portfolio. However, it is not possible to compare static pools across different studies because errors, if any, are corrected by every new update, and the criteria for inclusion or exclusion of companies in the default study are subject to minor revisions over time. Therefore, with every new update, we revise results back to the same starting date of Dec. 31, 1980, to avoid continuity problems.

200. We surveil entities on which the ratings have been withdrawn--that is, revised to 'NR' (not rated)--with the aim of capturing potential defaults. We exclude these companies, as well as those that have defaulted, from subsequent static pools.

201. For instance, the 1981 static pool comprises all companies rated as of 12:01a.m. Jan. 1, 1981. Adding those companies first rated in 1981 to the surviving members of the 1981 static pool forms the 1982 static pool. All rating changes that took place are reflected in the newly formed 1982 static pool. We used this same method to form static pools for 1983 through 2007. Between Jan. 1, 1981 and March 31, 2014, we added 12,655 newly rated organizations to form new static pools, while we excluded 2,134 defaulting companies and 6,135 companies on which the last rating was classified as 'NR' (not rated).

202. We compute default rates for a static pool using a conditional probability methodology, which follows a cohort of issuers through time. As an example, suppose that we want to compute the five-year default rate for the cohort of issuers from January 1984. We compute the one-year default rate for these issuers by checking their ratings as of January 1985. We remove from the sample any issuers that had ratings withdrawn between January 1984 and January 1985, and do not include them in any further calculations. We follow the January 1984 cohort, which has had defaulted issuers and issuers with ratings withdrawn over the preceding one-year period removed, and compute the annual default rate for January 1985 to January 1986 with this adjusted cohort, assigning defaults according to the original rating held by the issuer in the January 1984 cohort. We repeat this process for every annual period until January 1989, removing any issuers with defaulted or withdrawn ratings from the preceding year from that year's cohort. We compute the five-year default rate from these one-year conditional default rates.

E: Asset Default Rate Inputs For CDO Evaluator Default Simulation Model

Table 30

30-Year Corporate Default Table

(%)

	Rating						
Year	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**
1	0.003	0.018	0.198	0.462	2.109	7.848	20.495
2	0.016	0.074	0.452	1.092	4.644	14.782	34.623
3	0.041	0.172	0.771	1.896	7.476	20.935	44.486
4	0.085	0.318	1.159	2.868	10.488	26.397	51.603
5	0.150	0.514	1.622	3.995	13.587	31.246	56.923
6	0.240	0.763	2.162	5.258	16.698	35.560	61.036
7	0.361	1.069	2.780	6.639	19.767	39.406	64.313
8	0.514	1.433	3.476	8.116	22.758	42.850	66.996
9	0.704	1.856	4.246	9.669	25.645	45.945	69.243
10	0.933	2.339	5.088	11.281	28.413	48.740	71.164
11	1.204	2.881	5.997	12.935	31.054	51.274	72.832
12	1.519	3.482	6.968	14.616	33.567	53.583	74.302
13	1.879	4.140	7.996	16.312	35.952	55.696	75.612
14	2.286	4.854	9.076	18.013	38.213	57.635	76.789
15	2.741	5.621	10.202	19.710	40.354	59.423	77.857
16	3.245	6.440	11.368	21.396	42.382	61.077	78.832
17	3.796	7.307	12.569	23.066	44.304	62.612	79.727
18	4.394	8.219	13.799	24.714	46.125	64.040	80.551
19	5.040	9.173	15.055	26.338	47.851	65.372	81.315
20	5.732	10.166	16.331	27.935	49.491	66.619	82.025
21	6.468	11.195	17.623	29.503	51.048	67.788	82.687
22	7.247	12.256	18.927	31.040	52.529	68.886	83.306
23	8.067	13.346	20.240	32.546	53.939	69.921	83.886
24	8.926	14.463	21.558	34.019	55.283	70.897	84.431
25	9.822	15.602	22.878	35.461	56.565	71.820	84.945
26	10.753	16.761	24.198	36.870	57.790	72.695	85.430
27	11.716	17.938	25.515	38.247	58.962	73.524	85.889
28	12.709	19.128	26.827	39.593	60.083	74.312	86.323
29	13.730	20.330	28.132	40.907	61.157	75.062	86.736
30	14.776	21.541	29.428	42.190	62.188	75.777	87.128

Note: The above percentages are rounded to three decimal places.

F: Correlation Override Table For CDO Evaluator Default Simulation Model

203. Table 31 reflects the correlation assumptions used in CDO Evaluator.

Table 31

Correlation Assumptions

Correlation Between Assets With The Same Asset Type

	Corp (local)	Corp (regional)	Corp (global)	SF (excluding CDO)	CDO	Project finance	Muni	Sovereign
Assets in the same country	0.200	0.200	0.200	0.700	0.700	0.200	0.150	1.000
Assets in the same region	0.200	0.200	0.200	0.600	0.700	0.200	0.150	0.200
Assets in different regions	0.050	0.050	0.200	0.500	0.700	0.050	0.050	0.050

Correlation Between Assets With Different Asset Types In The Same Country

	Corp (local)	Corp (regional)	Corp (global)	SF (excluding CDO)	CDO	Project finance	Muni	Sovereign
Corp (local)	0.075	0.075	0.075	0.075	0.075	0.075	0.050	0.200
Corp (regional)		0.075	0.075	0.075	0.075	0.075	0.050	0.200
Corp (global)			0.075	0.075	0.075	0.075	0.050	0.200
SF (excluding CDO)				0.400	0.300	0.075	0.050	0.200
CDO					0.300	0.075	0.050	0.200
Project finance						0.075	0.050	0.200
Muni							0.050	0.200
Sovereign								

Correlation Between Assets With Different Asset Types In The Same Region

	Corp (local)	Corp (regional)	Corp (global)	SF (excluding CDO)	CDO	Project finance	Muni	Sovereign
Corp (local)	0.075	0.075	0.075	0.050	0.075	0.075	0.050	0.100
Corp (regional)		0.075	0.075	0.050	0.075	0.075	0.050	0.100
Corp (global)			0.075	0.050	0.075	0.075	0.050	0.100
SF (excluding CDO)				0.300	0.300	0.050	0.050	0.100
CDO					0.300	0.075	0.050	0.100
Project finance						0.075	0.050	0.100
Muni							0.050	0.100
Sovereign								

Table 31

Correlation Assumptions (cont.)

Correlation Between Assets With Different Asset Types In Different Regions

	Corp (local)	Corp (regional)	Corp (global)	SF (excluding CDO)	CDO	Project finance	Muni	Sovereign
Corp (local)	0.050	0.050	0.050	0.050	0.075	0.050	0.050	0.050
Corp (regional)		0.050	0.050	0.050	0.075	0.050	0.050	0.050
Corp (global)			0.050	0.050	0.075	0.050	0.050	0.050
SF (excluding CDO)				0.200	0.300	0.050	0.050	0.050
CDO					0.300	0.075	0.050	0.050
Project finance						0.050	0.050	0.050
Muni							0.050	0.050
Sovereign								

Correlation Override Table

Asset sector	Asset type	Within country correlation	Within region correlation	Between regions correlation
Corp	50	0.100	0.100	0.100
Project Finance	50	0.100	0.100	0.100
USM2	25	0.200	0.200	0.050
USM2	USM2	0.200	0.200	0.050
USM5	39	0.200	0.200	0.050
USM5	USM5	0.200	0.200	0.050
20	20	0.250	0.250	0.200
20	40	0.100	0.075	0.075
20	41	0.100	0.075	0.075
20	43	0.250	0.200	0.150
20	44	0.100	0.075	0.050
20	45	0.100	0.075	0.050
20	46	0.250	0.200	0.150
20	50	0.100	0.100	0.100
20	50A	0.100	0.100	0.100
20	50B	0.100	0.100	0.100
20	51	0.100	0.075	0.075
20	52	0.100	0.075	0.075
20	53	0.100	0.075	0.075
20	56	0.100	0.075	0.075
20	59	0.100	0.075	0.075
20	60	0.100	0.075	0.075
20	62	0.100	0.075	0.075
40	40	0.700	0.550	0.450
40	41	0.400	0.300	0.200

Table 31

Correlation Assumptions (cont.)				
40	43	0.100	0.075	0.050
40	44	0.100	0.075	0.050
40	45	0.100	0.075	0.050
40	46	0.100	0.075	0.050
40	50	0.300	0.300	0.300
40	50A	0.400	0.400	0.400
40	50B	0.300	0.300	0.300
40	51	0.400	0.300	0.200
40	52	0.400	0.300	0.200
40	53	0.400	0.300	0.200
40	56	0.400	0.300	0.200
40	59	0.300	0.050	0.050
40	60	0.150	0.100	0.100
40	62	0.150	0.050	0.050
41	41	0.700	0.550	0.450
41	43	0.100	0.075	0.050
41	44	0.100	0.075	0.050
41	45	0.100	0.075	0.050
41	46	0.100	0.075	0.050
41	50	0.300	0.300	0.300
41	50A	0.400	0.400	0.400
41	50B	0.300	0.300	0.300
41	51	0.400	0.300	0.200
41	52	0.400	0.300	0.200
41	53	0.400	0.300	0.200
41	56	0.400	0.300	0.200
41	59	0.300	0.050	0.050
41	60	0.150	0.100	0.100
41	62	0.150	0.050	0.050
43	43	0.250	0.200	0.175
43	44	0.100	0.075	0.050
43	45	0.100	0.075	0.050
43	46	0.200	0.125	0.100
43	50	0.100	0.100	0.100
43	50A	0.075	0.075	0.075
43	50B	0.075	0.075	0.075
43	51	0.075	0.050	0.050
43	52	0.075	0.050	0.050
43	53	0.075	0.050	0.050
43	56	0.075	0.050	0.050
43	59	0.075	0.050	0.050
43	60	0.100	0.100	0.100

Table 31

Correlation Assumptions (cont.)				
43	62	0.075	0.050	0.050
44	44	0.200	0.200	0.050
44	45	0.100	0.075	0.050
44	46	0.100	0.075	0.050
44	50	0.100	0.100	0.100
44	50A	0.075	0.075	0.075
44	50B	0.075	0.075	0.075
44	51	0.075	0.050	0.050
44	52	0.075	0.050	0.050
44	53	0.075	0.050	0.050
44	56	0.075	0.050	0.050
44	59	0.075	0.050	0.050
44	60	0.100	0.100	0.100
44	62	0.075	0.050	0.050
45	45	0.200	0.200	0.050
45	46	0.100	0.075	0.050
45	50	0.100	0.100	0.100
45	50A	0.075	0.075	0.075
45	50B	0.075	0.075	0.075
45	51	0.075	0.050	0.050
45	52	0.075	0.050	0.050
45	53	0.075	0.050	0.050
45	56	0.075	0.050	0.050
45	59	0.075	0.050	0.050
45	60	0.100	0.100	0.100
45	62	0.075	0.050	0.050
46	46	0.250	0.200	0.175
46	50	0.100	0.100	0.100
46	50A	0.075	0.075	0.075
46	50B	0.075	0.075	0.075
46	51	0.075	0.050	0.050
46	52	0.075	0.050	0.050
46	53	0.075	0.050	0.050
46	56	0.075	0.050	0.050
46	59	0.075	0.050	0.050
46	60	0.100	0.100	0.100
46	62	0.075	0.050	0.050
50	59	0.200	0.200	0.200
50	60	0.150	0.150	0.150
50	62	0.100	0.100	0.100
50A	50A	0.800	0.800	0.800
50A	51	0.450	0.450	0.450

Table 31

Correlation Assumptions (cont.)				
50A	52	0.450	0.450	0.450
50A	53	0.450	0.450	0.450
50A	56	0.450	0.450	0.450
50A	60	0.200	0.200	0.200
50A	62	0.200	0.200	0.200
50B	59	0.200	0.200	0.200
50B	60	0.150	0.150	0.150
50B	62	0.200	0.200	0.200
51	59	0.200	0.050	0.050
51	60	0.150	0.100	0.075
51	62	0.200	0.050	0.050
52	59	0.200	0.050	0.050
52	60	0.150	0.100	0.075
52	62	0.200	0.050	0.050
53	59	0.200	0.050	0.050
53	60	0.150	0.100	0.075
53	62	0.200	0.050	0.050
56	59	0.300	0.100	0.050
56	60	0.150	0.100	0.075
56	62	0.200	0.050	0.050
59	59	0.700	0.400	0.350
59	60	0.200	0.100	0.075
59	62	0.300	0.050	0.050
60	62	0.200	0.050	0.050
62	62	0.700	0.500	0.450
PF1	28	0.200	0.200	0.050
PF2	30	0.200	0.200	0.050
PF3	31	0.200	0.200	0.200
PF6	USM3	0.200	0.200	0.050
PF7	38	0.200	0.200	0.200
PF8	37	0.200	0.200	0.050
PF8	34	0.200	0.200	0.050
PF4	32	0.200	0.200	0.200
PF5	32	0.200	0.200	0.050
PF5	39	0.200	0.200	0.050
PF4	PF4	0.200	0.200	0.200
PF4	PF5	0.200	0.200	0.050
PF3	PF3	0.200	0.200	0.200
PF7	PF7	0.200	0.200	0.200

G: Tranche Rating Quantile For CDO Evaluator Default Simulation Model

Table 32

Tranche Rating Quantile For CDO Evaluator Simulation Model

(%)

	Rating						
Year	**AAA**	**AA**	**A**	**BBB**	**BB**	**B**	**CCC**
1	0.001	0.018	0.248	0.692	2.637	8.633	21.520
2	0.006	0.074	0.566	1.638	5.805	16.260	36.354
3	0.017	0.172	0.963	2.844	9.345	23.028	46.710
4	0.034	0.318	1.449	4.302	13.110	29.036	54.183
5	0.060	0.514	2.027	5.992	16.984	34.371	59.769
6	0.096	0.763	2.703	7.888	20.872	39.116	64.087
7	0.144	1.069	3.476	9.959	24.709	43.347	67.529
8	0.206	1.433	4.345	12.174	28.447	47.135	70.345
9	0.281	1.856	5.308	14.504	32.056	50.540	72.705
10	0.373	2.339	6.360	16.922	35.516	53.614	74.722
11	0.481	2.881	7.496	19.402	38.818	56.402	76.474
12	0.607	3.482	8.710	21.924	41.959	58.942	78.017
13	0.752	4.140	9.995	24.468	44.940	61.265	79.392
14	0.915	4.854	11.345	27.019	47.766	63.399	80.629
15	1.097	5.621	12.752	29.565	50.443	65.366	81.750
16	1.298	6.440	14.210	32.094	52.978	67.185	82.774
17	1.518	7.307	15.711	34.598	55.380	68.873	83.713
18	1.758	8.219	17.249	37.071	57.656	70.444	84.579
19	2.016	9.173	18.819	39.507	59.814	71.909	85.381
20	2.293	10.166	20.414	41.903	61.863	73.281	86.126
21	2.587	11.195	22.029	44.254	63.810	74.566	86.821
22	2.899	12.256	23.659	46.560	65.661	75.775	87.471
23	3.227	13.346	25.300	48.818	67.424	76.913	88.080
24	3.570	14.463	26.948	51.029	69.104	77.987	88.653
25	3.929	15.602	28.598	53.191	70.707	79.002	89.192
26	4.301	16.761	30.247	55.305	72.238	79.964	89.702
27	4.686	17.938	31.894	57.371	73.702	80.877	90.183
28	5.084	19.128	33.533	59.389	75.104	81.744	90.639
29	5.492	20.330	35.165	61.360	76.447	82.569	91.072
30	5.910	21.541	36.785	63.286	77.735	83.355	91.484

H: Recovery Rates For Assets Junior To Assets With Recovery Ratings

Table 33

Recovery Rates For Senior Unsecured Assets Junior To Assets With Recovery Ratings (%)

Group 1

	CDO liability rating					
Senior asset RR	**AAA**	**AA**	**A**	**BBB**	**BB**	**B/CCC**
1+	18	20	23	26	29	31
1	18	20	23	26	29	31
2	18	20	23	26	29	31
3	12	15	18	21	22	23
4	5	8	11	13	14	15
5	2	4	6	8	9	10
6	-	-	-	-	-	-

Group 2

	CDO liability rating					
Senior asset RR	**AAA**	**AA**	**A**	**BBB**	**BB**	**B/CCC**
1+	16	18	21	24	27	29
1	16	18	21	24	27	29
2	16	18	21	24	27	29
3	10	13	15	18	19	20
4	5	5	5	5	5	5
5	2	2	2	2	2	2
6	-	-	-	-	-	-

Group 3

	CDO liability rating					
Senior asset RR	**AAA**	**AA**	**A**	**BBB**	**BB**	**B/CCC**
1+	13	16	18	21	23	25
1	13	16	18	21	23	25
2	13	16	18	21	23	25
3	8	11	13	15	16	17
4	5	5	5	5	5	5
5	2	2	2	2	2	2
6	-	-	-	-	-	-

The adjustments to the ranges from published reports as shown in table 12 do not apply to this table. RR-Recovery rating.

Table 34

Recovery Rates For Subordinated Assets Junior To Assets With Recovery Ratings (%)

Groups 1, 2, and 3

	CDO liability rating					
Senior asset RR	**AAA**	**AA**	**A**	**BBB**	**BB**	**B/CCC**
1+	8	8	8	8	8	8
1	8	8	8	8	8	8
2	8	8	8	8	8	8

Table 34

Recovery Rates For Subordinated Assets Junior To Assets With Recovery Ratings (%) (cont.)

Groups 1, 2, and 3

	CDO liability rating					
Senior asset RR	**AAA**	**AA**	**A**	**BBB**	**BB**	**B/CCC**
3	5	5	5	5	5	5
4	2	2	2	2	2	2
5	-	-	-	-	-	-
6	-	-	-	-	-	-

The adjustments to the ranges from published reports as shown in table 12 do not apply to this table. RR-Recovery rating.

RELATED CRITERIA AND RESEARCH

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- Standard & Poor's Provides Guidance For Collateral Managers And Trustees Regarding CDO Monitor, Nov. 11, 2009

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