

CDO Handbook

Overview

Global CDO funded issuance has averaged \$98 billion per year for the last three years. In the context of asset-backed securities (ABS), this figure is about one-third of public and private U.S. issuance. This sustained level of activity is remarkable, given that annual volume never exceeded \$5 billion until 1996. We estimate outstanding funded CDO volume at \$500 billion. The current status of CDOs is due to the acceptance of the product by investors and credit risk hedgers.

This report is a comprehensive introduction to CDOs. It addresses:

- the structural components of CDOs;
- typical CDOs;
- why CDOs exist;
- the cash flow and market value credit structures;
- synthetic CDOs;
- the asset manager and other parties to a CDO;
- CDO terminology.

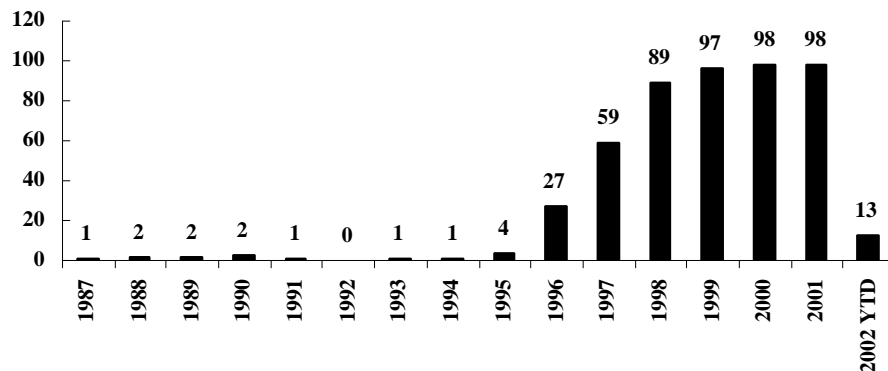
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Chart 1

Global Funded CDO Issuance

US\$ billions



Source: JPM Securities, Inc

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Introduction

A person new to collateralized debt obligations (CDOs) is faced with bewildering terminology:

Arbitrage CBO	Balance Sheet CLO	Market Value CDO
Cash Flow CDO	EMCBO	Repacks
CBO of ABS	Synthetic CDO	Re-REMICs
Synthetic Arbitrage CLO	Investment Grade CBO	CBO of Real Estate

These names, for different types of CDOs, reflect the variety of features and forms a CDO can take and still be called a CDO. A CDO can hold bonds, loans, emerging market debt, ABS, RMBS, and CMBS. It can also gain exposure to these assets synthetically. The CDO can issue floating or fixed rate obligations tranching in a variety of ways with respect to seniority and payment. Its obligations can be revolving, have delay draw features, and be guaranteed by a third party. CDOs are done for one of two different purposes and use either of two distinct credit structures or a combination of the two credit structures.

The CDO names above do not fully describe any CDO's structure and are not mutually exclusive from one another. We think the easiest way to both classify and understand CDOs is by taking a component or "a la carte" approach. A CDO can be pretty completely described by the choices made with respect to its:

- (1) underlying assets;
- (2) tranche structure;
- (3) purpose;
- (4) credit structure.

Looking at CDOs this way will also allow future innovations to be placed in the context of an existing conceptual framework.

The next section of this paper discusses these four structural components. The second section of this paper describes the most typical CDO structures existing today or, to stretch the menu analogy, the most popular "prix fixe" CDO combinations. In these two sections, we hope to provide a flexible definition of CDOs and a description of current market practice.

The third through seventh sections of this report address specific CDO topics. The sections are "stand alone;" they can be read in any order and sections can be skipped if they are not of current interest. These sections are:

- Why do CDOs exist and why do investors buy them?;
- Market value credit structure;
- Cash flow credit structure;
- Synthetic CDOs;
- Parties to a CDO;

A "Glossary and Notes" section defines italicized terms in the text and discusses topics removed from the main concern of the paper.

Please note that "CDO" refers to the special purpose vehicle (SPV) that holds assets and issues obligations. "CDO" also refers specifically to the obligations the SPV issues, leading to the seemingly circular phrase "the CDO issues CDOs." Finally, CDO is an umbrella term encompassing the various subclasses, including the CDO species listed above.

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Assets, Tranches, Purposes, and Credit Structures

Assets

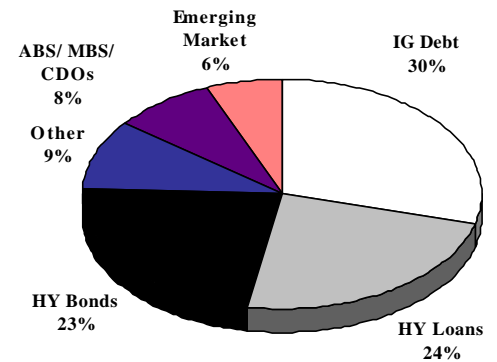
Its assets, more than anything else, make a CDO a CDO. The general definition is that a CDO is a securitization¹ of corporate obligations. By order of volume, CDOs have securitized (or re-securitized) commercial loans; corporate bonds; ABS, RMBS, and CMBS; and emerging market debt. Even tranches of CDOs have been re-securitized into CDOs of CDOs.

The trend in 2001 has been for high yield bonds and loans to make up a slightly smaller share (70%) of CDO assets than has been the case historically. ABS, MBS, and CDOs have increased, and now comprise 18% of underlying assets. CDO assets are more and more diverse globally. In 2001, 36% of CDO assets were from non-U.S. obligors.

But CDOs do not always own these assets outright. Sometimes a CDO achieves exposure to these assets synthetically by entering into a credit default swap. In a credit default swap, the CDO receives a periodic payment from a counterparty that seeks protection against the default of a referenced asset. In return for this payment, the CDO must pay the protection buyer default losses on the referenced asset if the obligor of the referenced asset defaults. The exact definitions of "default" and "default losses" can be negotiated to suit the requirements of the CDO and the protection buyer, but typically follow standard ISDA definitions.

The protection-buying counterparty in a credit default swap is usually exposed to the referenced credit by, for example, having made a loan to the name. Any credit loss the counterparty sustains from its dealings with the referenced credit is offset by a payment from the CDO. As the CDO assumes credit exposure to the referenced asset without buying it, the protection buyer gets rid of credit risk without selling the asset. A CDO might have a few synthetic visible exposures or be comprised entirely of synthetic exposures. Approximately 17% of CDO deals are comprised mainly of synthetic exposures.

Chart 2
CDO Underlying Assets (1987 through 2001)



Source: JPMS

Tranches

CDOs issue multiple classes² of equity and debt that are tranching with respect to seniority in bankruptcy and timing of repayment. The equity tranche, sometimes called junior subordinated notes, preferred stock or income notes, is the lowest tranche in the CDO's capital structure. The equity tranche sustains the risk of payment delays and credit losses first in order to make debt tranches less credit-risky. It receives whatever cash flows are left after the satisfaction of debt tranche claims. Chart 3 shows a typical CDO structure.

¹ Please see the "Glossary and Notes" below for more on italicized terms.

² SPVs issuing one tranche are generally called *repackagings*

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Chart 3
Typical CDO Tranching

TRANCHES		RATINGS
A-1 Floating Rate Revolving Facility	A-2 Fixed Rate Tranche	Triple-A or Double-A
B-1 Floating Rate Tranche	B-2 Fixed Rate Tranche	Single-A
C Floating Rate Tranche		Triple-B
D Fixed Rate Tranche		Double-B
Equity (Most Subordinate Tranche)		Not Rated

Source: JPMS

Tranches are sized to minimize funding costs within the constraints of investor requirements. In most CDOs, the top-most tranche provides the majority of the vehicle’s financing. Other debt tranches are sized around 5% to 15%. Equity is generally around 2% to 15% of the CDO’s capital structure, depending on the credit quality and diversity of the assets.

Seniority can also be created synthetically outside the CDO structure by the terms of a credit default swap so that the protection buyer retains a first loss position. The CDO’s payment under the credit default swap might occur only if losses on referenced assets exceed some set amount. This first loss carve out might be expressed on a per-name basis (losses up to \$X per name) or on an overall portfolio basis (losses up to \$X across the entire portfolio). In the language of insurance, the protection-buying counterparty in the credit default swap essentially has to meet a deductible before being able to make a claim under the credit default swap.

Subordinated CDO debt tranches protect more senior debt tranches against credit losses and receive a higher coupon for taking on greater credit risk. Coupon payments on subordinated tranches might be deferrable if the CDO does not have sufficient cash flow or if it is in violation of certain tests.

Sometimes a CDO senior debt tranche is structured with a delayed draw feature. This is useful if the CDO’s assets are to be purchased over time, as draws against the facility can be taken as they are needed. A revolving tranche might serve to allow the CDO to adjust its leverage. Often a double structure of tranches is used where the same seniority tranche is comprised of separate fixed and floating rate sub-tranches. Finally, debt tranches are sometimes guaranteed by third parties, such as bond insurers.

Purposes

CDOs are classified as either balance sheet or arbitrage CDOs, depending on the motivation behind the securitization and the source of the CDO’s assets. Balance sheet CDOs are initiated by holders of

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securitizable assets, such as commercial banks, which desire to sell assets or transfer the risk of assets. The motivation may be to shrink the balance sheet, reduce required regulatory capital, or reduce required economic capital.

The most straightforward way to achieve all three goals is the cash sale of assets to the CDO. But for a variety of reasons, the risk of the assets might be better transferred to the CDO synthetically, as described above. This second method can reduce required capital, but cannot shrink the balance sheet. Nevertheless, we refer to synthetic CDOs done to adjust required capital as balance sheet transactions.

Arbitrage CDOs, in contrast, are inspired by asset managers and equity tranche investors. Equity tranche investors hope to achieve a leveraged return between the after-default yield on assets and the financing cost due debt tranches. This potential spread, or funding gap, is the “arbitrage” of the arbitrage CDO. The asset manager gains a management fee from monitoring and trading the CDO’s assets.

An arbitrage CDO’s assets are purchased from a variety of sources in the open market, over a period that may stretch for months from a warehousing period before the CDO closes to a ramp-up period after the CDO closes. The asset manager often invests in a portion of the CDO’s equity tranche or subordinates a significant portion of its fee to debt and equity tranches. There is generally more trading in an arbitrage CDO than in a balance sheet CDO, where trading of the portfolio is not allowed or limited to replacement of amortized assets. By number, 76% of CDOs are arbitrage transactions, but because balance sheet transactions are typically larger, the division is almost perfectly 50%-50% by volume.

The distinction commonly drawn between balance sheet and arbitrage CDOs ignores the fact that the asset seller in a balance sheet CDO also enjoys potential “arbitrage” profits from retention of the equity tranche. After the close of the transaction, there is nothing very different between the economic position of an equity investor in a CDO that buys assets in the open market and the equity investor in a CDO that buys assets the equity investor originated.

A third CDO purpose has been discussed since the inception of the CDO market in 1987, but realized only recently. While CDOs have been ever-increasing purchasers of primary market issues, until 1998 no CDO had been created to purchase new issues specifically originated to be sold to a CDO. This occurred first in CDOs that bought Japanese bank capital obligations and later in rated CDOs that purchased the capital obligations of small U.S. banks. In light of these CDOs, we would like to suggest “origination CDO” as a third CDO purpose and method of obtaining CDO assets.

Perhaps the most practical distinction between balance sheet, arbitrage, and origination CDOs is how likely the proposed CDOs are to be accomplished. The key to the successful closing of a CDO is the placement of the CDO’s equity. A balance sheet CDO often has the advantage of a pre-packaged investor for most or all of the equity tranche. Thus, a typical balance sheet CDO is more likely to close than the typical arbitrage CDO where the asset manager only commits to a portion of the equity tranche.

Credit Structures

A CDO can have either a market value or a cash flow credit structure, depending upon the way the CDO protects debt tranches from credit losses. In a market value structure, the CDO’s assets are marked-to-market periodically. The mark-to-market value is then haircut, or reduced, to take into account future market value fluctuations. If the haircut value of assets falls below debt tranche par, CDO assets must be sold and debt tranches repaid until haircut asset value once again exceeds debt tranche par.

In contrast, there is no market value test in a cash flow CDO. Subordination is sized so that after-default interest and principal cash flow from the CDO’s asset portfolio is expected to cover debt tranche requirements. This expectation is based on assessment of default probability, default correlation, and loss in the event of default. A common cash flow structuring technique is to divert cash flow from subordinated tranches to senior tranches if the quality of CDO assets diminishes by some objective measure. But while

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the manager of a troubled cash flow CDO can sell CDO assets, and the senior CDO obligation holders can sell CDO assets after a CDO default, there is generally never a requirement to sell CDO assets. Nine out of ten CDOs, both by number and volume, use the cash flow credit structure.

The À la Carte CDO Menu

A table of these four CDO attributes appears below in Chart 4. A wide variety of CDOs can be constructed by picking one attribute from each menu column, but in actual practice, CDOs tend to fall into three common “prix fixe” combinations as discussed in the next section.

Chart 4
À la Carte CDO Menu

ASSETS	LIABILITIES	PURPOSE	CREDIT STRUCTURE
High Yield Corporate Bonds	Different number of tranches possible	Balance Sheet Transaction: A seller desires to shed assets to shrink its balance sheet and adjust economic and regulatory capital. Existing assets are transferred to the CDO and the seller takes back the CDO's most subordinate tranche.	Market Value: The haircut value of CDO assets is periodically compared to CDO tranche par. If haircut assets are less than tranche par, CDO assets must be sold and tranches repaid.
Commercial and Industrial Loans	Sequential, fast/slow, or contemporaneous paydown of principal	Arbitrage Transaction: A money manager wants to expand assets under management and equity investors desire non-recourse leverage. Assets may be purchased over warehousing and ramp-up periods.	Cash Flow: CDO subordinate tranches are sized so that senior tranches can survive asset default losses. If portfolio quality deteriorates, asset cash flow may be redirected from subordinate tranches to senior tranches.
Emerging Market Corporate and Sovereign Debt	Coupons can be fixed rate or floating rate		
ABS, CMBS, RMBS and other CDOs	Variety of portfolio tests to divert cash flow from subordinate to senior tranches	Origination transactions (not a recognized term) Underlying CDO assets are issued specifically for a CDO.	
Investment Grade Debt, Distressed Securities, Equity	Delay draw tranche possible		
Assets can be purchased or exposure can be gained synthetically	Revolving tranche possible		
	Guarantee by a third party possible		

Source: JPMS

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Typical Structures

The two ways a CDO can gain exposure to assets, by cash purchase or synthetically; the two main CDO purposes, arbitrage or balance sheet; and the two CDO credit structures, cash flow or market value; would lead to eight types of CDOs (two times two times two) without considering different types of underlying assets. Market value transactions, however, are never done, at least now, for balance sheet purposes and have not been done, at least yet, with synthetic assets.

The negative correlation between the market value credit structure and the balance sheet purpose is ironic, as the first five CDOs ever done, in 1987 and 1988, combined that purpose with that credit structure. But the cash flow credit structure, introduced in 1988, superseded the market value approach because it allowed greater leverage. Evolving accounting standards for retained CDO interests probably would have doomed balance-sheet market-value CDOs anyway. With respect to synthetic securitization, the comparative illiquidity of synthetic assets has prevented their use in market value CDOs.

The fact that market value transactions are almost always cash asset and arbitrage purpose CDOs reduces the number of CDO structural combinations to five. Here are their market shares by value of assets, out of total CDO funded issuance from 1987 of 500 billion dollars:

Table 1

Structure	Percent of Funded Volume 1987 - 2001
Cash, arbitrage, cash flow	53%
Synthetic, arbitrage, cash flow	3%
Cash, balance sheet, cash flow	28%
Synthetic, balance sheet, cash flow	9%
Cash, arbitrage, market value	6%

Sources: JPMS

After the first balance-sheet market-value CDOs in 1987 and 1988, balance-sheet cash-flow CDOs reigned briefly in 1989 before arbitrage cash-flow CDOs took over from 1990 through 1995. In 1996, CDO funded issuance rose to \$27 billion, more than twice the volume of the previous nine years combined. The explosion of CDO issuance was led by balance-sheet cash-flow CDOs.

On the assets side, since 1996 loan-backed CDOs have exceeded bond-backed CDOs. The former assets were associated with balance-sheet cash-flow CLOs. Over the history of CDOs, loans have been the most prominent asset, followed by bonds. ABS/RMBS/CMBS-backed CDOs are currently increasing market share while emerging market CDO issuance peaked in 1997.

Table 2

Structure	Percent of Funded Volume 1987 - 2001
IG Debt	30%
HY Loans	24%
HY Bonds	23%
Other	9%
ABS/RMBS/CMBS	8%
Emerging market	6%

Source: JPMS

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While CDOs sponsored by commercial banks have caused loans to be the primary asset for balance sheet CDOs, loans are also a large factor in arbitrage CDOs. Bonds, in contrast, are almost always found in arbitrage CDOs.

Table 3

Structure	Percent of Funded Volume 1987 - 2001
Cash and synthetic, arbitrage, cash flow	
HY Bonds	19%
HY Loans	16%
ABS/RMBS/CMBS	7%
IG Debt	7%
Emerging market	3%
Cash and synthetic, balance sheet, cash flow	
IG Debt	24%
HY Loans	15%
HY Bonds	1%
ABS/RMBS/CMBS	2%
Cash, arbitrage, market value	
HY Bonds	4%
HY Loans	2%
ABS/RMBS/CMBS	1%

Source: JPMS.

Table 4 goes into more detail on these typical CDO structures.

Table 4

CDO Structural Prix Fixe Menu

	Arbitrage Cash Flow	Balance Sheet Cash Flow	Arbitrage Market Value
Purpose	Arbitrage: Leveraged return to equity holders via non-recourse term financing, fees to asset manager	Balance sheet: Reduce balance sheet or required economic and regulatory capital	Arbitrage: Leveraged return to equity holders via non-recourse term financing, fees to asset manager
Credit structure	Cash flow: Subordination is sized so that asset's after-default interest and principal repay debt tranches	Cash flow: Subordination is sized so that asset's after-default interest and principal repay debt tranches	Market value: Assets are sold and debt tranches repaid if the market value of assets declines too much
Source of assets	Assets are purchased in primary or secondary market	The balance sheet of a single financial institution	Assets are purchased in primary or secondary market
Sponsor	Asset manager or insurance company	Commercial bank	Asset manager or insurance company
Assets	Speculative grade bonds and commercial loans. Emerging market debt is decreasing and ABS/MBS	Bank loans, sometimes to smaller companies. Some bond and ABS/MBS collateral.	Wide range of assets including convertibles, equity and distressed debt

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is increasing.

Table 4

CDO Structural Prix Fixe Menu (Continued)

	Arbitrage Cash Flow	Balance Sheet Cash Flow	Arbitrage Market Value
Cash versus synthetic exposure	May have a few synthetic exposures among dominant cash assets	Some completely synthetic	Hardly ever has synthetic exposures
Special tranche features	May have a deferred draw tranche as assets are often purchased over a ramp up period	May have a revolving tranche to accommodate revolving bank loans	Likely to have a revolving tranche as assets are adjusted to meet OC tests
Equity investors	Some retained by asset manager	Typically retained by asset seller	Some retained by asset manager
Leverage	7 to 12 times	20 to 50 times	4 to 5 times
Interest rate derivatives	Interest rate swap often used to bridge between fixed rate assets and floating rate liabilities	Not usually used since assets are typically floating rate	Interest rate swap often used to bridge between fixed rate assets and floating rate liabilities
Deal size	\$200 to 350 million for bonds, \$400 to 700 million for loans	\$1 to 10 billion	\$500 million to 1.5 billion
Trading activity	Turnover of assets is restricted	Little or none	Greatest
Tenor	Five-year reinvestment period followed by a seven-year amortization period. Senior tranche average life seven to nine years, mezzanine 10-13 years. Callable after two or three years with premium to fixed rate tranches.	Based on remaining life of original assets or duration of synthetic instrument	Five year life with amortization over the last two years. Callable after two or three years with premium to fixed rate tranches.
Market share by volume	52%	41%	7%

Source: JPMS

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Why Do CDOs Exist and Why Do Investors Buy Them?

The Sum of the Parts

The questions above arise from the recognition that the cost of CDO tranches exceeds the cost of CDO assets. The difference goes to pay professionals associated with the transaction: security firms, asset managers, trustees, rating agencies, attorneys, and accountants. Why do investors buy CDOs that cost more than the assets the CDO holds?

We believe it is because the CDO structure creates custom exposures that investors desire and cannot achieve any other way. These custom exposures fit into investors' various risk appetites and capital constraints. Some investors are more efficient holders of speculative-grade assets and some have a comparative advantage holding investment-grade assets. The CDO separates the credit risk of its portfolio into tranches and sells each to the investor most suited to hold that risk.

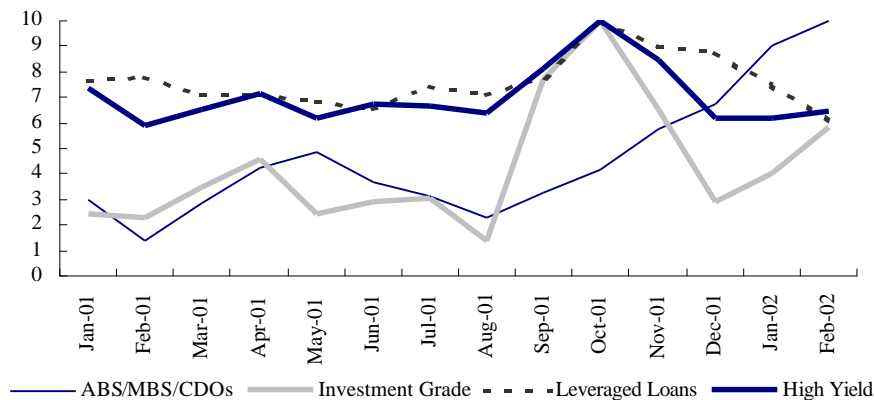
The aggregate price of CDO tranches is bounded at the low end by the cost of the collateral and the minimum amount necessary to entice professionals to create CDOs. At the high end, the aggregate price of the CDO is bounded by the utmost value each CDO tranche investor places on receiving their preferred risk in its distilled form. As more professionals have entered the CDO business, fees have declined and the cost of CDO tranches has steadily declined within the above-described bounds.

Equity Investors

In an arbitrage CDO, equity tranches allow investors to achieve non-recourse term financing of the CDO's underlying assets. If the CDO's assets perform poorly, debt tranche holders have no recourse, other than to the CDO assets, and cannot make a further claim against the equity tranche. This is in contrast to the repo market where financing is short term and the creditor has recourse to the borrower if the collateral is insufficient to extinguish the debt. Equity tranche holders' purpose is to gain a favorable leveraged return between the after-default yield on CDO assets and the financing cost due debt tranches.

In Chart 5, we compare the yield on traditional CDO collateral classes to the cost of funds raised via CDO debt tranches. The difference is a rough measure of the gross spread available to CDO equity holders. This gross spread is reduced by fees, trading losses, and default losses; and subject to calls on the CDO assets and de-leveraging of the CDO.

Chart 5
Normalized CDO Funding Gaps



Source: JPMS

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Theoretically, asset spreads are comprised of expected credit losses, a risk premium, and a liquidity premium. Equity tranche holders bet that actual credit losses compare favorably to expected credit losses and that they will also capture risk and liquidity premiums. The level of expected credit losses embedded in asset prices is irrelevant; what matters is the difference between expected and experienced credit losses.

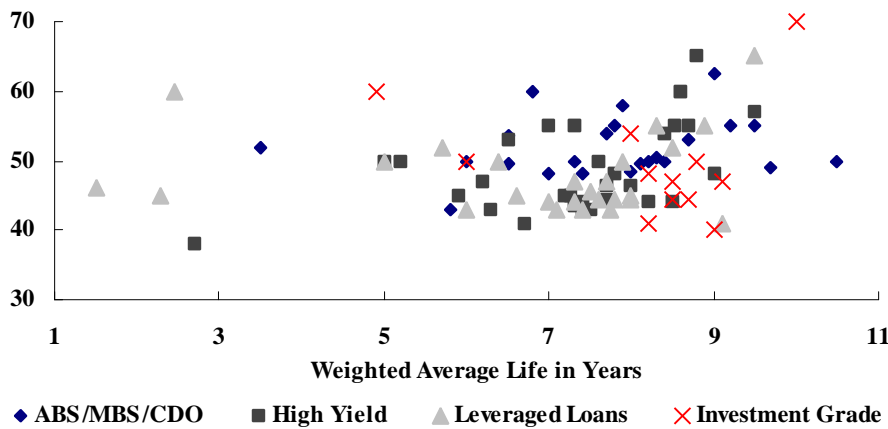
The purchase of the equity tranche of a CDO is first a decision in favor of the underlying asset class, second a decision in favor of leverage relative to that asset class, and finally, a decision in favor of the manager.

Balance sheet CDOs, at the time of execution, are driven by an asset seller's working, economic, and regulatory capital considerations and the availability and expense of alternative methods of managing those considerations. In the longer view, a balance sheet sponsor's decision to gather assets with the intent to securitize them in a CDO is very similar to the decision of an arbitrage equity holder. In the future, balance sheet issuance will be affected by the new Basel capital guidelines for commercial banks and the growing use of single-name and basket credit default swaps. These two factors will change the cost of holding and hedging assets.

Debt Investors

Debt tranche investors are attracted to CDOs because of their higher yields as compared to almost all corporates and many asset-backed of the same maturity and rating. For example, in 2001, seven- to ten-year AAA-rated credit card-backed deals were priced from about 17 to 30 basis points above Libor. During the same period, high yield debt-backed CDOs of the same maturity and rating ranged in price from 40 to 65 basis points above Libor.

Chart 6
AAA CDO Spreads to USD Libor by Asset Type (2001 Issuance)



Source: JPMS

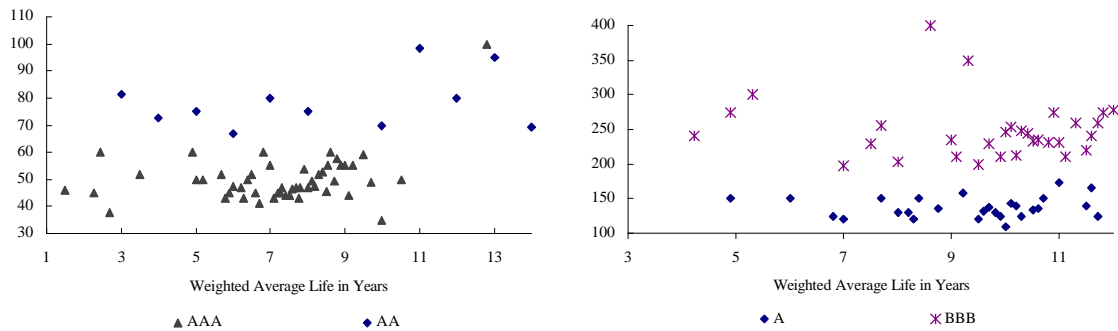
Like ABS and MBS debt tranches, CDO debt tranches have narrower default loss distributions than individual corporate bonds. If an individual corporate bond defaults, the loss to investors is usually quite

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high; 47% of par on average, as measured by a recent recovery study³. But it is possible for a CDO debt tranche to be “a little bit in default.”

Suppose that defaults in the CDO asset portfolio have been so high that the CDO debt tranche now depends upon the performance of each and every one of the names in its portfolio. The debt tranche is still supported by a portfolio comprised of multiple credits. The additional default of one of those credits has a relatively small percentage effect on debt tranche return. And the probability of incremental collateral defaults is less and less likely. In comparison to the drastic loss a corporate bond sustains if it defaults, a CDO might sustain a relatively mild default.

Chart 7
CDO Spreads to USD Libor by Rating (2001 Issuance)



Source: JPMS

Because of their different default severities, corporate bonds and CDO debt tranches must be compared on an expected loss basis. Expected loss is the product of default probability and loss in the event of default, and therefore incorporates both those risks in the evaluation of an investment’s credit quality.

Finally, CDO debt tranches may help diversify an investment portfolio by providing exposure to a new asset class. By definition, an investment grade investor cannot gain exposure to speculative grade assets other than through the first loss protection offered via a CDO. The CDO debt tranche provides the investment grade investor with exposure to new industries or countries, while still maintaining investment grade credit quality.

Stretching Credit Quality

It would seem that investors prefer the extremes of credit risk, either highly rated triple- and double-A credit or unrated equity. The initial securitization of consumer and corporate obligations stretches the middling credit quality of these assets across the credit quality spectrum into triple-A to unrated equity tranches. The re-securitization of the middle, triple-B tranches of these securitizations again stretches middling credit quality into triple-A to unrated equity tranches. Middle credit quality is stretched and stretched again into the extremes.

This does not mean however, that investor portfolios are also heading for the extremes. They may be taking a barbell approach to credit and liquidity risk by constructing portfolios of highly liquid and creditworthy assets along side positions of concentrated credit and liquidity risk. The investor who changes from a

³ Hamilton, David T., et al, *Default and Recovery Rates of Corporate Bond Issuers: 2000*, Moody’s Investors Service, February 2001.

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Global Structured Finance Research

CDO Research
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portfolio completely comprised of high yield bonds to a portfolio of equity CDO tranches and Treasuries might maintain the same expected credit loss but improve liquidity, eliminate extreme downside credit risk, and gain regulatory capital relief.

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Market Value Credit Structure

Advance Rate Mechanism

As briefly discussed above, the credit quality of market value debt tranches depends upon the ability of the CDO to sell assets and pay off debt tranche principal and accrued interest. The market value of CDO assets is periodically calculated. Asset market values are then multiplied by advance rates (a number less than 100%) to arrive at haircut asset values.

Advance rates are specific to particular asset categories (e.g., performing high-yield bonds, performing bank loans, distressed high-yield bonds, distressed bank loans, and distressed equities). The advance rate is the amount of tranche par and interest the CDO asset can support, expressed as a percentage of the asset's market value. Advance rates decline the higher the rating on the CDO debt tranche and the less diverse the CDO portfolio.

Table 5 shows sample advance rates Moody's requires for a 20-issuer, five-industry CDO portfolio seeking a Aa2 rating on its senior debt tranche.

The sum of haircut asset values is then compared to debt tranche par and accrued interest in the over-collateralization (OC) test. In other words, the sum of each asset's market value, times each asset's advance rate, must be greater or equal than debt tranche par and accrued:

$$\sum_i \{ \text{Market Value (Asset}_i) \times \text{Advance Rate(Asset}_i) \} \geq \text{Debt tranche par and accrued.}$$

If market value losses have caused the portfolio to fall below this minimum requirement, the CDO has failed its OC test and must sell assets until the structure regains the prescribed ratio. Alternatively, the equity holders of the CDO can contribute assets to the CDO to cause the CDO to pass its OC test. If the CDO cannot right itself by either of these methods within the cure period, it is an event of default and senior-most tranche holders may take control of the CDO and its assets.

Market value CDOs often have a quarterly net worth test, net worth being the value of the equity tranche, defined approximately as the excess of collateral market value over the par and accrued interest of all debt tranches. If net worth becomes too small, in absolute or percentage terms, the CDO's collateral must also be sold until all debt tranches are retired. The net worth test might terminate the CDO while the CDO passes its OC trigger tests.

It is anticipated that in the normal course a market value CDO will liquidate itself by the voluntary and orderly sale of assets over the final months of its prescribed life.

The Effectiveness of the Market Value Credit Structure

The credit quality of debt tranches in a market value CDO depends upon the effectiveness of its OC test. In a scenario where the market value of CDO assets is declining, the decline in market value must be recognized early enough and the assets must be sold quickly enough so that debt tranche holders can still be repaid. The two time intervals of concern are:

Table 5

Sample Advance Rates

Collateral	Adv Rate
Performing bank loans valued more than 90%	0.895
Distressed bank loans valued more than 85%	0.790
Performing high-yield bonds rated Ba	0.800
Performing high-yield bonds rated B	0.760
Distressed bank loans valued less than 85%	0.630
Performing high-yield bonds rated Caa	0.500
Distressed Bonds	0.400
Reorganized equities	0.380

Source: Moody's Investors Service.

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- the time between valuation tests;
- the cure period, or time given for assets to be sold after a test failure.

There is a trade off between the conservatism of the advance rates and the combined length of the above two intervals. In some combination, a longer time period is acceptable with lower advance rates and higher advance rates are acceptable with a shorter time period. In usual practice, the asset portfolio is marked to market daily or weekly and the collateral manager is allowed a two-week cure period to rectify any shortfall in the OC test.

The market value volatility of CDO assets is affected by the volatility of general interest rates and the volatility of credit spreads. While general interest rate volatility affects all CDO assets equally, lower quality assets not only have larger credit spreads, but also greater credit spread volatility, as shown in the Table 6.

The diversity of the market value CDO portfolio is important because a well-diversified portfolio will have lower market value volatility than a poorly diversified portfolio and perhaps be more resistant to liquidity problems, as shown in Table 7.

However, the analysis of portfolio diversity is a difficult task. In times of market turmoil, market value and liquidity trends have exhibited startling uniformity across asset type, industry sector, and issuer domicile. In assessing portfolio diversity, investors often look at the industry distribution of U.S. and European names and the geographic distribution of emerging market names.

Typically, a CDO has restrictions with respect to concentrations by single name, industry, issuer domicile, and other collateral attributes. Collateral value in excess of concentration limits is not counted in the OC test. But given this, it is usual for a market value asset manager to have latitude to invest in a wide range of assets. The debt tranche investor must be comfortable with the allowable set of assets and their associated advance rates.

Since the credit quality of the market value CDO structure depends upon the actual sale of assets, should it become necessary, a concern arises over whether a sale can be completed at the assets' value. This is referred to as liquidity risk, and its supposition suggests a contradiction: if a sale cannot be completed at the asset's value, is that indeed the asset's value?

Nevertheless, bid-ask spreads do vary by asset type and over time. A seller's ability to achieve the best price for an asset is also hindered by the urgency with which the asset must be sold. It is felt that certain assets are more susceptible to losing liquidity. Liquidity risk is assumed to be highest for more credit risky assets and for less well-known or less widely-traded names. Regulatory or legal restrictions on ownership can also make an asset less liquid and more apt to become less liquid still. Investor familiarity with asset type is another factor; bank loans are considered less liquid than bonds, all other factors being equal.

Table 6
Credit Spread Volatility
Ten-Year Maturity Industrial Indexes
(basis points)

Rating	Range of Credit Spread	Two Week Std Dev of Credit Spread
Triple-A	60	25
Double-A	67	26
Single-A	88	34
Triple-B	100	37
Double-B	277	93
Single-B	596	163
Triple-C	1547	447

Source: JPMS

Table 7
Yield Volatility of JPMorgan High Yield USD Index vs. Constituent Parts

Standard Deviation of Two Week Total Returns of Index	202 bps
Average Standard Deviation of Two Week Total Returns of Index's 25 Industry Categories	224 bps

Source: JPMS

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Since debt tranche protection derives from the ability to sell CDO assets, the cash flow characteristics of market value CDO assets are irrelevant. For example, assets with a longer tenor than the CDO are welcomed in a market value CDO. In a cash flow structure, they might be prohibited. Similarly, equity, zero-coupon bonds, and even defaulted debt can be put into a market value CDO. However, the ability to get transactionable market prices for an asset is critical. Without credible market valuations, an asset cannot receive credit in a market value CDO.

In a multiple tranche structure, each debt tranche has its own array of asset advance rates, set according to the desired credit quality or rating of the tranche. But the cure for breakage of any tranche's OC trigger is repayment of the senior-most tranche. Thus, the credit requirements of subordinate tranches might call for repayment of the senior-most tranche when the senior-most tranche's OC tests are being passed.

All of the following factors: over-collateralization, market value volatility, liquidity risk, portfolio diversity, and the interaction of tranche OC tests and the CDO's net worth test must be analyzed by the market value debt tranche investor.

Table 8

Market Value Credit Factors

Primary Factors	Secondary Factors
Over Collateralization Test	Level of advance rates Cushion between the haircut value of assets and tranche par and accrued Time between OC tests Cure period to sell assets
Mark to Market Volatility	Interest rate volatility Credit spread volatility Propensity for credit and other events
Liquidity Risk	Credit quality Ownership restrictions Market familiarity with name and size of outstanding issuance Market familiarity with asset type Seller desperation, e.g., timing constraints
Portfolio Diversity	Industry diversification Geographical diversification Other known and unknown correlation factors Convergence of market value movements in times of stress
Interaction of tranche advance rates and net worth test	Tranche size and differences in advance rates

Sources: JPMS

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Cash Flow Credit Structure

As briefly discussed above, the credit quality of cash flow debt tranches depends upon the ability of the CDO to withstand portfolio default losses and still pay its debt tranches. The two factors that affect the credit quality of cash flow debt tranches are the riskiness of the CDO's assets and the protectiveness of its structure.

Asset Risks

With respect to CDO assets, the credit risk of debt tranches is determined by three factors:

- default probability;
- default correlation;
- default severity.

To define these factors briefly, default probability is the likelihood that an asset will default over a given time period. Obviously, an asset will either default or not default; there is no middle ground. What is meant, for example, by a 2% estimate of default probability is that over repeated trials we expect an average of 2% of such assets in such trials to default. The implication of higher default probability in a portfolio is obvious.

Default correlation addresses the distribution of defaults in the portfolio given individual asset default probability. If the credits tend to default together, they are positively correlated with respect to default. If credits tend to default separately, they are negatively default correlated. For example, suppose that the default probability of each CDO asset is 5% over a certain time horizon. Maximum positive correlation would mean that 5% of the time the entire portfolio defaults and 95% of the time no credits default. Maximum negative correlation would mean that 5% of the portfolio always defaults over the given time horizon.

The implications of these two distributions, brought about by extremely different default correlations, are very different. In the first scenario, both equity and debt tranches are at risk for massive losses that occur infrequently. In the second scenario, the equity tranche is sure to sustain losses but debt tranches are completely insulated from loss.

Default severity is the loss in the event a default occurs. It can be measured as the market value of the asset after it defaults or as the present value of all after-default cash flows. Default severity, and its complement, recovery amount, is usually represented as a percentage of par. It varies by industry and the type of assets the credit owns. Recovery also varies by legal jurisdiction depending on how quickly local law allows a creditor to be put into bankruptcy and how strictly seniority is enforced.

The combination of all these factors produces a probability distribution of total CDO default losses over the life of the CDO. However, the timing of losses is also important because earlier asset defaults deny coupon cash flow to the CDO. To be complete, the probability distribution of aggregate losses must take into account the timing of losses.

Filling in this theoretical framework with default and recovery assumptions specific to a CDO's portfolio is difficult. Investors use rating agency ratings, default studies, rating transition studies, and recovery studies. Other credit consultants offer default probability and default correlation products. Investors should look at the manager's track record, not only for experienced defaults and recoveries, but also for sales of assets at significant loss related to credit deterioration. They should also consider trends in both economic conditions and the credit quality of recent new issues in the targeted asset classes. The robustness of the new issue calendar is important for arbitrage CDOs because it dictates how choosy the manager can be in selecting

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credits. The underwriting quality of the asset seller and the selection process for including assets in the CDO are relevant for balance sheet CDOs.

Structural Protections

Asset defaults and recoveries affect the different tranches of the cash flow CDO according to the subordination of the tranches. There are two kinds of subordination, priority in bankruptcy and priority in cash flow timing.

Priority in bankruptcy in a CDO is almost always strict, meaning that in bankruptcy the proceeds from liquidated CDO assets will first be used to satisfy the claims of the senior debt tranche and only then, if there are any remaining proceeds, the next most senior tranche. The absolute seniority of CDO tranches is discussed in the section below on legal considerations affecting credit risk.

Both within and outside the world of CDOs, priority of cash flow often trumps priority in bankruptcy. Cash flow distributed to subordinated tranches is lost to more senior tranches no matter how poorly the entity does subsequently. With corporate debt, an early-maturing subordinate bond can be a better credit risk than a later-maturing senior bond.

However, a cash flow CDO employs several mechanisms to maintain tranche priority in cash flows. The first is the sequential principal paydown of tranches, meaning that principal payments are made to tranches in order of priority. This has the effect, as the CDO's assets amortize, of increasing the percentage subordination below senior tranches. While the portfolio becomes smaller, less diverse, and more susceptible to default variability, subordination protection increases commensurately.

Table 9

Typical Sequential Paydown Structure

Tranche	Initial Structure		After 50% Collateral Paydown	
	Tranche Size (\$MM)	Subordination	Tranche Size (\$MM)	Subordination
A	\$62	38%	\$12	76%
B	\$10	28%	\$10	56%
C	\$10	18%	\$10	36%
Equity	\$18	NA	\$18	NA
Total assets/Total liabilities	\$100		\$50	

Source: JPMS

A few outstanding CDOs use a fast pay/slow pay structure where the bulk of principal payments go to senior tranches while a smaller amount goes to subordinated tranches. Some CDOs also make pro-rata distributions of principal to their tranches.

The second mechanism to maintain tranche priority in cash flows is the use of collateral coverage tests. These tests divert cash flows from subordinate tranches, prevent reinvestment in new CDO assets, and cause senior tranches to be paid down. The two main collateral coverage tests are the over-collateralization test and the interest coverage test.

In simplified form, the over-collateralization test is the ratio of CDO asset par to tranche par. In the test, defaulted assets are counted at an assumed recovery rate or at the lower of that assumption or market value. Note that this is a par to par test, not a market value style market value to par test. In simplified form, the interest coverage test is the ratio of CDO asset interest to CDO tranche coupon. Scheduled coupons from

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defaulted assets are excluded from the test. Sometimes the deterioration of CDO asset credit quality, as determined by some objective measure, such as credit ratings, is also used to divert cash flows.

*Chart 8***Over Collateralization Collateral Coverage Tests**

Tranche A Over-collateralization Test:	<u>CDO Asset Par</u> Tranche A Par
Tranche B Over-collateralization Test:	<u>CDO Asset Par</u> Tranche A and B Par
Tranche C (& etc.) Over-collateralization Test:	<u>CDO Asset Par</u> Tranche A, B, and C (Etc.) Par

Where: CDO Asset Par equals the par of CDO assets deemed not to be in default and a recovery assumption credit applied to defaulted assets.

Source: JPMS

*Chart 9***Interest Collateral Coverage Tests**

Tranche A Interest Coverage Test:	<u>CDO Asset Coupon</u> Tranche A Coupon
Tranche B Interest Coverage Test:	<u>CDO Asset Coupon</u> Tranche A and B Coupon
Tranche C (& etc.) Interest Coverage Test:	<u>CDO Asset Coupon</u> Tranche A, B, and C (Etc.) Coupon

Where the CDO Asset Coupons are actual coupons received and scheduled coupons from non-defaulted collateral over the current interest payment period and Tranche Coupons are calculated over the same period.

Source: JPMS

A typical priority of payments schedule, or “waterfall” shows how sequential principal paydown and coverage tests work together to enhance senior tranche credit quality by assuring priority in cash flows:

Interest proceeds are used to pay:

1. Base fees and expenses of the CDO, including trustee, custodian, and paying agent fees.
2. The net periodic coupon due any swap counterparty.
3. Base asset manager fee.
4. Interest on Class A tranche and any termination amount due any swap counterparty caused by the CDO’s default.

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5. If the Class A tranche coverage tests are not met, redemption of Class A tranche until the coverage tests are met.
 6. Interest on Class B.
 7. If the Class B tranche coverage tests are not met, first the redemption of Class A tranche and then, if necessary, the redemption of Class B tranche until the Class B coverage tests are met.
 8. Class B interest accrued but not previously paid.
- (Steps six and eight are repeated for each debt tranche.)
9. Termination amount due any swap counterparty caused by the swap counterparty's termination or default. (Sometimes included in step 4 above.)
 10. Any additional fees to the trustee and custodian.
 11. Additional asset manager fee.
 12. Equity tranche until it achieves a particular IRR.
 13. Remainder divided between equity and the asset manager.

Principal proceeds are used to pay:

1. Amounts due in one through eight above not met with interest proceeds.
2. During the reinvestment period, reinvestment in new assets.
3. After the reinvestment period, paydown of tranches in sequence.
4. Amounts in 9 through 13 above.

Note that the above waterfall specifies that all principal proceeds, including proceeds from asset sales, be used to pay down debt tranches in sequence unless the CDO is both (1) in its reinvestment phase and (2) all tranches are meeting their coverage tests. In that case only, principal proceeds can be used to purchase new assets. Importantly, principal cash flow cannot usually reach equity holders until all debt tranches are retired.

Cash flow CDOs also have trading prohibitions that restrict reinvestment. These trading rules revolve around collateral quality tests, or objective measures of certain portfolio characteristics, such as:

- industry or geographical diversity;
- average rating;
- average life;
- prospective average recovery;
- minimum weighted average coupon or spread.

Other concentration tests address the presence in the portfolio of large single issuers, loan participations, triple-C credits, deferred interest instruments, and the like.

In order to reinvest principal proceeds, the CDO must pass its collateral coverage tests as described above and also maintain these quality and concentration measures above their thresholds or, if a measure is already below its threshold, maintain or improve the measure. Since the portfolio is not always in place at closing, and since the portfolio can be traded anyway, the CDO is often evaluated as if all collateral quality and concentration tests were at their thresholds. To maintain trading flexibility, the initial portfolio is chosen to

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surpass quality and concentration thresholds by a significant margin. Thus, the actual CDO portfolio is better than the theoretical one used to size subordination requirements.

A conservative aspect of the collateral quality and concentration tests is that they are usually applied independently. A proposed trade must cause the portfolio to satisfy each quality and concentration test without allowing for acceptable trade-offs among these portfolio characteristics. An exception to this is that many deals now incorporate a matrix of acceptable combinations of factors such as issuer and industry diversity, average rating, prospective average recovery, or yield spread.

Debt tranche investors examine the cash flow waterfall, collateral coverage tests, and collateral quality requirements closely to assess their priority in cash flows. They also scrutinize possible trading actions that could be taken by managers and frequently ask for modifications. For example, in some CDOs, an appreciated asset can be sold and the proceeds used to purchase the same amount of par at lower cost. The difference between sale proceeds and purchase price can then be put into the interest proceeds waterfall where, if collateral coverage tests are met, cash flow is eventually available to the equity tranche. Such a situation allows the asset manager to sell credit-improved assets and skim off the price appreciation from those assets.

But if other assets have suffered price deterioration, and presumably decreased credit quality, the selling of winners and retention of losers causes the average credit quality of the portfolio to suffer. This scenario is now addressed in most CDOs by requiring capital gains to be reinvested unless the CDO's initial over-collateralization ratios are satisfied.

However, it is still widely the case that a manager can trade a defaulted asset, which is given no credit in a CDO's interest coverage test and only partial credit in the CDO's over-collateralization test, for a performing security that trades at the same price as the defaulted security. Under certain circumstances, this might improve coverage tests and permit the distribution of proceeds to subordinated tranches that would otherwise be restricted. But has the trade actually improved the credit quality of the CDO? Such trading scenarios, and their significance, must be placed in the context of the CDO's trading restrictions as a whole.

Balancing Asset Risk and Structural Protection

The purchaser of a cash flow CDO debt tranche must balance the default characteristics of the assets against subordination levels and the effectiveness of the coverage, quality, and concentration tests that redirect asset cash flows and control trading. As with market value CDOs, the investor must also consider how asset characteristics might change because of trading.

Table 10

Cash Flow Asset Risks and Structural Protections

Asset Risk	Structural Protections
Default probability	Subordination
Default correlation	Cash flow distribution before breach of coverage tests
Default loss	The trigger levels and effectiveness of coverage tests in redirecting cash flows Protection afforded by quality and concentration tests

Sources: JPMS

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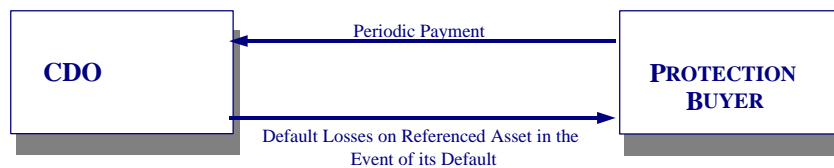
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Synthetic CDOs

As an alternative to purchasing bonds or loans, a CDO might gain market exposure to an obligor synthetically by entering into a credit default swap. In a credit default swap, the CDO receives a periodic payment from a counterparty that seeks protection against the default of a referenced asset. The payment is based on the credit spread of the referenced asset. In return for this payment, the CDO must pay the protection buyer default losses on the referenced asset if the obligor of the referenced asset defaults. An analogy can be made to insurance where one party pays premiums and the other provides loss coverage. The exact definitions of “default” and “default losses” can be customized to suit the desires of the CDO and the protection buyer, but typically follow standard ISDA definitions. The tenor of the swap can be shorter than the tenor of the referenced asset.

Chart 10

Credit Default Swap



Source: JPMS

Synthetic Balance Sheet CDOs

In a synthetic balance sheet CDO, the protection buyer entering into the credit default swap with the CDO owns the referenced asset, or has exposure to the referenced obligor via, for example, a letter of credit or a swap receivable position. The protection buyer is trying to offset a credit loss it might sustain with a payment from the CDO in that event. As the CDO assumes credit exposure to the referenced obligor without buying an asset, the protection buyer gets rid of credit risk to the referenced obligor without selling an asset. These are balance sheet transactions only in that they reduce the protection buyer’s economic and regulatory required capital; they do not remove assets from the balance sheet.

The credit default swap in a balance sheet CDO can reference more than one asset or underlying obligor. It can also be structured to incorporate loss thresholds that must be exceeded before the CDO makes a payment. This threshold might be expressed on a per-asset basis (losses exceeding X amount per asset) or on an overall portfolio basis (losses exceeding X amount over the entire portfolio). The protection buyer essentially has to meet a deductible before being protected from credit losses on the referenced assets.

Credit default swaps are a popular means of hedging credit risk from loans because of the difficulty or reluctance commercial banks have in selling loans they have extended. In many circumstances, loans cannot be sold without notifying or gaining the approval of the borrower and other lenders. In other cases, loans are simply not saleable at all. Finally, as discussed below in the Legal Considerations section, the purchase or participation in loans might create credit complications from the point of view of the CDO.

Credit default swaps also separate the funding of an asset from the assumption of its credit risk. A bank can use a credit derivative to shed risk while still maintaining funding advantages it might have.

Synthetic Arbitrage CDOs

Credit default swap-backed CDOs are increasingly associated with arbitrage CDOs. The motivation for a synthetic arbitrage CDO typically comes from a party that seeks leveraged credit exposure to a portfolio of

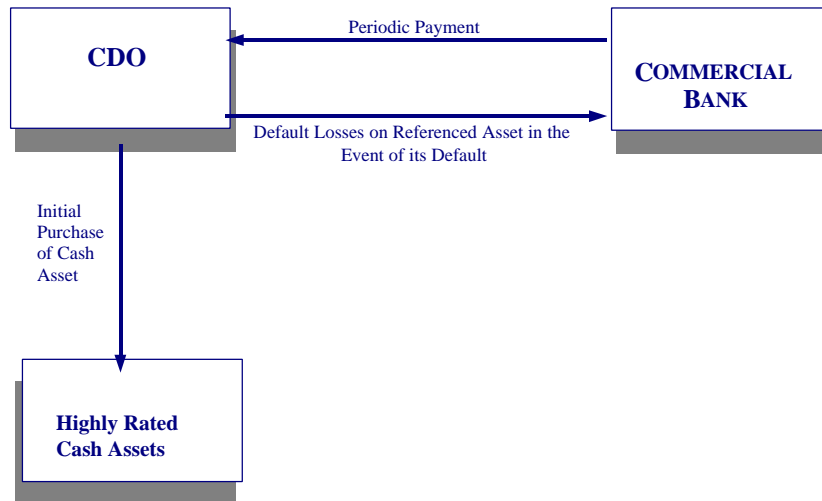
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names. It might be the case that the CDO cannot achieve exposure to the names other than through a credit derivative. To date, almost all synthetic CDOs have been based on static reference portfolios. In the future, we anticipate active trading of underlying reference names in synthetic arbitrage CDOs. Synthetic arbitrage CDOs will enter into a number of individual credit default swaps with different counterparties.

Funded and Unfunded CDOs

An important aspect of credit default swaps is that they do not require cash investment by the CDO. In cases where investors want to buy a funded note, the CDO must therefore find other uses for the cash it receives from tranche investors. The method of JPMorgan Bistro transactions of 1997 and 1998 was for the CDO to purchase a highly credit worthy asset, such as triple-A rated credit card-backed securities as shown in Chart 11⁴. The asset is selected to mature at the termination of the credit default swap. If referenced obligors have defaulted under the swap, proceeds from the security are used to pay the counterparty. Residual amounts are then available to tranche holders. Another alternative is to create a funded position by embedding the credit default swap in a credit-linked note of a well-rated issuer.

Chart 11
Synthetic CLO with Highly-Rated Asset and Credit Default Swap



Source: JPMS

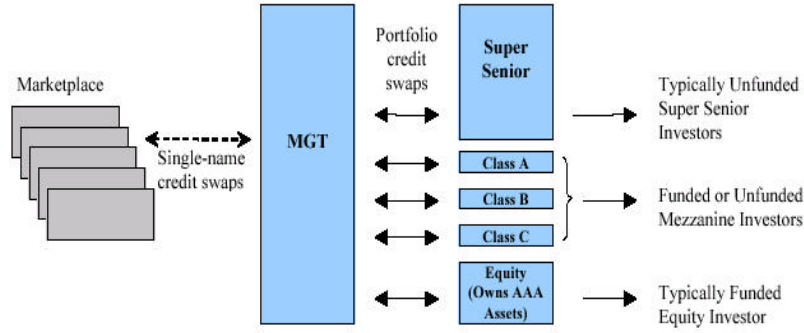
In more recent synthetic CDOs, cash investment has become optional and the CDO investor can simply enter into a credit default swap with the sponsoring financial institution. In chart 12, investors in the super senior, mezzanine, or equity tranches can take tranche exposure to the referenced portfolio on either an unfunded or funded basis.

⁴ See the Glossary entry under *credit-linked note* for a description of an alternative method of investing cash proceeds.

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Chart 12
Synthetic CDO with Funded and Unfunded Tranches



Source: JPMS.

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Parties to a CDO

Asset Manager

The focus of a cash flow manager is often said to be to avoid defaults while the focus of a market value manager is to achieve price appreciation. Certainly the market value structure, with its wider array of assets and easier trading rules is a more efficient vehicle to realize price appreciation. At the same time, the credit manager who can avoid defaults does not want to rely on other parties agreeing with its credit assessment in order to realize value. For that manager, the cash flow structure is ideal since assets are not typically sold prior to maturity. Yet it is obvious that the market value manager does not want to experience defaults and that the cash flow manager may wish to realize the benefit of price appreciation.

Debt and equity tranche investors take care in reviewing the asset manager. Besides expertise in the CDO's underlying assets, the manager must understand the intricacies of CDO trading rules and be able to comply with them. The manager may also need expertise in derivative instruments and interest rate or foreign exchange hedging. Some CDO investors prefer a small management company that will be focused on the CDO. Others prefer a large manager that has available back-up personnel and clout in gaining access to allocations. A larger firm might also have formal internal risk controls and audit procedures.

The argument about the best manager can take other twists as well. One investor might spurn discussion of the size of the asset management firm as irrelevant, and stress that all that really matters is the manager's historical risk-adjusted performance. But an answer to this argument is that managing a CDO is not like managing a normal portfolio because of the CDO structure and trading restrictions.

The rating agency view of asset managers is ambivalent. As a policy and marketing issue, they have to base their CDO analysis on the ratings their organizations place on the underlying collateral. They cannot give a manager a lot of credit for being able to improve upon rating agency credit assessment. However, ratings analysts are also aware that there is great variability in the default probability of credits in the same rating category. The nightmare of the CDO rating agency analyst is the manager who buys the most risky credits within rating categories.

In some cases, Moody's will adjust debt tranche target expected loss in view of their assessment of the manager's capabilities. The adjustments are more significant on the downside than the upside. Fitch differentiates between managers via trading limits and other structural provisions. S&P adjusts its model recovery assumptions on the theory that managers with demonstrated work out experience will reap higher recovery values.

Neither equity nor debt tranches want the asset manager to forget their interests. The compromise that is often reached is that the asset manager purchases a meaningful part of the CDO's equity tranche or subordinates a significant portion of its fee to debt and equity tranches. Debt tranche investors are satisfied that the manager has a first loss position in the collateral while equity investors appreciate that the asset manager will share in equity tranche gains and losses.

It can be argued that the debt tranche investors are getting the worst part of this arrangement. The equity tranche holders' position is analogous to owning a call on the value of the CDO portfolio struck at the par value of the debt tranches. The "value of the CDO portfolio" for a cash flow CDO is the after-default cash flow of the CDO portfolio. When CDO equity is deep in the money, equity holders are ambivalent about the volatility of the CDO's after-default cash flow. (In the language of options, their delta is high and their vega is low.) Equity holders would appreciate higher CDO asset yields, but to have them they would have to put up with higher default probabilities and potential losses. As potential gains go along with potential losses, prudence is a relevant virtue.

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But suppose the intrinsic value of the equity tranche option has already been eroded by defaults, such that equity's option is at the money or out of the money. In this case, the potential change in the value of equity's option is one-sided and it craves volatility. Unfettered, equity would like the CDO to purchase the most yieldy, credit risky portfolio: equity can't lose more than it already has, and the potential for upside is only possible if the CDO takes chances. (In the language of options, their delta is low and their vega is high.)

This view of asset manager motivation suggests that debt holders should understand how CDO collateral coverage, quality, and concentration tests restrict trading activity if the CDO portfolio deteriorates. It also may argue for CDO managers who do not want their CDOs to fail and affect their other businesses outside the CDO.

Bond Insurer

Sometimes a CDO structure incorporates bond insurance (financial guarantee insurance) on senior tranches. Tranche holders then have two sources of payment: the CDO and, if the CDO fails, the bond insurer. Triple-A-rated bond insurers usually insure tranches that would have been rated single- or double-A or higher without their guarantee. Typically, bond insurance is used with new asset classes or new CDO managers until investors become familiar and more generous in their bids for unenhanced tranches.

Rating agencies appreciate the monitoring and structuring involvement of bond insurers in transactions. They will require a bond insurer to hold less capital to insure a CDO than they would require a CDO to hold internally. From the perspective of the CDO equity tranche, bond insurance makes sense if the reduction in senior tranche yield with bond insurance is greater than the bond insurer fee.

Co-Issuer

When the CDO is located offshore, a Delaware corporate co-issuer is often used. The co-issuer has a passive role in the overall CDO structure but is sufficient U.S. connection to qualify the CDO as a U.S. corporate issuer under National Association of Insurance Commissioners (NAIC) guidelines applicable to U.S. insurance companies.

Rating Agencies

S&P pioneered market value CDO ratings in 1987 and cash flow ratings in 1988. By 1990, however, Moody's dominated the rating of cash flow structures due to rating standards that more flexibly addressed a wider range of portfolio credit quality and diversity. Beginning in 1996, Fitch began rating the second generation of market value CDOs. Moody's and S&P came out with revised market value requirements in 1998 and 1999, respectively, and became more active in that market.

*Table 11***Rating Agency Market Shares: By Number of Rated CDOs**

	Moody's	S&P	Fitch
1987 – 2001	66%	52%	35%
2001 only	66%	56%	36%

Source: JPMS

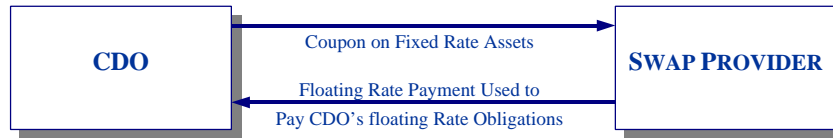
Swap Provider

CDOs sometimes enter into interest rate or currency options or swaps to match the cash flow of their assets to the requirements of their liabilities. For example, many CBOs issue floating rate tranches backed by fixed rate bonds. To bridge the interest rate mismatch, the CBO might enter into a fixed-for-floating interest rate swap or purchase an interest rate cap. The CBO would pay a fixed interest rate on a notional amount to a

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counterparty in exchange for a floating interest rate on the same notional amount. In this example, the fixed coupons on its bonds would support the fixed rate payments the CBO makes to the swap counterparty. The floating rate the CBO receives from the counterparty would be used to make payments on its floating rate tranches. A currency swap or option might be used if CDO assets and liabilities are in different currencies.

*Chart 13***Interest Rate Swap**

Source: JPMS

In these circumstances, the CDO, and by extension the CDO tranche holders, take on credit risk to the swap or option provider. If the swap provider terminates or defaults, the CDO also faces the risk to its liquidity of having to make a termination payment to the swap provider. The CDO must also then find a replacement counterparty for the defaulted swap or cap. These risks are addressed by requiring the swap provider to be of high credit quality and writing other protective provisions into the derivative documentation.

Trustee, Collateral Custodian and Servicer and Paying Agent

Usually the same entity, the trustee is responsible for issuing the CDOs, maintaining and servicing the collateral, short-term cash reinvestment, payments (from the collateral and to the tranches), and compliance testing. The various collateral coverage, quality, and concentration tests makes this last task more complicated than a trustee role in a typical asset backed securitization. Active trading also makes this role more difficult. Adherence to the CDO waterfall when distributing payments to tranche holders is critical. The trustee usually issues a monthly report detailing the status of the CDO portfolio and cash distributions made by the CDO.

Underwriter and Placement Agent

Usually a Wall Street securities firm that balances the differing objectives of tranche investors while satisfying the requirements of regulators and rating agencies and reconciling the advice of legal, tax, and accounting experts. The firm may advise prospective managers, produce cash flow models and results, negotiate with rating agencies, engage other professionals, market the tranches, monitor completed transactions, and produce relevant, timely, insightful, and helpful research.

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Glossary and Notes

Advance rate: In a market value CDO, the amount of tranche debt supportable by an asset type, expressed as a percent of the market value of the asset type. Varies according to the characteristics of the asset type and the desired rating of the tranche.

Amortization period: The period, after the reinvestment or revolving period, in which new collateral purchases are not allowed and principal cash flow is used to pay down tranche principal.

Arbitrage CDO: A CDO whose purpose is to allow a money manager to expand assets under management and equity investors to achieve non-recourse leverage to CDO assets. There is no “arbitrage” in the classic sense of the word. Rather, equity holders hope to capture the difference between the after-default yield on the assets and the financing cost due debt tranches. Assets are purchased over a warehousing period before closing and a ramp-up period after closing. Arbitrage CDOs and repackagings are exceptions to the usual balance sheet purpose of securitizations.

Asset manager: Party responsible for trading CDO assets.

Balance sheet CDO: A CDO whose purpose is to allow a commercial bank or other entity to reduce their balance sheet or free up economic or regulatory capital. An existing portfolio (or the risk of the portfolio) is transferred to the CDO and the transferor usually purchases CDO equity. Compare to Arbitrage CDO.

Bond insurance: An external guarantee of debt tranche performance from a financial guarantor insurance company.

Cash flow CDO: A CDO where subordinated tranches are sized so that senior tranches can be paid from after-default cash flow with a high degree of confidence. If portfolio quality deteriorates, asset cash flow may be redirected from subordinated tranches to senior tranches.

Collateral coverage tests: Cash flow CDO tests that divert cash flows from subordinated tranches, prevent reinvestment in new CDO assets, and cause senior tranches to be paid down. The two main collateral coverage tests are the over-collateralization test and the interest coverage test. Sometimes a ratings based test is also used.

Collateral quality tests: Cash flow CDO tests that restrict portfolio trading. Tests may include objective measures of portfolio diversity, average rating, average life, prospective average recovery, and minimum weighted average coupon or spread.

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Collateralized bond obligation (CBO): A securitization of corporate bonds. Refers to the special purpose vehicle (SPV) that holds the asset portfolio and issues liabilities and also to the obligations the SPV issues. See the definition of collateralized debt obligation.

Collateralized debt obligation (CDO): A securitization of corporate bonds, bank loans, ABS, RMBS, CMBS, or almost any non-consumer obligation. Refers to the special purpose vehicle (SPV) that holds the asset portfolio and issues liabilities and also to the obligations the SPV issues.

In the late 1980s, when high yield bonds were first securitized, two nomenclatures vied for supremacy. The alliterative “bonds-backed bonds” had the advantage of being descriptive and similar to the names of other securitizations like mortgage-backed securities and asset-backed securities. In contrast, “collateralized bond obligation” is off-target. It better describes a debt obligation secured by specific physical assets, like a mortgage bond secured by land and buildings or an equipment trust certificate secured by airplanes.

But high-yield bonds, or more pejoratively, junk bonds, carried a stigma. Meanwhile, collateralized mortgage obligations (CMOs) enjoyed acceptance and esteem due to their pristine credit quality and government agency affiliation. The CBO moniker borrowed the respectability and popularity of CMOs and won out in usage over the arguably better “BBBs.”

The CBO terminology also enabled a clever marketing analogy: “a CMO divides 30 years of first mortgage cash flows into maturity ranges that appeal to investors with different time horizons; a CBO divides the credit risk of a pool of high yield bonds into different classes that appeal to investors with different credit risk tolerances.”

Having settled on “CBO” for the securitization of high-yield bonds, it was natural for “collateralized loan obligation” to be used for the securitization of commercial loans. And when bonds and loans were mixed into the same vehicle, “collateralized debt obligation” described the conglomeration. Now, having trounced the upstart and unfortunate moniker “kitchen sink bonds,” “CDO” is also the firmly entrenched name for the securitization of emerging market corporates and sovereigns, and the middle tranches of ABS, RMBS, and CMBS securitizations.

Collateralized loan obligation (CLO): A securitization of bank loans, usually commercial and industrial loans. Refers to the special purpose vehicle (SPV) that holds the asset portfolio and issues liabilities and also to the obligations the SPV issues. See the definition of collateralized debt obligation.

Concentration tests: Addresses the presence in the portfolio of a single issuer, loan participations, non-U.S. obligors, triple-C credits, deferred interest instruments and the like.

Credit default swap: A contract where one party pays a fee and the other party has the contingent obligation to make a payment if a referenced entity defaults. The structure incorporates flexibility with respect to the definition of default and the calculation of the default payment.

Credit derivatives: A derivative whose underlying is a credit event or credit measure such as default, credit spread, or rating change of a referenced asset or obligor.

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Credit impaired or improved assets: Designation used to determine flexibility in selling and reinvesting sale proceeds.

Credit-linked note: A note whose cash flow depends upon a credit event or credit measure of a referenced entity or asset such as default, credit spread, or rating change.

Chart 14



Sources: JPMS.

Debt tranches: Tranches ranking in seniority above the equity tranche.

Default correlation: The phenomenon that companies tend to default together. The state of the general economy or of specific industries affect companies and lead to correlated defaults.

Default probability: The likelihood that an obligor or asset will default over a given time period.

Default severity: The loss in the event default occurs.

Disintermediation: The process of eliminating intermediaries between ultimate users of capital and ultimate providers of capital. It is brought about by better communication, transparency, and securitization technology. See definition of securitization.

Diversity score: Moody's index of a portfolio's diversity based on the insight that a number of correlated credits will exhibit the same return variance as a smaller number of uncorrelated credits. For example, ten credits in ten industries have a Moody's diversity score of ten while ten credits in the same industry have a diversity score of four. Besides industry diversity categories, Moody's has geographical diversity categories for emerging market obligors and asset categories for ABS and MBS assets.

Emerging market CBOs (EMCBOs): A securitization of bonds or bank loans from obligors domiciled in emerging markets. Refers to the special purpose vehicle (SPV) that holds the asset portfolio and issues liabilities and also to the obligations the SPV issues. See the definition of collateralized debt obligation.

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Equity tranche: The most subordinate tranche, regardless of whether the instrument is structured to look like equity or debt or issued in the legal form of equity or debt. Sometimes referred to as junior subordinate notes, preference shares or income notes.

Fast pay/slow pay: The sharing of principal repayment among tranches simultaneously but with a bias to senior tranches. Not used much now.

Final or legal maturity: While the exact amortization of CDOs is not known for cash flow CDOs because it depends on defaults and calls, the latest maturity date on the underlying CDO assets provides this outside limit.

Fraudulent conveyance: Under Section 548 of the U.S. Bankruptcy Code, a fraudulent conveyance can be found to occur if a transfer by a person of an interest in its property, made within one year of the commencement of a bankruptcy case with respect to such person, either (i) is made with an actual intent to hinder, defraud or delay such person's creditors or (ii) constitutes a "constructive fraud" on such person's creditors. A "constructive fraud" can be found to occur if the transferor receives less than "reasonably equivalent value" in exchange for the transfer and was insolvent at the time of (or became insolvent as a result of) such transfer, was engaged in a business for which its property remaining after the transfer constituted unreasonably small capital or intended to incur debts that would be beyond its ability to repay as they matured.

Interest coverage test: One of the collateral coverage tests that diverts cash flows from subordinate tranches, prevents reinvestment in new CDO assets, and causes senior tranches to be paid down.

Lender liability: Lender liability is a collective reference to various evolving legal theories used to uphold the right of borrowers to sue lenders under certain circumstances. Generally, lender liability is founded on the premise that an institutional lender has violated a duty (whether implied or contractual) of good faith and fair dealing owed to the borrower or has assumed a degree of control over the borrower resulting in the creation of a fiduciary duty owed to the borrower or its other creditors or shareholders.

Liquidity risk: An asset's price risk that is not related to fluctuations in its theoretical or intrinsic value but rather the ability of the seller to get a "fair" price.

Market value CDO: A CDO where the haircut market value of assets is compared to tranche par and accrued interest. If there is not a superiority of the first quantity, the CDO's assets must be sold and tranches repaid in seniority until the prescribed ratio is achieved.

Net worth test: A market value CDO test of the equity tranche value that, if breached, causes the CDO to sell its assets and retire debt tranches.

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Notional amount: The amount that interest rates or currency rates are multiplied by to calculate the cash flow of a derivative.

Open-market transaction: An arm's-length non-recourse sale of financial assets between unaffiliated entities in which the seller receives payment in full at the time of the sale and takes such payments in the form of cash, rather than in the form of the buyer's securities.

Origination CDO: A term coined in this paper and not in use. A CDO created to purchase assets specifically originated for it.

Overcollateralization test or par value test: For a cash flow CDO, one of the collateral coverage tests that diverts cash flows from subordinated tranches, prevents reinvestment in new CDO assets, and causes senior tranches to be paid down. For a market value CDO, the test that causes CDO assets to be sold to retire the senior-most tranche outstanding.

Perfected security interest: A secured party's security interest in a financial asset is "perfected" once it has taken all the steps required under applicable law (e.g., filing

a UCC financing statement or taking possession of the asset) that affords the secured party maximum secured creditor protections in terms of being able to take the asset from or to the exclusion of third parties upon the debtor's default.

Preference: Under Section 547 of the U.S. Bankruptcy Code, a preference can be found to occur upon a transfer by a person of an interest in its property to a creditor, in respect of an antecedent debt owed by such person prior to the transfer, during the relevant "preference period" preceding the filing of a bankruptcy petition with respect to the debtor, if at the time of the transfer, such person was insolvent and if the effect of the transfer was to improve the position of the creditor at the expense of other similarly situated creditors. Under the U.S. Bankruptcy Code, the preference period is one year prior to the date of the bankrupt's petition filing if the creditor is an "insider" with respect to the bankrupt and otherwise 90 days prior the date of its petition filing.

Principal-protected note: A structuring and credit rating device to achieve a higher rating for an investment. A high yield instrument, such as an equity CDO tranche, is combined with a high credit quality zero coupon security, often a stripped Treasury bond. The rating agency limits their credit assessment solely to the cash flow supported by the zero coupon bond and is silent to the upside potential contributed by the more risky asset. Generally this is done when regulatory or capital requirements restrict or penalize the purchase of the two assets separately.

Priority in bankruptcy: The intended seniority of claimants in bankruptcy which can be partially overthrown, especially in the U.S., by the bankruptcy judge's powers of equitable distribution and the negotiating power of subordinated investors.

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Priority in cash flow timing: The credit protection afforded senior tranches relative to subordinated tranches in a cash flow CDO by the redirection of cash flows to paydown debt tranches via the operation of the waterfall and collateral coverage tests.

Priority of payments, or “waterfall”: The schedule that determines distribution of interest and principal proceeds to cash flow CDO tranches taking into account collateral coverage tests.

Pro-rata distribution: The distribution of principal repayment to tranches simultaneously.

Ramp up: Period after CDO closing in which assets are purchased. Associated with arbitrage rather than balance sheet CDOs.

Recovery amount: The market value of the asset after it defaults or the present value of all after-default cash flows

Referenced asset or obligor: The asset or obligor whose performance determines cash flows in a total return or credit default swap.

Reinvestment or revolving period: In a cash flow CDO, the period in which principal proceeds can be reinvested in new assets so long as collateral coverage tests are met.

Repackagings: CDO-like structures with one liability tranche and one asset are called repackagings. In such a structure, an interest rate swap or a currency rate swap changes the cash flow characteristics of the asset into the cash flow characteristics of the liability. The swap might transform the currency of the underlying asset, or a fixed rate coupon into floating, or even a zero coupon into a current pay coupon. This structure is employed when, for perhaps regulatory or credit reasons, the investor cannot enter into the transactions separately.

Securitization: The process and the result of pooling financial assets together and issuing liability and equity obligations backed by the pool of assets. The entity that issues the obligations and purchases the assets is generically called a special purpose vehicle (SPV) or Special Purpose Entity (SPE). The SPV is set up solely for the purpose of the securitization and might be a trust, limited liability company, partnership or a corporation. The obligations of the SPV are typically tranching into multiple classes with different maturities and seniorities.

First mortgages on residential property were the first asset class to be securitized, beginning with a Ginnie Mae sponsored transaction in 1970. Today, first mortgages are still the most prevalent securitization. But since the mid-1980s almost every other imaginable type of consumer debt has also been securitized: credit card, auto, boat, second mortgages, home equity lines, manufactured housing, RV, student loans, time share payments, and even property tax liens.

Non-consumer assets that have been securitized include: equipment leases, mortgages on commercial property, small business loans, franchise payments, loans for taxi-cab medallions, and even the future

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royalty stream on record and CD airplay and sales, playfully called “Bowie Bonds” after the first recording artist to be so securitized.

Securitization goes hand-in-hand with the disintermediation of commercial banks, finance companies, and other traditional holders of credit assets. Over the last two decades, many of these institutions have gradually transformed themselves from originators, servicers, and holders of credit assets to originators, servicers, and distributors of credit assets. The result is that the chain between ultimate borrower and ultimate lender has shortened as these links have fallen out.

The success of CDOs, particularly of commercial loan-backed CDOs, is analogous to the disintermediation of consumer credit.

Sequential principal paydown or sequential pay: Repayment of principal to tranches in order of seniority.

Set-off: The term “set-off,” when used in connection with a loan in respect of which a lender has sold a participation interest, refers to the borrower’s reduction, in connection with the lender’s insolvency, of amounts payable under the loan to the lender by amounts owed by the lender to the borrower in respect of unrelated obligations (e.g., deposits of the borrower held by the lender).

Special purpose vehicle (SPV) or special purpose entity (SPE): See definition of securitization.

Structured note: A note, which, for example, embeds a total return or credit default swap and whose cash flows depend on some referenced asset or obligor.

Substantive consolidation: Substantive consolidation is the principle of law under which a bankruptcy court, in the exercise of its equitable powers, will consolidate the assets and liabilities of separate, but related, entities so that their combined assets and liabilities will be treated as those of one, single entity.

Synthetic CDO or CLO or CBO: A CDO that gains exposure to credit-risky assets via derivative transactions rather than cash purchase of the assets.

Total return swap: A derivative whose underlying is the total return of a referenced asset, i.e., all coupons plus appreciation/depreciation.

Tranched: Set in a senior or subordinate position relative to one another.

True sale: A transfer of financial assets that, for purposes of U.S. bankruptcy or insolvency laws, constitutes a sale of such assets, rather than a transfer of the assets as collateral in connection with a secured financing in which the transferor is the debtor and the transferee is the secured creditor.

Warehousing: The purchase of assets before a CDO closes.

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CDO Handbook



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Waterfall or priority of payments: The schedule that determines distribution of interest and principal proceeds to cash flow CDO tranches taking into account collateral coverage tests.