EXECUTIVE SUMMARY

In recent years, collateralized debt obligations (CDOs) have emerged as one of the largest and fastest growing sectors of the asset-backed securities (ABS) market. Due to increasing use of bond and loan collateral within one transaction, the term collateralized debt obligation is becoming more popular, and the terms collateralized bond obligation (CBO) and collateralized loan obligation (CLO) are becoming less common. CDOs are segmented into two categories, cash flow and market value. This article exclusively addresses DCR’s approach to rating cash flow CDOs.

The first CDO was issued in 1988, however issuance was limited until the mid-1990s. In 1996 the CDO market began to grow dramatically, and 108 transactions totaling $36 billion were closed that year. Issuance increased steadily in the following three years as shown in Chart 1 on page 2. DCR played a significant role in this growth, having rated 80 transactions totaling $45 billion since 1996.

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In cash flow CDOs, overcollateralization is based upon the aggregate par value of the collateral. Cash flows to investors consist primarily of the periodic interest and principal payments from the underlying collateral. This structure contrasts market value CDOs in which overcollateralization is based upon the aggregate market value of the collateral. In market value transactions, cash flows to investors are primarily received from capital gains realized through active trading of the collateral.

**Motivations**

Cash flow CDOs are divided into “balance sheet” and “arbitrage” transactions. With balance sheet CDOs, the primary motivation of the issuer is generally regulatory capital relief and/or risk management. These transactions most frequently take the form of a large bank selling a substantial portion of its commercial loan portfolio. Arbitrage CDO issuers are motivated by capturing excess spread. Excess spread is the difference between the cash flows generated by a higher weighted-average coupon on the underlying collateral over the weighted-average funding cost on the issued notes. A portfolio made up of below-investment-grade securities can serve as the collateral for a substantial amount of investment-grade notes. Thus, an issuer can potentially capture the excess spread between the coupon payments on the below-investment-grade collateral and the coupon payments on the primarily investment-grade notes.

In addition to the arbitrage opportunity, many collateral managers see the securitization market as a way to take on additional financial leverage and thus maximize their return on equity. Most managers may also see the CDO market as a means to grow their assets under management. CDOs present a relatively unique method of doing so because managers can obtain a more stable funding source and avoid the risk of being funded by “hot money.” Hot money refers to inconsistent funding that comes from investors who tend to quickly reward the manager with major inflows following strong performance, but also quickly punish the manager with major outflows following underperformance.

Investors find CDOs attractive for many reasons. One of the most important is additional spread. The yields on CDOs continue to offer wider spreads than similarly rated asset-backed securities. CDOs are also fairly large transactions (generally $250 million to $1 billion or more) and, thus, allow for investors to realize substantial economies of scale. Another benefit of the large transaction size is that issuers and their bankers are more willing to tailor the characteristics of different tranches to fit the needs of different investors. Thus, many transactions include both fixed and floating classes, both rated interest and unrated contingent interest classes, various expected maturities from six months to 12 or more years, and various ratings from ‘AAA’ to ‘B-’ (as well as unrated equity). One final characteristic of CDOs that makes them attractive to many investors is that they offer broad exposure to markets in which they lack direct expertise. Unlike a conventional high-yield fund, this broad exposure comes with a rating and an investor-selectable amount of leverage.

**Typical Structure of a Cash Flow CDO**

In a typical CDO, a bankruptcy-remote, special-purpose corporation (SPC) is incorporated solely for the purpose of investing in a diversified pool of amortizing bonds and loans, engaging in appropriate risk management activities and issuing notes. The issuer buys the collateral in the open market or from a sponsor (such as a bank) and finances its purchase through the issuance of asset-backed securities. The interest and principal received from the underlying collateral is used to make payments on the issued securities. These transactions are called arbitrage CDOs because the weighted-average coupon of the underlying securities exceeds the weighted-average cost of funds on the notes, creating excess spread. Note that the asset-backed securities are designed to be completely amortized from cash generated by the underlying securities. The ability of a cash flow CDO to repay investors is independent of market prices of the underlying collateral, while remaining dependent on the credit quality of the underlying collateral debt securities.

The parties involved in a CDO transaction include a collateral manager, a trustee, a credit enhancement provider (which may be equity investors, and a lead underwriter from a commercial bank.
holders, mezzanine lenders or a surety bond provider) and a risk management counterparty. See Parties to the Transaction section on page 7.

Typically credit enhancement is provided in the form of subordination and overcollateralization. Excess spread and sometimes a surety bond are used to achieve the desired level of credit enhancement. Regardless of credit enhancement, the senior notes have first claim on all cash flow from the underlying collateral. After the senior notes come the mezzanine and equithyolders. For a discussion on the rating of equity tranches, please see DCR’s special report/methodology titled Criteria for Rating ‘Equity’ of Cash Flow CDOs dated January 2000, which is available on DCR’s Web site at www.dcrco.com (Quick Search: Equity). Various triggers and tests are used to measure the performance of the underlying collateral and must be maintained in order to avoid either a partial or complete early amortization of the transaction. Credit enhancement is discussed in more detail below.

Prior to the transaction closing, the collateral manager begins acquiring collateral for the issuer. Typically, collateral managers will have acquired a significant percentage of the collateral before closing. The remainder is acquired during a “ramp-up” period that lasts anywhere from 60 days to six months. All purchases must meet the eligibility criteria, as discussed below.

After the ramp-up period, the transaction enters a revolving period that typically lasts four-to-six years. During this time, the proceeds from the collateral, after paying fees, expenses and interest on the notes, are reinvested in new collateral. The collateral manager is allowed to manage the collateral pool, subject to compliance with the eligibility criteria and coverage tests (discussed subsequently). After the revolving period ends, the transaction enters an amortization period during which principal payments are made on the asset-backed securities. Notes are generally retired sequentially during the amortization period, with all remaining payments due by the stated final maturity dates.

Eligibility Criteria

DCR examines the collateral eligibility criteria as stipulated in the indenture to determine the appropriate stresses for each transaction. The eligibility criteria determine, among other things, the mean expected cumulative gross default rate and the subsequent recovery rate of the collateral. Within the eligibility criteria, the following items are of particular importance:

- The weighted-average credit rating of collateral;
- The collateral composition (e.g., senior unsecured bonds versus subordinated loans);
- The weighted-average life of the collateral;
- The obligor concentration in the collateral pool;
- The industry concentrations;
- The weighted-average coupon rate of the collateral; and
- Other factors including the fixed-rate versus floating-rate mix of the pool.

The weighted-average credit rating of the portfolio is an indication of its overall credit quality. This statistic is one of the best predictors of future default rates because each rating corresponds directly to a probability of default. Each item of collateral should have a rating assigned to it, or DCR will assume it is rated ‘CCC’. If DCR rates the collateral, then DCR will use its rating. If no DCR rating exists, DCR will use the lowest available public rating.

Recently there has been increased activity in converting bank loan portfolios into CLOs. Often banks have their own internal credit rating system that reflects default expectations. However, each item of collateral may not have a public rating. To establish a weighted-average rating for these portfolios, based on a sample of loans, DCR establishes a “mapping” system that translates the bank’s internal system into a DCR credit rating score. DCR then uses these ratings to establish credit enhancement levels for bank balance sheet CLOs.

<table>
<thead>
<tr>
<th>Table 1: DCR Rating Factors</th>
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<tr>
<td>Rating</td>
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<td>AAA</td>
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<td>B+</td>
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<td>B</td>
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<tr>
<td>B-</td>
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<tr>
<td>CCC</td>
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Each rating category is assigned a numeric value corresponding to the default probability. DCR’s rating factors are shown in Table 1. The

1 The typical priority of payments actually contains some claimants that are superior to the senior notes such as the trustee, the risk management counterparty and issuer expenses. However, these expenses are usually small relative to the claims of the senior and subordinate noteholders.
The credit rating of each piece of collateral is weighted against its par value, and then summed. Note that the ratings scale is non-linear, which means that the increased default probability between ratings classifications does not progress at an even rate. For example, the increased default probability between ‘BB+’ and ‘BB’ is less than the increase from ‘BB’ to ‘BB-’.

The most common types of collateral in CDOs include high-yield bonds, loans, emerging market sovereign and corporate debts, and “other” collateral. The types of collateral influence the recovery rates on the collateral pool, but not the default rates. The collateral composition does not affect the default rate because the default rate is presumed to be a function of the weighted-average credit rating of the collateral and not the type of collateral. For example, ‘BB-’ rated bonds and loans are presumed to default at the same rate, although the recovery experience on the two collateral types has been different. See the Recovery Rates section on page 11 of this report for further detail.

Most CDOs include allocations for “other” collateral types. These include synthetic securities, pay-in-kinds (PIKs), convertibles, split coupon, zero coupon, private securities, debt with warrants and structured finance securities. DCR is comfortable including these securities in a CDO as long as the maximum allowable percentage of each one of these types is small and the coverage tests address their inclusion. For example, the calculation of the weighted-average collateral coupon should include all zero coupons, split coupon bonds, convertibles and others at their actual payment rate without giving effect to accrual or other features. Furthermore, “yield enhancers” such as warrants or participating payments should be discounted. The effect of discounting the “yield enhancers” is to discourage their inclusion in the collateral pool. For instance, if a collateral manager needs to maintain a weighted-average coupon of 9.50%, any zero-coupon bond included is going to negatively impact the overall weighted-average coupon rating, forcing the inclusion of securities with a very high coupon to compensate. However, including these high coupon securities is likely to negatively impact the weighted-average rating of the collateral pool, effectively limiting the amount of these securities that may be included. As a result, even though most CDOs allow for limited buckets of these collateral types, to date DCR has not seen many of these actually included in collateral pools. A number of collateral managers have stated flatly that they have no intention of including these securities in their transactions.

Another significant predictor of defaults in a given portfolio is the weighted-average life of the collateral assets. A collateral pool with a longer weighted-average life of the assets will have a higher cumulative gross default rate than a pool with a shorter weighted-average life, ceteris paribus. Although weighted-average life and weighted-average maturity are sometimes used interchangeably, DCR does distinguish between the two. A portfolio of non-amortizing “bullet” bonds will have an identical weighted-average life and weighted-average maturity, while a portfolio of amortizing loans will have a shorter weighted-average life than weighted-average maturity. Because amortization reduces the amount of default risk, it is generally viewed as a positive attribute. Therefore, DCR will size credit enhancement to the weighted-average life of the securities rather than the weighted-average maturity.

One of the distinguishing characteristics of a cash flow CDO, as opposed to a market value CDO, is that the collateral is fully repaid through amortization of underlying collateral. No reliance is placed on the market value of assets sold prior to their respective maturities to retire a rated class of notes. If a significant portion of the collateral pool matures after the stated final maturity of the CDO, some portion of the collateral might have to be sold at its market value to retire notes. A cash flow CDO should not contain a reliance on market values. Therefore, one of two situations should exist for DCR to rate CDOs that contain securities whose stated final maturities exceed the stated final maturity date of the CDO. First, all rated classes of notes are fully retired from available cash flows without reliance on liquidation prior to maturity of any of the underlying collateral securities. Second, if such reliance is required, those securities are treated as defaults on the stated final maturity date of the CDO and included in the cash flows at their respective recovery rates.

Modern portfolio theory suggests that increasing diversification reduces overall risk. The biggest factor in determining portfolio diversification is the obligor concentration level. Portfolio theory suggests that the benefit of diversification increases as the number of obligors increases to 30. The benefit further increases from that level, but at a slower rate. Therefore, DCR has established its “base case” default rates assuming a maximum obligor concentration level of 3%. For amounts above that level, an overconcentration penalty is applied.

Recent CDO transactions have been larger on average in terms of total asset size than past transactions. Therefore, while older transactions often used a 3% limit, most newer transactions are finding it easier to continue to shrink the maximum obligor concentration level down toward 2%. DCR recognizes the increasing benefit to the CDO over increased di-
versification beyond the 3% level and adjusts the cumulative expected gross default rate for additional diversification.

Another factor affecting diversification is industry concentration. DCR limits concentration within a single industry to 8% of the total collateral pool. Furthermore, the sum of excesses above 5% usually does not exceed 15% of the total collateral pool. Many collateral managers will tend to have more concentrated pools for their other investment activities than DCR’s CDO criteria allow. DCR penalizes overconcentrated pools. A pool of well-diversified collateral is more likely to produce long-term results similar to those predicted by the historical studies than what might be expected from more concentrated pools. Concentrated pools are likely to produce results that are skewed from the historical studies that represent a survey of the universe of high-yield bonds. Skewed pools make an actuarial analysis more difficult. Therefore, DCR’s criteria limits overall industry concentrations.

The fixed-rate versus floating-rate composition of the collateral pool does not drive the credit enhancement levels because it is not, in itself, a predictor of future default rates. However, it is an important factor in assessing the asset and liability risk profile of the CDO structure. (Interest rate risk management is discussed in a separate section.)

Similarly, the weighted-average coupon rate of the collateral pool does not directly drive the required level of cumulative gross defaults that the CDO structure must withstand. This rate is based on the collateral coupon and not the yield to maturity or “yield to worst” of the underlying securities. This discourages the collateral manager from buying deeply discounted securities to increase portfolio yield. Furthermore, floating-rate collateral often has coupon rates below that of comparable term fixed-rate securities. Floating-rate securities are included for the purpose of calculating the coverage tests at their current coupon rates.

While the weighted-average coupon rate does not directly drive the amount of required cumulative gross defaults, it does indirectly influence the overall level of credit enhancement. This is because the weighted-average coupon rate is a primary component of the excess spread in the transaction. Excess spread is an important, although somewhat invisible, element of the overall credit enhancement. Ceteris paribus, transactions with significant excess spread can withstand more defaults than those

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Table 2: Bar-belling Example

In this example, Generic CBO’s overcollateralization (O/C) ratio is near the low end of its required minimum level. In this case the ratio must be maintained at 110%, and its current O/C level is 111%. If the par value of the total collateral pool is $100 million and the O/C ratio is 111%, then the notes outstanding are $90.09 million.

The collateral manager is concerned about the low O/C ratio and wants to improve it. One possible solution is for the collateral manager to sell an asset trading near par and use the proceeds to buy a deeply discounted one trading around 80% of par. The new asset costs less than the old asset, and therefore, the collateral manager will be able to buy more par value for an equivalent amount of cash.

<table>
<thead>
<tr>
<th>Sell existing collateral bond</th>
<th>Par value $5.000 million</th>
<th>Price 99% proceeds $4.95 million</th>
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<tbody>
<tr>
<td>Buy new collateral bond</td>
<td>Par value $6.188 million</td>
<td>Price 80% cost $4.95 million</td>
</tr>
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</table>

Result: par value increase of $1,187,500, net cost is zero.

Immediately after the sale, the collateral manager has increased the par value of the collateral pool to $100.1875 million while the notes remain at $90.09 million, thereby increasing the O/C ratio to over 112%, without using any cash. Whether this move benefits investors is a matter of open debate.

Note however, the new security is probably deeply discounted for a reason and that reason is most likely reflected in its current credit rating. If the new security has a lower credit rating than the old security, the inclusion of the new security would drive down the overall weighted average credit rating (“WAR”) of the CDO, especially since the credit rating scale is non-linear.

| Minimum allowable WAR of collateral from eligibility criteria: | 1.60 (B+) |
| Assumed actual portfolio collateral WAR (prior to collateral sale) | 1.55 |
| Rating of collateral sold | 1.25 (BB-) |
| Rating of collateral purchased | 3.75 (CCC+) |
| WAR of collateral pool after purchase | 1.70 |

Therefore, because the WAR of the collateral pool after the trade is below the minimally acceptable level as defined by the eligibility criteria, the collateral manager would be prevented from making such a trade. The multiple non-linear tests prevent the collateral manager from having a group of assets well above a certain minimum criteria level offset by a group of assets well below the minimum criteria level.
with little or no excess spread. Typical high-yield CDOs have approximately 300 basis points of excess spread in a “normalized” scenario (i.e., excluding the effect of defaults).

“Bar-belling” the Eligibility Criteria

Some investors have expressed concern about the collateral manager’s ability to “barbell” the portfolio. “Bar-belling” refers to having collateral that meets the requirements of a certain test by having assets with attributes far below a certain required minimum offset by assets having attributes far above the same required minimum. The concern is that meeting minimum requirements does not directly address the overall composition of the portfolio and that the collateral manager could manipulate these requirements to produce a portfolio that is materially different from the one originally envisioned. In DCR’s view, this concern is balanced by the multiple and non-linear nature of the collateral constraints, as shown in Table 2 on page 5.

The Initial Period

Many CDOs will not have purchased all of their collateral at the time of closing, while all of the notes are fully funded. The excess of the notes over the collateral purchased at closing is funded into an account and invested in high-quality short-term instruments. The collateral manager makes withdrawals from this account over a specified period to purchase additional collateral. However, while the closing proceeds are invested in these short-term accounts, the transaction could have a period of “negative arbitrage,” whereby the accrual rate on the notes is more than the accrual rate on the collateral pool (consisting of high-yield securities plus the cash in short-term instruments). As the collateral manager makes withdrawals from the cash account to purchase collateral for the CDO, the weighted-average coupon rate of the transaction rises. This quickly eliminates the negative arbitrage and establishes the excess spread in the transaction.

DCR specifically analyzes the excess spread in the initial period of the CDO to ensure there is sufficient proceeds to pay timely interest to investors on the initial payment date. For the purposes of this analysis, DCR assumes the minimally acceptable “ramp-up” rate. DCR further assumes an interest rate on the cash invested in short-term instruments at a rate significantly below current LIBOR. If the “ramp-up” is unsuccessful (meaning the collateral manager failed to acquire the required amount of collateral within the specified time frame), the remaining uninvested cash is returned to investors.

The Revolving Period

After the initial period, assuming the ramp-up was successful, many CDOs enter the revolving period. During this time all principal collections (and sometimes excess interest collections) that are received by the trustee are reinvested by the collateral manager in new collateral, subject to the eligibility criteria and compliance with the coverage tests. For most CBOs (where the collateral is typically bonds that pay principal only at maturity), the average life of the collateral is longer than the length of the revolving period. This means that little principal is usually scheduled to be received during the revolving period. However, whatever is received is reinvested. CLOs typically have more amortizing and revolving debt securities so there is generally more cash received during the revolving period to reinvest. Prepayments on collateral debt securities will also increase the cash received during the revolving period. These amounts would be reinvested by the collateral manager.

The Amortization Period

After the revolving period, the transaction enters the amortization period. All principal payments received during the amortization period are passed through to investors as principal reductions.

Portfolio Trading

During the revolving period, the collateral manager may trade in the portfolio subject to strict limitations. In addition to reinvesting collateral that paid off or paid down during the revolving period (see above), the portfolio manager may trade collateral from the pool and use the proceeds to buy different collateral securities.

The collateral manager may sell collateral that has, in the manager’s opinion, either appreciated in value or depreciated in value beyond some thresholds. In addition, the collateral manager may trade up to a certain percentage of the collateral every year. A typical allocation for this “trading bucket” is 10-20%. Note that with a 20% annual trading bucket and a four-year revolving period, the collateral manager has the ability to substantially alter the composition of the collateral pool during the revolving period.

The collateral manager’s ability to trade is governed primarily by the eligibility criteria and the coverage tests. The collateral manager must buy collateral that meets the eligibility requirements. For example, if the maximum allowable obligor concentration is 2%, the collateral manager may not buy securities that increase the exposure of the pool to above 2% to a single obligor. In addition, the collateral manager is limited by minimum thresholds for the weighted-average rating, weighted-average life, weighted-average coupon and other criteria. Also the collateral manager is constrained by coverage tests such as a minimum overcollateralization test or an interest
coverage test. If the transaction is out of compliance with these tests, the manager may only trade to improve compliance with the tests. Although the collateral manager has considerable latitude to trade names within the portfolio during the revolving period, these restrictions do not allow the overall character of the portfolio to change over time because replacement collateral must still comply with the eligibility criteria.

**Parties to the Transaction**

There are several parties that play key roles in a CDO transaction. These roles typically include the collateral manager, the trustee, the credit enhancer and the swap counterparty. As the rating agency, DCR is responsible for the evaluation of risks associated with each of these parties. However, DCR does not numerically credit the transaction because of the demonstrated performance of the collateral manager or the trustee above market norms. The focus of DCR’s due diligence effort is to assess whether each party can perform to industry norms. However, the ratings of the swap counterparty and credit enhancer can affect the ratings of the notes.

**The Collateral Manager**

The collateral manager is responsible for the ongoing supervision and trading of the portfolio collateral during the life of the transaction. The collateral manager is frequently an affiliate of the issuer and often retains an equity position in the CDO transaction.

Before rating a CDO, DCR performs an on-site evaluation or due diligence of the collateral manager to evaluate its qualifications for managing the related portfolio collateral. During this due diligence, DCR might examine:

- Corporate affiliations of the investment manager;
- Assets under management—total and high yield;
- Management philosophy, style and experience in related asset types;
- Investment objectives, attitude toward risk/return tradeoffs;
- Organization of credit research function;
- Frequency of formal monitoring or review of portfolio holdings;
- Performance of high-yield funds: risk/return analysis and comparison to market;
- Information on defaulted securities and recoveries;
- Manager’s willingness to hold defaulted debt through workout; and
- Organization chart and biographical information on key personnel.
While many collateral managers focus on “total return” as a performance benchmark, DCR focuses on defaults and distressed sales as an indicator of portfolio management. Note that most investors in senior and mezzanine tranches of cash flow CDOs will not benefit from upward price movement of the underlying securities, but will suffer from defaults of those securities. DCR will issue a separate research article with more detail on the evaluation of collateral managers in the near future.

The Trustee

The trustee is a participant in every CDO transaction and is responsible for administering various transaction functions throughout the tenor of the deal. Although there are certain approved trustees that seem to be more widely used across the marketplace, DCR continues to evaluate potential new entrants. As part of this process, DCR executes an exercise similar to the collateral manager evaluation. Some of the aspects examined during a trustee due diligence are:

- Corporate affiliations;
- Primary assets types and total assets under management;
- Quality of systems used for bookkeeping, etc.;
- Performance history on past securitizations;
- Organization chart and biographical information on key personnel;
- Management structure and philosophy;
- Experience of management and staff with respect to CDOs; and
- Crisis management and quality control.

The Credit Enhancer and Swap Counterparty

Often in CDO structures, there are inherent risks such as interest rate, payment and asset/liability mismatches (see Credit Enhancement, below). Therefore, swaps, caps or other derivatives are often structured into the transaction in order to mitigate these risks. Although not as often, surety bonds may also be put in place to hedge similar risks on certain tranches. However, these “wraps” are often investor-driven and more expensive and, therefore, not used as frequently.

Given the reliance on these parties throughout the life of the transaction, DCR requires certain provisions and eligibility criteria for these counterparties and providers, which include:

- Ratings of parties should be at least as high as the desired rating of the senior notes;
- Replacement parties should be required to maintain a corresponding rating level; and
- The termination events associated with these contracts should not introduce additional risks to the CDO transaction.

Credit Enhancement

Overview

The greatest threat to payment of timely interest and ultimate principal to investors comes from the default of the underlying collateral securities. Therefore, the focus of the credit enhancement analysis is on the probability of default of the underlying collateral and estimated subsequent recoveries. While the default and recovery analysis is the primary determinant of the required credit enhancement levels, the analysis takes into account a host of other issues that may also affect payment to investors such as asset and liability management and the transaction structure.

DCR’s rating addresses the probability of default on the rated class of notes. The rating for any particular class of notes should reflect its probability of default, and that probability should be equal to the overall expected default rate for all securities of an equivalent rating. In other words, if the universe of ‘BBB’ securities defaults at the cumulative rate of 5.00% over 10 years, then the credit enhancement should be sized so that the 10-year cumulative expected default rate for that class of notes is 5.00%. This is akin to establishing a statistical “confidence interval” around an expected mean default rate.

This confidence interval is achieved by stressing expected defaults by multiple standard deviations from the mean expected default rate. The mean expected default rate is derived from the eligibility criteria as specified in the trust indenture. The number of standard deviations from the mean is a function of the confidence interval selected. A 5.00% default rate implies a 95% confidence interval, which implies a certain number of standard deviations from the mean expected default rate.

The stressed mean default rate is then applied to the transaction structure through the use of a cash flow model. The performance of the structure is evaluated through various stress tests (which are described below). The structure is deemed to have passed the tests if timely interest2 and ultimate principal payments are received.

Calculation of the Cumulative Gross Default Rate

The calculation of the cumulative gross default rate is at the heart of DCR’s methodology. This rate must be withstood by the CDO structure to garner the requested rating level. The cumulative gross default rate is a function of

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2 Depending on the tranche in question, DCR will rate the receipt of either timely periodic interest or cumulative ultimate interest. Periodic interest on mezzanine tranches may sometimes be deferred without causing an event of default. For simplicity herein, both terms will be referred to as “timely interest”.

DCR’s Criteria for Rating Cash Flow CDOs
the weighted-average credit rating, the weighted-average life, the obligor concentration and the requested rating level.

DCR has reviewed the results of various corporate bond default studies. The primary source for DCR’s mean default rates, the standard deviation of default rates and recovery rates is the Altman study. The Altman study refers to a study of empirical evidence of default and recovery performance for publicly rated bonds. The study, a recognized industry benchmark, is authored by Edward I. Altman, et al. and is conducted through the New York University Salomon Center. DCR periodically reviews the studies to determine whether adjustments to the base case default rates are warranted based on new data. The default rates, standard deviations and recovery rates used by DCR represent the most recent rates and update prior DCR published statistics. The default rates represent an increase relative to the 1998 Altman study because of the higher level of defaults experienced in the high-yield marketplace in 1999.

The cumulative gross default rate is determined using the following formula:

$$\text{Stressed cumulative gross default rate} = \text{mean default rate} + (\text{rating multiplier} \times \text{standard deviation})$$

Where,

- **Mean Default Rate** = The expected cumulative gross default rate given the weighted-average rating of the collateral, the weighted-average life of the collateral and the obligor concentration level.
- **Rating Multiplier** = The multiple of standard deviations used to establish the “stress” on the structure given the requested rating. The higher the requested rating the more standard deviations from the mean that need to be covered.
- **Standard Deviation** = The standard deviation of defaults taken from the empirical studies.

The combination of these items results in the cumulative gross default rate that must be withstood by the CDO structure at the requested rating level.

The formula is designed to establish confidence intervals that are consistent with the probability of default for other securities of an equivalent rating. For example, ‘AAA’ securities are expected to default at the rate of 0.01% over 10 years. The cumulative gross default formula stresses sufficient standard deviations from an expected default rate to establish a 99.99% confidence interval around that mean. The cumulative gross default rate for each class of notes is established by stressing standard deviations of expected defaults to a level that is consistent with its default probability.

The structural elements of each transaction are incorporated into a mathematical model. The cumulative gross default rate is used as an input into this cash flow model (see below). For a class of notes to earn the requested rating, the output of the cash flow model must demonstrate that the required cumulative gross default rate is covered through the stress scenarios outlined below and that timely interest and ultimate principal is received.

**Interest Rate Risk Management**

CDOs will typically contain both fixed and floating rate assets and fixed and floating rate liabilities. In many cases the interest rate sensitivity of the assets will not identically match the interest rate sensitivity of the liabilities. In such a case, the transaction may be exposed to the risk that movements in interest rates may impair the ability of the transaction to make timely interest payments to investors. There are a number of ways to hedge the transaction’s interest rate risk exposure. Common hedging strategies include swaps and caps for the interest rate risk and basis swaps for the basis risk. DCR does not stipulate that particular hedging strategies be employed by collateral manager, nor require that the collateral manager eliminate the interest rate risk. In fact, many collateral managers will choose to retain some interest rate risk within the CDO structure.
agreement should exclude any events tied to the performance of the underlying collateral. For example, the swap cannot be terminated if defaults exceed a certain level. The termination events should only cover the standard clauses such as bankruptcy of the issuer (who should be a bankruptcy-remote SPC). The intention is to determine whether the transaction is exposed to risk from the termination of the hedge (such as termination costs and the lack of a hedge).

**Triggers and Coverage Tests**

CDOs contain various triggers and coverage tests. These tests stipulate such things as a minimum overcollateralization ratio, interest coverage ratio or a default rate trigger. These tests serve as “early warning devices.” Their purpose is to stop collateral deterioration before the outstanding notes are severely impaired. Generally, failure to pass these tests results in a partial amortization event. For example, if the minimum acceptable overcollateralization is 115% and the ratio drops to 110% on the payment date, excess spread would cease to be released to the equity holders. Instead, excess spread is paid to the most senior class of notes then outstanding as a principal reduction. The senior notes would continue amortizing until compliance is restored, or all notes are repaid.

DCR does not explicitly stipulate coverage tests and trigger levels when evaluating the CDO structure. However, DCR does implicitly rely upon them. The cash flow model that is constructed should represent every aspect of the CDO structure, including embedded coverage tests and triggers. For instance, excess defaults may cause a coverage test failure in a stressful scenario. In such a case, the cash flow model would reflect the amortization of the senior notes. Early amortization events add protection for investors. Thus, to the extent that the triggers increase the structure’s ability to withstand stress, the transaction is better able to pay timely interest and ultimate principal.

### Table 3: Excess Spread

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<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Collateral Pool</td>
<td>$500 million</td>
</tr>
<tr>
<td>Minimum weighted-average coupon</td>
<td>9.50%</td>
</tr>
<tr>
<td>Total revenue from collateral</td>
<td>$47.50 million</td>
</tr>
<tr>
<td>Total rated notes</td>
<td>$450 million</td>
</tr>
<tr>
<td>Weighted-average note coupon rate</td>
<td>7.50%</td>
</tr>
<tr>
<td>Total interest paid to notes</td>
<td>$33.75 million</td>
</tr>
<tr>
<td>Annual excess spread</td>
<td>$13.75 million</td>
</tr>
<tr>
<td>Excess spread as function of notes</td>
<td>306 basis points, or 3.06%</td>
</tr>
</tbody>
</table>

### Excess Spread

Excess spread is the difference between the weighted-average coupon rate on the underlying portfolio collateral and the weighted-average coupon rate to the noteholders. Using a simple example, excess spread can be calculated as shown in Table 3.

Most high-yield CDOs have substantial amounts of excess spread. Barring failure of a coverage test, this excess spread is passed through the CDO structure to the equity holders. However, in the event that one of the coverage tests (see previous section) is breached, the excess spread is retained to pay down senior notes. Therefore, excess spread is a form of credit enhancement.

DCR does not require certain levels of excess spread in a transaction. Doing so is nearly impossible because the actual excess spread in the transaction is highly variable and dependent on a number of factors. These factors include the cumulative levels of defaults and recoveries and the interest environment and the effectiveness of the hedge at that time. As with the coverage tests and trigger levels, DCR implicitly relies on the credit enhancement from the excess spread. To the extent that excess spread is available to cushion the effect of defaults and other stresses (e.g., interest rate movements), that cushion will be evident in the output of the cash flow model. Excess spread increases the ability of the structure to pay timely interest and ultimate principal.

### The Cash Flow Model

One of the focal points of the ratings analysis for a cash flow CDO is the cash flow model. The cash flow model is a mathematical abstraction of the structure of the CDO. It contains all of the inputs previously discussed including:

- The portfolio eligibility criteria;
- The structure of the transaction;
- The interest rate risk management strategy;
- Applicable coverage tests and triggers;
- Recovery rate assumptions based on the collateral composition;
- Stressed default assumptions;
- Stressed interest rate scenarios; and
- Revolving and amortization periods.

The purpose of the cash flow model is to simulate how the structure of the transaction reacts to various stresses. The reactions are measured in light of transaction’s ability to pay timely interest and ultimate principal. DCR models the transaction in parallel with the sponsoring underwriter or placement agent and compares the results of the models for consistency.

The construction of the model starts with the portfolio collateral. The actual composition
of the collateral prior to the closing date is unknown because it has not all been acquired yet. Furthermore, because the collateral manager has a wide trading latitude during the revolving period, even if all the initial collateral were identified prior to closing, there is a high probability that the composition of the same pool could be very different by the end of the revolving period. Therefore, for purposes of modeling, DCR uses theoretical collateral. This is a set of collateral that has the same characteristics as the eligibility criteria. For example, if the eligibility criteria state the collateral must have a weighted-average coupon rate of 9.50%, a weighted-average life of 8 years, and be 90% non-amortizing fixed-rate bonds, then those are the characteristics that the theoretical collateral pool will have.

The cash flow model runs this collateral pool through time and through the payment waterfall as specified in the transaction documents. The differing stress scenarios are applied to the structure. For each rated class of notes, DCR applies six stress scenarios as listed below:

Default timing – front, middle and back
Interest rate movement – LIBOR up and down

During the term of the transaction, incoming cash flows (such as interest payments received on the underlying collateral) as assumed to be reinvested during the intra-period time frame at the then-current LIBOR rate (from the forward LIBOR curve) less 2.50%.

**Evaluation of the Cash Flow Model**

DCR’s primary concern in rating cash flow CDOs is assessing the probability of payment of timely interest and ultimate principal under stressful conditions. Therefore, the evaluation of the cash flow model is essentially a determination of whether the structure is able to withstand the prescribed stresses while making interest and principal payments in full as rated.

**Recovery Rates**

An additional way of stressing CDOs is by discounting historical average prices of defaulted bonds immediately after default. The recovery rate varies based on the seniority of debt in the capital structure of the company. For example, if the collateral is senior secured, it will generally have a higher recovery rate than if it is senior unsecured. The Altman study tracks mean “recovery” pricing data by position in the obligor’s capital structure. Thus, DCR has historical mean prices for each category, based on collateral prices immediately following default.

In addition to varying recovery rates by collateral seniority, DCR varied recovery rates by the desired rating level for each tranche of the transaction. Higher desired rating levels should be able to pass more stressful (lower) recovery rates in the simulated cash flow runs. The more stressful recovery rates at higher rating levels reflect the inclusion of more standard deviations around the mean recovery rate. See Table 4.

DCR assumes base recovery rates of 20% and 25% for emerging market corporate and sovereign bonds, respectively. DCR may adjust the recovery rate for emerging market corporate debt upward if the firm’s local currency rating is higher than the foreign currency rating of the sovereign. (For additional information on CDOs backed by emerging market debt, please refer to DCR’s Approach to Rating Emerging Market CBOs/CLOs which will soon be available on DCR’s Web site).

Recovery rates are based upon the seniority, security and country of issuance, as well as the desired rating on the notes. For example, if the indenture specifies only that the collateral must be U.S. senior bonds, with the exception of 10% which can be U.S. subordinated bonds and 5% which can be bonds from emerging markets, the blended recovery rate for the “AAA” class would be determined as follows:

<table>
<thead>
<tr>
<th>Category</th>
<th>Recovery Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Secured Bonds</td>
<td>65.00%</td>
</tr>
<tr>
<td>Subordinated</td>
<td>25.00%</td>
</tr>
<tr>
<td>Emerging Market</td>
<td>35.00%</td>
</tr>
<tr>
<td><strong>Weighted-Average Recovery Rate:</strong></td>
<td><strong>46.00%</strong></td>
</tr>
</tbody>
</table>

The weighted-average recovery concept gives the collateral manager more flexibility in determining the collateral allocation than specifically limiting exposure to certain categories (the traditional bucket requirement), while still maintaining a minimum desired collateral quality. The weighted-average recovery concept allows the portfolio to select a certain weighted-average recovery rate. The manager can then adjust collateral allocations as long as the weighted-average is greater than or equal than the minimum weighted-average recovery

<table>
<thead>
<tr>
<th>Desired Rating Level</th>
<th>Sr. Sec’d</th>
<th>Sr. Sec’d</th>
<th>Senior</th>
<th>Senior</th>
<th>Senior</th>
<th>Subord.</th>
<th>Subord.</th>
<th>Emerging</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAA/AA</td>
<td>60.00%</td>
<td>50.00%</td>
<td>40.00%</td>
<td>25.00%</td>
<td>25.00%</td>
<td>20-25%</td>
<td>20-25%</td>
<td></td>
</tr>
<tr>
<td>A/BBB</td>
<td>65.00%</td>
<td>55.00%</td>
<td>45.00%</td>
<td>30.00%</td>
<td>30.00%</td>
<td>20-25%</td>
<td>20-25%</td>
<td></td>
</tr>
<tr>
<td>&lt; Investment Grade</td>
<td>70.00%</td>
<td>58.00%</td>
<td>48.00%</td>
<td>34.00%</td>
<td>31.00%</td>
<td>20-25%</td>
<td>20-25%</td>
<td></td>
</tr>
</tbody>
</table>
rate stated in the transaction documents. For example, if a 46.00% weighted-average recovery rate is selected for a ‘AAA’-rated tranche, the collateral composition could equal the above-mentioned allocations. Or, it could be adjusted to any combination with the same 46.00% outcome, such as:

<table>
<thead>
<tr>
<th>Collateral Type</th>
<th>Recovery Rate</th>
<th>Product of Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Senior Secured Bonds</td>
<td>0.73 * 50%</td>
<td>36.50%</td>
</tr>
<tr>
<td>Senior Unsecured</td>
<td>0.20 * 40%</td>
<td>8.00%</td>
</tr>
<tr>
<td>Subordinated</td>
<td>0.05 * 25%</td>
<td>1.25%</td>
</tr>
<tr>
<td>Emerging Markets</td>
<td>0.02 * 20%</td>
<td>0.04%</td>
</tr>
<tr>
<td><strong>Weighted-Average Recovery Rate:</strong></td>
<td><strong>46.00%</strong></td>
<td></td>
</tr>
</tbody>
</table>

Thus, the weighted-average recovery concept eliminates the need for collateral buckets as a determination of recovery rates. In addition to the inclusion of the weighted-average recovery test, some collateral buckets may limit the pool’s exposure to certain types of collateral, like emerging market debt.

**Recovery Timing**

DCR further stresses recoveries by assuming a time lag from default to disposition of the collateral. Sale of the bonds (the recovery) is realized at the beginning of the next assumed payment period, a six-month lag, instead of instantaneously. Most CBO managers will sell the bonds at a discount in the public markets, rather than hold for an extended period of time through the workout process. For loans, the recovery is lagged further, by one full year. This additional lag reflects a longer workout scenario for loans than bonds and the increased likelihood of the collateral manager to hold a loan through the workout period.

**Legal Analysis**

In addition to the transaction structure, DCR conducts a review of the legal documents and opinions. Some of the critical issues are explained below.

As in other asset-backed transactions, the issuer should be established as a bankruptcy-remote SPC, with its activities limited to purchasing collateral, issuing securities to investors, and other actions that are incidental to its role in the transaction. This limits the risk of the issuer being put into bankruptcy.

DCR also evaluates the transfer of collateral from the seller to the issuer. If one entity transfers the assets to the issuer, DCR would usually expect to receive the normal true sale, non-consolidation and first-priority security interest opinions that DCR receives in other asset-backed securitizations. However, many CDO transactions will begin with a sponsor warehousing collateral for the issuer prior to the close of the CDO transaction. The sponsor sells the collateral to the issuer at the closing without retaining any residual interest in the collateral. In other instances, the issuer may acquire the assets in market transactions with unrelated parties. In these situations, a true sale opinion is not necessary but DCR should receive legal comfort that a valid transfer of the assets has occurred free and clear of adverse claims. In this regard, an opinion may be rendered that the issuer is a “bona fide purchaser” under Article 8 of the Uniform Commercial Code.

In addition, DCR should receive a legal opinion that the trustee for the investors has a first-priority perfected security interest in the issuer’s assets for the benefit of investors. This perfected security interest gives the investors a first lien on the assets of the issuer even if the issuer is forced into bankruptcy or the seller’s transfer of the assets to the issuer is recharacterized as a secured financing rather than a sale.

Standard corporate opinions regarding the enforceability of the transaction documents against all parties thereto are also required. These opinions should be given based on the law of each applicable jurisdiction. Finally, depending on the structure of the transaction, DCR may require opinions that the issuer is not an investment company under the Investment Company Act of 1940, and as to the tax structure of the transaction.

**Monitoring**

Each CDO transaction receives ongoing surveillance after closing. At DCR this function is performed by the monitoring group. That group functions as a security alarm and information focal point for CDO transactions. The group uses both ongoing communications with the transaction parties and the analysis of performance data to detect changes in a transaction. All anticipated risks to the securitization are addressed at the time of original rating, but many risk-imposing events may not occur until long after the transaction closes. Monitoring ensures that, if these events occur, they are identified and evaluated in a timely manner. DCR communicates with the collateral manager to assess its strategy to mitigate whatever risks may appear over time.

DCR conducts formal reviews for all DCR-rated CDOs. Soon after a transaction closes, DCR monitoring personnel create a model to assist in the review process. During these reviews, each transaction’s asset performance, credit enhancement levels and trigger compliance is evaluated based on the original ratings guidelines and cash flow analysis. All information received through communication with the portfolio manager, trustee or other parties is also considered. Through these reviews, and any subsequent rating reaffirmation or ratings action, DCR validates that the integrity of the rating is in line with the rating analyst’s and rating committee’s original ex-
pectations for the transaction. At a minimum, all DCR CDO ratings are reviewed by monitoring personnel monthly and by senior management quarterly.

**Outlook for the CDO Market**

DCR has been a major player in the CDO market since its inception and DCR expects that its market participation will continue to grow as the market grows and evolves. The concurrent growth of the CDO market and the high-yield market is not a coincidence. CDOs are becoming a force within the high-yield world whose growing market share is beginning to directly influence high-yield debt issuance. Increasing liquidity in the market benefits all players. Cash flow CDO collateral managers benefit from increased liquidity even though they do not rely on current market values as a source of repayment for the notes. Instead, increased liquidity supports recovery values and makes portfolio management more efficient.

Although cash flow CDO issuance will most likely continue to exhibit significant correlation with the performance of the high-yield market, (although less correlation than market value CDO issuance), cash flow CDO issuance should continue to grow in the coming years. Indeed, some arbitrage opportunities have increased in the wake of the liquidity crunch that occurred in the second half of 1998. The flight to quality during this period increased the arbitrage and thus increased CDO issuance (albeit with a lag). The second half of 1998 also demonstrated to collateral managers and other market participants the desirability of having more “long-term” investors (such as cash flow CDOs) in the high-yield markets. Indeed, the high-yield sell-off appears to have been seriously aggravated by those managing significant amounts of “hot money” who were forced to sell into a “down” market due to substantial redemption requests.

**New collateral types**

Recent transactions have shown an increasing concentration of ABS/CMBS/REIT collateral. In the past these asset types have not been included for several reasons. These include:

- Limited history regarding default rates and recovery rates;
- The assets were considered “esoteric” and hard to understand;
- Predicting cash flows on asset-backed securities is more difficult than on assets that have predetermined payment schedules;
- Some of these securities have stated final maturities that extend far beyond the stated final maturity of the CDO in which they are included;
- Some portfolio managers have limited experience in managing similar portfolios;
- Some of these securities, especially the junior tranches, allow interest to be deferred without being considered in default; and
- Limited secondary market activities.

DCR is comfortable including these assets within a CDO and has done so in a number of transactions. However, DCR recognizes that the above concerns are valid and has taken special care to address them. In particular, cash flows, default rates and recovery values are more difficult to predict. There is little empirical evidence of actual defaults and, in the event of default, their recovery patterns may be somewhat different than high-yield corporate debt. The details of this analysis are beyond the scope of this commentary. The ratings for these collateral types will be discussed in a separate article.

**Debt Securities from Emerging Markets**

Until fall 1998, emerging market debt securities had been a popular collateral type for CDOs. However, the well-publicized problems with these securities (e.g., the Russian default) have severely curtailed investors’ appetites for such collateral. In the past year, DCR has seen a significant drop in the amount of emerging market collateral in CDOs. In DCR’s view, the credit rating is still the best predictor of future default expectations, and those ratings are updated to reflect changing default expectations. Therefore, DCR will continue to rate CDOs that contain emerging market debt. However, recent experience has highlighted that recovery rates on emerging markets debts are lower than recovery rates on other collateral types. DCR already uses substantially lower recovery rates for emerging market debt than other asset types (see the Recovery Rates section of this report).