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ABSTRACT

Several studies have reported how new credit risk transfer vehicles have made it easier to reallocate large amounts of credit risk from the financial sector to the non-financial sector of the capital markets. In this article, we describe one of these new credit risk transfer vehicles, the collateralized debt obligation. Synthetic credit debt obligations utilize credit default swaps, another relatively new credit risk transfer vehicle.

Financial institutions face five major risks: credit, interest rate, price, currency, and liquidity. The development of the derivatives markets prior to 1990 provided financial institutions with efficient vehicles for the transfer of interest rate, price, and currency risks, as well as enhancing the liquidity of the underlying assets. However, it is only in recent years that the market for the efficient transfer of credit risk has developed. Credit risk is the risk that a debt instrument will decline in value as a result of the borrower's inability (real or perceived) to satisfy the contractual terms of its borrowing arrangement. In the case of corporate debt obligations, credit risk encompasses default, credit spread, and rating downgrade risks.

The most obvious way for a financial institution to transfer the credit risk of a loan it has originated is to sell it to another party. Loan covenants typically require that the obligor be informed of the sale. The drawback of a sale in the case of corporate loans is the potential impairment of the originating financial institution's relationship with the obligor of the loan sold. Syndicated loans overcome the drawback of an outright sale because banks in the syndicate may sell their loan shares in the secondary market. The sale may be through an assignment or through participation. While the former mechanism for a syndicated loan requires the approval of the obligor, the latter does not since the payments are merely passed through to the purchaser and therefore the obligor need not know about the sale.

Another form of credit risk transfer (CRT) vehicle developed in the 1980s is securitization [Fabozzi and Kothari (2007)]. In a securitization, a financial institution that originates loans pools them and sells them to a special purpose entity (SPE). The SPE obtains funds to acquire the pool of loans by issuing securities. Payment of interest and principal on the securities issued by the SPE is obtained from the cash flow of the pool of loans. While the financial institution employing securitization retains some of the credit risk associated with the pool of loans, the majority of the credit risk is transferred to the holders of the securities issued by the SPE.

Two recent developments for transferring credit risk are credit derivatives and collateralized debt obligations (CDOs). For financial institutions, credit derivatives allow the transfer of credit risk to another party without the sale of the loan. A CDO is an application of the securitization technology. With the development of the credit derivatives market, CDOs can be created without the actual sale of a pool of loans to an SPE using credit derivatives. CDOs created using credit derivatives are referred to as synthetic CDOs.

In this article, we discuss CDOs. We begin with the basics of CDOs and then discuss synthetic CDOs. The issues for regulators and supervisors of capital markets with respect to CDOs, as well as credit derivatives, are also discussed.

Fundamentals of CDOs

A CDO issues debt and equity and uses the money it raises to invest in a portfolio of financial assets, such as corporate debt obligations or structured debt obligations. It distributes the cash flows from its asset portfolio to the holders of its various liabilities in prescribed ways that take into account the relative seniority of those liabilities.

Four attributes of a CDO

Any CDO can be well described by focusing on its four important attributes: assets, liabilities, purposes, and credit structures. Like any company, a CDO has assets. With a CDO, these are financial assets, such as corporate loans or mortgage-backed securities. And like any company, a CDO has liabilities. With a CDO, these run the gamut of preferred shares to AAA rated senior debt. Beyond the seniority and subordination of CDO liabilities, CDOs have additional structural credit protections, which fall into the category of either cash flow or market value protections. Finally, every CDO has a purpose that it was created to fulfill, and these fall into the categories of arbitrage, balance sheet, or origination.

Assets

CDOs own financial assets such as corporate loans or mortgage-backed securities. A CDO is primarily identified by its underlying assets.

The first CDOs, created in 1987, owned high-yield bond portfolios. In fact, before the term ‘CDO’ was invented to encompass an ever-broadening array of assets, the term in use was ‘collateralized bond obligation’ or ‘CBO.’ In 1989, corporate loans and real estate loans were used in CDOs for the first time, causing the term ‘collateralized loan obligation’ or ‘CLO’ to be coined. Generally, CLOs are comprised of performing high-yield loans, but a few CLOs, even as far back as 1988, targeted distressed and nonperforming loans. Some CLOs comprised of investment-grade loans have also been issued.

Loans and bonds issued by emerging market corporations and sovereign governments were first used as CDO collateral in 1994, thus ‘emerging market CDO’ or ‘EM CDO.’ In 1995, CDOs comprised of residential mortgage-backed securities (RMBS) were first issued. CDOs comprised of commercial mortgage-backed securities (CMBS) and asset-backed securities (ABS), or combinations of RMBS, CMBS, and ABS followed. The term ‘structured finance CDO’ or ‘SF CDO’ is the term we prefer to use to describe this type of CDO. However, Moody’s champions the term ‘resecuritizations’ and many others use ‘ABS CDO,’ even to refer to CDOs with CMBS and RMBS in their collateral portfolios.

Liabilities

Any company that has assets also has liabilities. In the case of a CDO, these liabilities have a detailed and strict ranking of seniority, going up the CDO’s capital structure as equity or preferred shares, subordinated debt, mezzanine debt, and senior debt. These tranches of notes and equity are commonly labeled Class A, Class B, Class C, and so forth going from top to bottom of the capital

Figure 1 - Simple, typical CDO Tranche Structure

Tranche	Percent of capital structure	Rating	Coupon
Class A	77.50	AAA	LIBOR + 26
Class B	9.00	A	LIBOR + 75
Class C	2.75	BBB	LIBOR + 180
Class D	2.75	BB	LIBOR + 475
Preferred shares	8.00	NR	Residual cash flow

structure. They range from the most secured AAA rated tranche with the greatest amount of subordination beneath it, to the most levered, unrated equity tranche. Figure 1 shows a simplified tranche structure for a CDO.

Special purposes entities like CDOs are said to be ‘bankrupt remote.’ One aspect of the term is that they are new entities without previous business activities. They, therefore, cannot have any legal liability for sins of the past. Another aspect of their ‘remoteness from bankruptcy’ is that the CDO will not be caught up in the bankruptcy of any other entity, such as the manager of the CDO’s assets, a party that sold assets to the CDO, or the banker that structured the CDO.

Another, very important aspect of a CDO’s bankruptcy remoteness is the absolute seniority and subordination of the CDO’s debt tranches to one another. Even if it is a certainty that some holders of the CDO’s debt will not receive their full principal and interest, cash flows from the CDO’s assets are still distributed according to the original game plan dictated by seniority. The CDO cannot go into bankruptcy, either voluntarily or through the action of an aggrieved creditor. In fact, the need for bankruptcy is obviated because the distribution of the CDO’s cash flows, even if the CDO is insolvent, has already been determined in detail at the origination of the CDO.

Within the stipulation of strict seniority, there is great variety in the features of CDO debt tranches. The driving force for CDO structures is to raise funds at the lowest possible cost. This is done so that the CDO’s equity holder, who is at the bottom of the chain of seniority, can get the most residual cash flow.

Most CDO debt is floating rate off LIBOR, but sometimes a fixed rate tranche is structured. Avoiding an asset-liability mismatch is one reason why floating-rate high-yield loans are more popular in CDOs than fixed-rate high-yield bonds. Sometimes a CDO employs short-term debt in its capital structure. When such debt is employed, the CDO must have a standby liquidity provider ready to purchase the CDO’s short-term debt should it fail to be resold or roll in the market. A CDO will only issue short-term debt if its cost, plus that of the liquidity provider’s fee, is less than the cost of long-term debt.

Sometimes a financial guaranty insurer will wrap a CDO tranche. Usually this involves a AAA rated insurer and the most senior CDO tranche. Again, a CDO would employ insurance if the cost of the tranche's insured coupon plus the cost of the insurance premium is less than the coupon the tranche would have to pay in the absence of insurance. To meet the needs of particular investors, sometimes the AAA tranche is divided into senior and junior AAA tranches.

Purposes

CDOs are created for one of three purposes:

- **Balance Sheet** - A holder of CDO-able assets desires to (1) shrink its balance sheet, (2) reduce required regulatory and economic capital, or (3) achieve cheaper funding costs. The holder of these assets sells them to the CDO. The classic example of this is a bank that has originated loans over months or years and now wants to remove them from its balance sheet. Unless the bank is very poorly rated, CDO debt would not be cheaper than the bank's own source of funds. But selling the loans to a CDO removes them from the bank's balance sheet and therefore lowers the bank's regulatory capital requirements. This is true even if market practice requires the bank to buy some of the equity of the newly created CDO.
- **Arbitrage** - An asset manager wishes to gain assets under management and management fees. Investors wish to have the expertise of an asset manager. Assets are purchased in the marketplace from many different sellers and put into the CDO. CDOs are another means, along with mutual funds and hedge funds, for an asset management firm to provide its services to investors. The difference is that instead of all the investors sharing the fund's return in proportion to their investment, investor returns are also determined by the seniority of the CDO tranches they purchase.
- **Origination** - Banks, insurance companies, and REITs wish to increase equity capital. Here, the example is a large number of smaller-size banks issuing trust preferred securities¹ directly to the CDO simultaneous with the CDO's issuance of its own liabilities. The bank capital notes would not be issued but for the creation of the CDO to purchase them.

Three purposes differentiate CDOs on the basis of how they acquire their assets and focus on the motivations of asset sellers, asset managers, and trust preferred securities issuers. From the point of view of CDO investors, however, all CDOs have a number of common purposes, which explain why many investors find CDO debt and equity attractive. One purpose is the division and distribution of the risk of the CDO's assets to parties that have different risk appetites. Thus, a AAA investor can invest in speculative-grade assets on a loss-protected basis. Or a BB investor can invest in AAA assets on a levered basis.

For CDO equity investors, the CDO structure provides a leveraged return without some of the severe adverse consequences of borrowing via repurchase agreements from a bank. CDO equity holders own stock in a company and are not liable for the losses of that company. Equity's exposure to the CDO asset portfolio is, therefore, capped at the cost of equity minus previous equity distributions. Instead of short-term bank financing, financing via the CDO is locked in for the long term at fixed spreads to the London interbank offered rate (LIBOR).

Credit structures

Beyond the seniority and subordination of CDO liabilities, CDOs have additional structural credit protections, which fall into the category of either cash flow or market value protections. The credit quality of a market value CDO derives from the ability of the CDO to liquidate its assets and repay debt tranches. Because the market value credit structure is less often used, it will not be reviewed here [For a discussion of the market value credit structure, see Lucas et al. (2006)].

The cash flow credit structure is the most common type of CDO structure used today. It does not rely upon the sale of assets to satisfy interest and principal payments. Instead, subordination is sized so that the after-default cash flow of assets is expected to cover debt tranche principal and interest with some degree of

¹ Trust preferred securities are unsecured obligations that are generally ranked lowest in the order of repayment.

certainty. Obviously, the certainty that a AAA CDO tranche, with 23% subordination beneath it, will receive all its principal and interest is greater than the certainty a BB CDO tranche, with only 8% subordination beneath it, will. Most cash flow CDOs have overcollateralization and interest coverage tests. These tests determine whether collateral cash flow is distributed to equity and subordinate debt tranches, diverted to pay down senior debt tranche principal, or used to purchase additional collateral assets. We will discuss these tests in detail later in this article, but their purpose is to provide additional credit enhancement to senior CDO debt tranches.

A CDO structural matrix

Figure 2 shows the four CDO building blocks and a variety of options beneath each one. Any CDO can be well described by asking and answering the four questions implied by the Figure: what are its assets? What are the attributes of its liabilities? What is its purpose? What is its credit structure?

This way of looking at CDOs encompasses all the different kinds of CDOs that have existed in the past and all the kinds of CDOs that are currently being produced. By adding ‘synthetic asset option’ and ‘unfunded super senior’ to the matrix, the matrix also encompasses synthetic CDOs, a type of CDO we will discuss in detail later in this article.

Assets	Liabilities	Purpose	Credit structure
High-yield loans	Fixed/floating rate	Arbitrage	Cash flow
High-grade structured finance	PIK/non-PIK	Balance sheet	Market value
Mezzanine structured finance	Guaranteed/unenhanced		Origination
Capital notes		Short term/long term	
High-yield bonds		Delayed draw/revolving	
Emerging market debt			
Synthetic assets		Unfunded super senior	

Parties to a CDO

A CDO is a distinct legal entity, usually incorporated in the Cayman Islands. Its liabilities are called CDOs, so one might hear the seemingly circular phrase ‘the CDO issues CDOs.’ Offshore incorporation enables the CDO to more easily sell its obligations to United States and international investors and escape taxation at the corporate entity level. When a CDO is located outside the U.S., it will typically also have a Delaware co-issuer. This entity has a passive role, but its existence in the structure allows CDO obligations to be more easily sold to U.S. insurance companies.

Asset managers (or collateral managers) select the initial portfolio of an arbitrage CDO and manage it according to prescribed guidelines contained in the CDO’s indenture. Sometimes an asset manager is used in a balance sheet CDO of distressed assets to handle their workout or sale. A variety of firms offer CDO asset management services including hedge fund managers, mutual fund managers, and firms that specialize exclusively in CDO management.

Asset sellers supply the portfolio for a balance sheet CDO and typically retain its equity. In cash CDOs, the assets involved are usually smaller-sized loans extended to smaller-sized borrowers. In the U.S., these are called ‘middle market’ loans and in Europe they are called ‘small and medium enterprise’ (SME) loans.

Investment bankers and structurers work with the asset manager or asset seller to bring the CDO to fruition. They set up corporate entities, shepherd the CDO through the debt rating process, place the CDO’s debt and equity with investors, and handle other organizational details. A big part of this job involves structuring the CDO’s liabilities: their size and ratings, the cash diversion features of the structure, and, of course, debt tranche coupons. To obtain the cheapest funding cost for the CDO, the structurer must know when to use short-term debt or insured debt or senior/junior AAA notes, to name just a few structural options. Another part of the structurer’s job is to negotiate an acceptable set of eligible assets for the CDO. These tasks obviously involve working with and balancing the desires of the asset manager or seller, different debt and equity investors, and rating agencies.

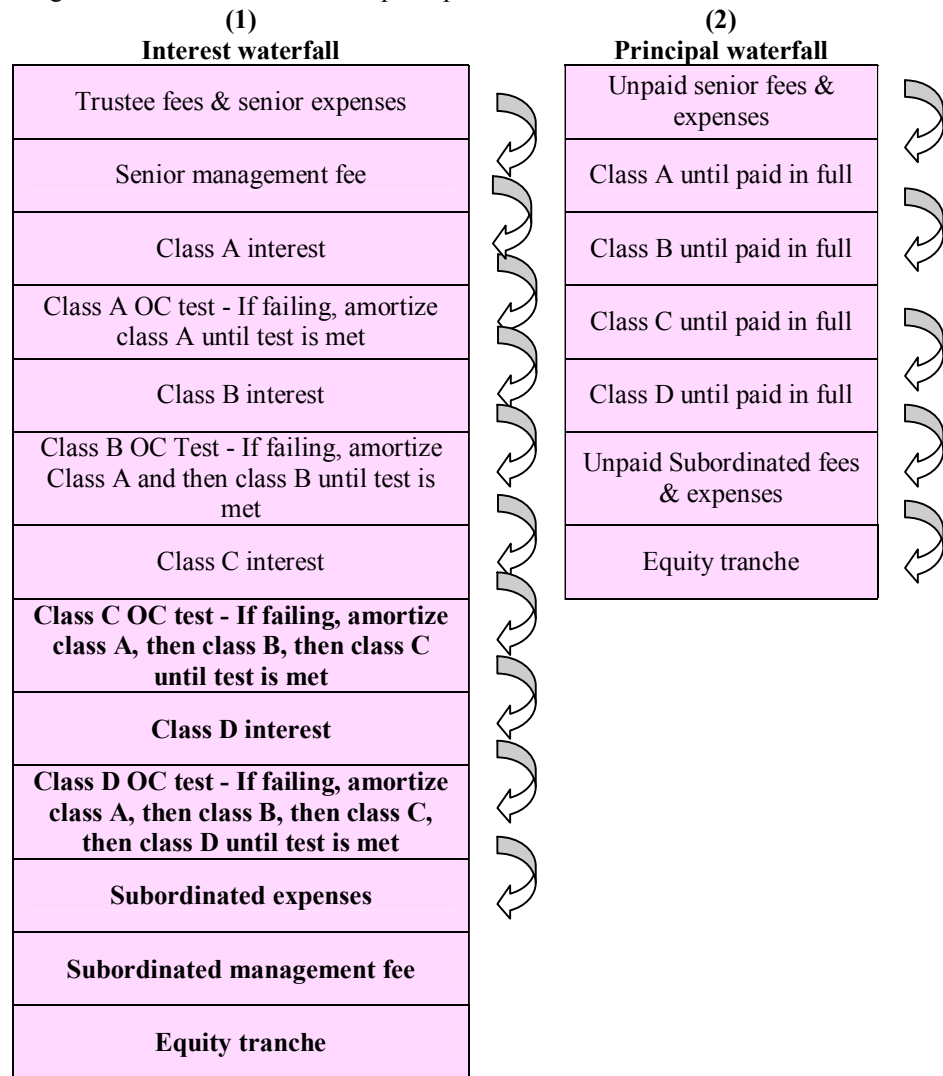
Monoline bond insurers or financial guarantors typically only guarantee the senior-most tranche in a CDO. Often, insurance is used when a CDO invests in newer asset types or is managed by a new CDO manager.

Rating agencies approve the legal and credit structure of the CDO, perform due diligence on the asset manager and the trustee, and rate the various seniorities of debt issued by the CDO. Usually two or three of the major rating agencies (Moody's, S&P, and Fitch) rate the CDO's debt. DBRS is a recent entrant in CDO ratings and A. M. Best has rated CDOs backed by insurance company trust preferred securities. Trustees hold the CDO's assets for the benefit of debt and equity holders, enforce the terms of the CDO indenture, monitor and report upon collateral performance, and disburse cash to debt and equity investors according to set rules. As such, their role also encompasses that of collateral custodian and CDO paying agent.

Cash flow CDOs

As explained earlier, arbitrage CDOs are categorized as either cash flow or market value transactions. The objective of the asset manager in a cash flow transaction is to generate cash flow for CDO tranches without the active trading of collateral. Because the cash flows from the structure are designed to accomplish the objective for each tranche, restrictions are imposed on the asset manager. The asset manager is limited in his or her authority to buy and sell bonds. The conditions for disposing of issues held are specified and are usually driven by credit risk management. Also, in assembling the portfolio, the asset manager must meet certain requirements set forth by the rating agency or agencies that rate the deal. Below we review cash flow transactions. Specifically, we look at the distribution of the cash flows, restrictions imposed on the asset manager to protect the noteholders, and the key factors considered by rating agencies in rating tranches of a cash flow transaction.

Figure 3 - Interest cash flow and principal waterfall



Distribution of cash flows

In a cash flow transaction, the cash flows from income and principal are distributed according to rules set forth in the prospectus. The distribution of the cash flows is referred to as the 'waterfall.' We describe these rules below and will use a representative CDO to illustrate them².

² For a discussion of deals based by other types of collateral, see Chapters 3–9 in Lucas et al. (2006).

The representative CDO deal we will use is a U.S.\$300 million cash flow CDO with a typical cash flow structure. The deal consists of the following: U.S.\$260 million (87% of the deal) Aaa/AAA (Moody's/S&P) floating rate tranche; U.S.\$27 million (U.S.\$7 million fixed rate plus U.S.\$20 million floating rate) Class B notes, rated A3 by Moody's; U.S.\$5 million (fixed rate) Class C notes, rated Ba2 by Moody's; and U.S.\$8 million in equity (called preference shares in this deal).

The collateral for this deal consists primarily of investment-grade, CMBS, ABS, REIT, and RMBS; 90% of which must be rated at least "Baa3" by Moody's or BBB- by S&P.³ The asset manager is a well respected money management firm. Column (1) of Figure 3 illustrates the priority of interest distributions among different classes for our sample deal. Interest payments are allocated first to high priority deal expenses such as fees, taxes, and registration, as well as monies owed to the asset manager and hedge counterparties. After these are satisfied, investors are paid in a fairly straightforward manner, with the more senior bonds paid off first, followed by the subordinate bonds, and then the equity classes.

Note the important role in the waterfall played by what is referred to as the coverage tests. We will explain these shortly. They are important because before any payments are made on class B or class C bonds, coverage tests are run to ensure that the deal is performing within guidelines. If that is not the case, consequences to the equity holders are severe. Note from column (1) that if the class A coverage tests are violated, then excess interest on the portfolio goes to pay down principal on the class A notes, and cash flows will be diverted from all other classes to do so. If the portfolio violates the class B coverage tests, then interest will be diverted from class C and the equity tranche to pay down first principal on class A, or, if class A is retired, class B principal.

Column (2) shows the simple principal cash flows for this deal. Principal is paid down purely in class order. Any remaining collateral principal from overcollateralization gets passed on to the equity piece.

Restrictions on management: safety nets

Note holders have two major protections provided in the form of tests, namely coverage and quality. Coverage tests are designed to protect noteholders against a deterioration of the existing portfolio. There are actually two categories of tests - overcollateralization and interest coverage. The overcollateralization, or O/C, ratio for a tranche is found by computing the ratio of the principal balance of the collateral portfolio over the principal balance of that tranche and all tranches senior to it. That is,

O/C ratio for a tranche = $\frac{\text{Principal (par) value of collateral portfolio}}{\text{Principal of tranche} + \text{principal of all tranches senior to it}}$

The higher the ratio, the greater protection there is for the note holders. Note that the O/C ratio is based on the principal or par value of the assets. (Hence, an O/C test is also referred to as a par value test.) An O/C ratio is computed for specified tranches subject to the O/C test. The O/C test for a tranche involves comparing the tranche's O/C ratio to the tranche's required minimum ratio as specified in the CDO's guidelines. The required minimum ratio is referred to as the overcollateralization trigger. The O/C test for a tranche is passed if the O/C ratio is greater than or equal to its respective O/C trigger. In our representative CDO, there are two rated tranches subject to the O/C test - classes A and B. Therefore two O/C ratios are computed for this deal.

The interest coverage or I/C ratio for a tranche is the ratio of scheduled interest due on the underlying collateral portfolio to scheduled interest to be paid to that tranche and all tranches senior to it. That is,

I/C ratio for a tranche = $\frac{\text{Scheduled interest due on underlying collateral portfolio}}{\text{Scheduled interest to that tranche} + \text{Scheduled interest to all tranches senior}}$

The higher the I/C ratio, the greater the protection. An I/C ratio is computed for specified tranches subject to the interest coverage test. The I/C test for a tranche involves comparing the tranche's I/C ratio to the tranche's interest coverage trigger (i.e., the required minimum ratio as specified in the guidelines). The I/C

³ At the time of purchase, the collateral corresponded, on average, to a Baa2 rating.

test for a tranche is passed if the computed I/C ratio is greater than or equal to its respective I/C trigger. For our representative deal, classes A and B are subject to the I/C test.

We showed in Figure 3 that if the class A coverage tests are violated, the excess interest on the portfolio goes to pay down principal on the class A notes, and cash flows will be diverted from the other classes to do so. In this case, what happens to the class B notes? They have a pay-in-kind or PIK feature. This is a clearly disclosed structural feature in most CDOs where, instead of paying a current coupon, the par value of the bond is increased by the appropriate amount. So if a U.S.\$5 coupon is missed, the par value increases, say from U.S.\$100 to U.S.\$105. The next coupon is calculated based on the larger U.S.\$105 par amount. The PIK concept originated in the high-yield market, and was employed for companies whose future cash flows were uncertain. The option to pay-in-kind was designed to help these issuers conserve scarce cash or even avoid default. It was imported to the CDO market as a structural feature to enhance the more senior classes.

After the tranches of a CDO deal are rated, the rating agencies are concerned that the composition of the collateral portfolio may be adversely altered by the asset manager over time. Tests are imposed to prevent the asset manager from trading assets so as to result in a deterioration of the quality of the portfolio and are referred to as quality tests. These tests deal with maturity restrictions, the degree of diversification, and credit ratings of the assets in the collateral portfolio.

Credit ratings

There are three key inputs to cash flow CDO ratings: collateral diversification, likelihood of default, and recovery rates. While each rating agency uses a slightly different methodology, they reach similar conclusions. For example, Moody's uses the same objective process for developing liability structures regardless of the type of collateral. Moody's determines losses on each tranche under different default scenarios, and probability-weights those results. A discussion of the methodology used by the rating agencies is beyond the scope of this article. The interested reader is referred to Lucas et al. (2006) and the references therein for more information about the rating process.

Synthetic CDOs

The development of the credit derivatives market, particularly the credit default swap (CDS) market, fostered the development of the synthetic CDO. A synthetic CDO does not actually own the portfolio of assets on which it bears credit risk. Instead, it gains credit exposure by selling protection via CDSs. In turn, the synthetic CDO buys protection from investors via the tranches it issues. These tranches are responsible for credit losses in the reference portfolio that rise above a particular attachment point; each tranche's liability ends at a particular detachment or exhaustion point.

The first synthetic CDOs were initiated by U.S. and European banks in 1997 for balance sheet purposes. The motivation was to achieve regulatory capital relief without forcing the banks to sell loans they had originated. Instead, synthetic balance sheet CDOs allowed sponsoring banks to purchase credit protection on loans they continued to own, which reduced their credit risk and required capital. A synthetic CDO's ability to de-link the credit risk of an asset from its ownership affords banks substantial flexibility in balance sheet management.

As explained earlier, there are balance sheet CDOs and arbitrage CDOs. The same is true for the synthetic variety. While the first synthetic CDOs were of the balance sheet type, synthetic arbitrage CDOs got under way in earnest in 2000, but exploded the next year to about U.S.\$60 billion, including both funded and unfunded tranches. By 2005, synthetic arbitrage issuance was in excess of U.S.\$500 billion, if one includes the standard tranches of CDS indices. Synthetic arbitrage CDOs come in the following forms:

- **Full-capital structure CDOs**, which are the oldest, include a full complement of tranches from super senior to equity. These CDOs have either static reference portfolios or a manager who actively trades the underlying portfolio of CDSs.
- **Single-tranche CDOs** are newer, and are made possible by dealers' faith in their ability to hedge the risk of a CDO tranche through single-name CDS. Single tranche CDOs often allow CDO investors to substitute credits and amend other terms over the course of the CDOs' life.

Below we outline the features of the first types of synthetic arbitrage CDOs since they are more typical of CDOs [Lucas et al. (2006)]. A survey of the market by the European Central Bank (2004) in 2003 found that the “growth in trading of CDSs and synthetic CDO tranches, as well as the emergence of single-tranche CDOs and CDOs of CDOs, were seen to be the most dynamic aspects of the market in 2003. However, single-name CDSs continued to be the most important instruments for hedging individual exposures.”

Full capital structure synthetic CDOs

Full capital structure synthetic arbitrage CDOs come in many forms. The best way to explain the differences is to focus on two CDO types that represent the range of structural variations. The first has a static reference portfolio of 100 investment-grade names which we will refer to as CDO #1. The second, which we refer to as CDO #2, is managed with roughly the same underlying credit quality as CDO #1. Salient features of each of the two CDOs, including capital structures and spreads, are shown in Figure 4.

Figure 4 - Synthetic CDO spectrum

		CDO #1		CDO #2	
	Reference pool amount	U.S.\$1billion		U.S.\$1billion	
	Number of reference entities	100		100	
	Management	Static		Managed	
Class	Capital structure	Amount (U.S.\$ million)	Spread (bps)	Amount (U.S.\$ million)	Spread (bps)
	Super senior	870	6	890	6
Class A	AAA	50	50	30	48
Class B	AA	30	90	30	85
Class C	A	5	175	14	125
Class D	BBB	15	400	20	275
Class E	Equity	30		16	
	Coverage test	none		[Cash collateral] ÷ [Class A+B+C+D] >111%	
	Final maturity	5 years		5 years	
	Write-down provisions	Immediately upon default		At end of life of deal	
	Swap settlement	Cash		Physical	

Synthetic arbitrage CDOs can be done as static pools or as managed transactions. The advantage to static CDOs is that the investor can examine the proposed portfolio before closing and know that the portfolio will not change. The investors can ask that certain credits be removed from the portfolio or can decide not to invest in the CDO at all. There are also no ongoing management fees. The disadvantage to a static deal becomes apparent if an underlying credit begins to deteriorate, because no mechanism exists for the CDO to rid itself of the problem credit, which remains in the portfolio and may continue to erode.

First, let us look at the capital structure. Observe from Figure 4 that static synthetic CDO #1 has much higher equity (3% versus 1.6%) and no coverage tests. The higher equity percentage is a reflection of the absence of coverage tests. The key to understanding the smaller size of the equity tranche in CDO #2 is the structure of its interest waterfall. Initially, the trustee, the senior default swap, and the senior advisory fees are all paid out of the available collateral interest and CDS premium receipts. Next, interest is paid to the various note holders, from class A to class D, in order of their seniority. Then, a coverage test is conducted. If the coverage test is passed, remaining funds are used to pay the subordinate advisory fee, and the residual cash flow goes to equity holders. But, if the coverage test is failed, cash flow is trapped in a reserve account. Cash in the CDO’s reserve account is factored into the coverage test, helping the CDO to meet its required ratio. If the coverage test comes back into compliance, future excess cash flows can be released to the subordinate advisory fee and to equity holders. At the CDO’s maturity, cash in the reserve account becomes part of the principal waterfall and helps to pay off tranches in order of their seniority.

Despite the different proportions of equity in the two CDOs, the credit protection enjoyed by rated tranches in each CDO is about equal. This is so because credit protection is measured not only by the amount of subordination below a tranche, but also by how high credit losses can be on the underlying portfolio before the tranche's cash flows are affected. In this case, the rated tranches from both CDOs can survive approximately the same level of default losses; the lower amount of equity in CDO #2 is compensated for by its coverage test and cash trap mechanism.

Now, let us compare the equity cash flows and the timing of write downs. In CDO #1, equity is paid a fixed coupon, and thus has no claim on the residual cash flows of the CDO. Equity holders receive interest only on the outstanding equity balance. In CDO #2, the equity holders have a claim on all residual cash flows of the CDO. The timing of write-downs is very different for the two CDOs. In CDO #1, there is a cash settlement whenever a credit event occurs. Thus, when a credit event occurs, (1) that credit is removed from the pool, (2) the CDO pays default losses, and (3) the lowest tranche in the CDO is written down by the amount of default losses. If equity is written down to zero further losses are written down against the next most junior tranche and so on, moving up the CDO's capital structure. By contrast, when a credit event occurs in CDO #2 physical settlement occurs. The security can be sold, but there is no write-down until the end of the deal. At that time, the principal cash flows go through the principal waterfall, paying off first the class A note holders and then those in class B, C, and D. After note holders are paid, remaining funds go to the equity holders.

Because of these structural differences and investor taste, the BBB and lower classes in CDO #1 generally sell at a wider spread than they do in CDO #2. In Figure 4, the BBB tranche is shown at LIBOR + 400 in CDO #1; it is only LIBOR + 275 in CDO #2. In CDO #1, the write-downs are immediate, and there is no way to recoup losses by better performance later in the deal's life. Moreover, if any of the classes (including the equity) incur losses, their interest is reduced accordingly.

Single-tranche CDOs

Single-tranche CDOs are notable for what they are not: the placement of a complete capital structure complement of tranches, from equity to super senior. Instead, a protection seller enters into one specific CDO tranche with a CDS dealer in isolation. Protection sellers can choose the portfolio they wish to reference, as well as the attachment and detachment points of the tranche they wish to sell protection on. These factors will imply a price for that protection. Alternatively, the protection seller can start with a premium in mind and then negotiate other terms to create a transaction furnishing that premium. Because there are only two parties to the transaction, execution can be quicker than it would be with a full-capital structure CDO encompassing many constituencies.

The single-tranche synthetic CDO can also provide flexibility over its life. As reference credits in the underlying portfolio either erode or improve in credit quality, the value of the CDO changes. If, for example, reference credits have all been severely downgraded the value of credit protection increases because it is more likely that there will be default losses. A protection seller of such a single-tranche CDO might be willing to pay a fee to terminate the CDO early rather than be exposed to default losses later. Single-tranche CDO investors can go back to the original dealer to reverse out of a trade, or they can reverse the trade with another dealer. If investors have sold protection to dealer A, for example, they can buy protection on the exact terms from dealer B. This would leave them with offsetting trades. In many cases, dealers will allow the investor to step out of the trades completely, and the two dealers will face each other directly.

Many single-tranche synthetic CDOs have a feature where terms of the CDO are adjustable over its life. Recall the example where underlying credits have severely deteriorated. Protection sellers might be allowed to replace a soured credit with a better one for a fee. Alternatively, instead of paying a fee, the terms of the CDO tranche might change. In exchange for getting rid of a troubled underlying credit, the attachment point might be decreased, the detachment point might be increased, or the premium might decrease.

Concerns with new CRT vehicles

As with any new complex financial product introduced by banks, there are regulatory and supervisory concerns. The introduction of new CRT vehicles, such as cash CDOs and credit derivatives that are employed to create synthetic CDOs, has elicited the same cautious response from overseers of the global banking system. As explained below, a good number of these concerns are the same as those identified for derivatives, such as interest rate and equity derivatives, and securitized products, such as collateralized mortgage obligations.

Five studies have identified regulatory and supervisory concerns with CRT vehicles, such as credit derivatives and CDOs. The first is a study by the Financial Stability Forum of the Joint Forum [Joint Forum (2003)]. The Joint Forum consists of the Basel Committee on Banking Supervision, the International Organization of Securities Commissions, and the International Association of Insurance Supervisors. The second study was conducted by the European Central Bank [ECB (2004)], which was a market survey based on interviews with more than 100 banks from 15 European Union banks, five large internationally active non-EU banks, and securities houses operating in London. The last three studies are by rating agencies, two by Fitch Ratings (2003, 2004) and the one by Standard & Poor's (2005). From the five studies, four general issues were identified. We discuss each of them below.

Issue 1 – ‘Clean’ risk transfer

As new vehicles for CRT have developed, increasing the market liquidity for corporate debt such as bonds and bank loans, the nature of the risks faced by market participants has changed in several ways. At one time, the focus of an investor in a corporate debt was on the ability of the corporation to meet its obligations. The issue with new CRTs is whether there is a ‘clean’ transfer of credit risk.

The concerns with credit derivatives and, therefore, synthetic CDOs being used as CRT vehicles are threefold. Firstly, there is a concern with counterparty risk - the failure of the counterparty selling credit protection would result in the buyer of credit protection maintaining the credit exposure that it thought it had eliminated. With respect to this concern, studies have noted that there are standard procedures available in risk management that can be employed to reduce counterparty risk. These risk management tools are equally applicable to over-the-counter derivatives used to manage interest rate and currency risk by regulated financial entities.

Secondly, while the development of standard documentation for credit derivative trades by the International Swaps and Derivatives Association (ISDA) fostered the growth of that market, there remains a concern with legal risks that may arise from a transaction. Legal risk is the risk that a credit derivative contract will not be enforceable or legally binding on the counterparty to the trade or may contain ambiguous provisions that result in a failure of the contract to fulfill its intent. The most prominent example is what the credit derivatives market faced early in its life dealing with the issue of whether a credit event has occurred and, in particular, controversial credit events such as restructuring. The 2004 survey of financial institutions by Fitch investigated the frequency of disputed credit events and found that about 14% of the credit events captured in the survey were reported to involve some form of dispute. As for the resolution of those disputes, Fitch found that at the time the vast majority had been or were being resolved without the involvement of the court system. Another example of legal risk is that of whether the counterparty has the authority to enter into a credit derivative transaction. This is not unique to credit derivatives, but has been the subject of litigation in other derivative markets. For example, interest rates swaps between various dealers and local U.K. authorities were void in 1991 because it was ruled the later did not have the legal authority to enter into the contracts in the first place.

Issue 2 - Risk of failure of market participants to understand associated risk

With the development of any market vehicle there is the concern that market participants will not understand the associated risks. For example, there is evidence in the interest rate swap market of corporate entities allegedly failing to understand these risks, probably the two most well-known legal cases being that of Gibson Greetings and Proctor & Gamble. The same is true for collateralized mortgage obligations. Both of these instruments have been important financial innovations, but there were users/investors who experienced financial difficulties/fiascos because product innovation may have run far ahead of product education.

In the case of a financial institution that seeks to make a market in the new CRT vehicles, there is a concern that in selling more complex products, such as synthetic CDOs, they may not be properly hedging their position and therefore increasing the institution's risk. (While we have not discussed the pricing of synthetic CDOs, it fair to say that these instruments are not simple to price.) There is modeling risk. For example, in the case of a single-tranche CDOs, the dealer will have an imbalanced position on CDSs and will try to hedge that position by delta hedging [Lucas (2007)]. The risk, of course, is that the dealer has not hedged properly.

With respect to this issue, the recommendations of the report of the Joint Forum concentrated on the need for market participants to continue "improving risk management capabilities and for supervisors and regulators to continue improving their understanding of the associated issues." Given this focus, the report sets forth recommendations for market participants and supervisors in three areas: risk management, disclosure, and supervisory approaches, with particular emphasis on reporting and disclosure.

Issue 3 - Potentially high concentration of risk

A CRT vehicle can result in either the transfer of the credit risk from one bank to another or from a bank to a non-bank entity. Within the banking system, the concern is whether there has become too much concentration of credit risk. For credit risk transferred out of the banking system, there is the concern with the extent to which credit risk is being transferred to non-banks, such as monoline or multi-line insurance companies and hedge funds. The overall concern is the impact on the financial system resulting from a failure of one or a few major participants in the CRT market.

The two studies by Fitch Rating (2003, 2004) reported the number of banks (North American and European) and insurance companies active in the CRT market and the relative size of each. In its 2003 market survey, Fitch surveyed about 200 financial institutions (banks, securities firms, and insurance companies), focusing on those it classified as protection sellers. Fitch found that through credit derivatives the global banking system transferred U.S.\$229 billion of credit risk outside of the banking system. Most of this was to the insurance industry (monoline insurance companies/financial guarantors, reinsurance, and insurance companies). The insurance industry itself is the largest seller of credit protection. Fitch estimated that the insurance industry sold U.S.\$381 billion of net credit protection (i.e., credit protection sold less credit protection purchased). Of that amount, insurance companies provided U.S.\$303 in credit protection via the credit derivatives market and the balance, U.S.\$78 billion in credit protection by their participation in the cash CDO market. Within the insurance industry, the largest seller of credit protection is financial guarantors, insuring the senior tranches in synthetic CDO deals. In the opinion of Fitch, "the expansion of the sector in credit derivatives market has generally been well managed and consistent with the industry's rating." Fitch concludes that bank buying of credit protection via credit derivatives "has significantly increased liquidity in the secondary credit market and allowed the efficient transfer of risk to other sectors that lack the ability to originate credit." There was a relatively high concentration of credit protection buying by large, more sophisticated banks. Smaller and regional banks were net sellers of credit protection despite banks being net buyers of credit protection in the aggregate.

With respect to counterparty concentration, Fitch reported that the market is concentrated among the top 10 global banks and broker-dealers. While having investment-grade ratings, the risk is that the withdrawal of one or more of these firms from the market for financial or strategic reasons could undermine the confidence in the CRT market.

In its 2003 survey, Fitch attempted to collect information on hedge fund activities by writing to the 50 largest hedge funds in the world. None responded. In its 2004 survey, Fitch included questions for the major intermediaries as to their dealings with hedge funds. Fitch found that hedge funds represented between 20% to 30% of their overall CDS index trading. Ultimately, counterparty risk exposure to hedge funds depends on the extent of the collateralization of the trades. While most of the intermediaries in the survey responded that their positions with hedge funds were fully collateralized, some stated that it was less than 100% collateralized.

Fitch also found that there is high concentration in the corporations that are the reference obligations in a CDS. Settlement problems could occur if there is a credit event for one of these references, leading to a

major market disruption. Moreover, because of the higher correlation of default that exists for counterparties and corporate references in the CRT market, in comparison to other derivative markets, there is a concern with the market facing multiple defaults. The ECB report concluded that the potential for disruption of the new CRT vehicles was generally small.

Issue 4 - Adverse selection

The ability of originators to transfer credit risk via credit derivatives, CDOs, or securitization has raised concerns that a lending culture based on origination volume rather than prudent lending practices may be inadvertently adopted by banks. This is a concern about securitization in general as noted in Fabozzi and Kothari (2007).

Conclusion

The two most recent introductions into the CRT market, which have made it possible to transfer large amounts of corporate credit risk exposure among banks as well as from the financial sector to the non-financial sector, are credit derivatives, in particular CDS, and CDOs. One variety of the CDO is the synthetic CDO, in which credit risk exposure is transferred via CDS rather than the transfer of ownership of corporate debt obligations. There are concerns raised by regulators regarding CDOs and CDSs, some of these being the usual concerns with the introduction of any new financial innovation. The report by the European Central Bank (ECB (2004)] concluded the following regarding these new CRT vehicles: "The report's overall assessment of trends in this market is positive. Improvements in the ability of banks and other financial institutions to diversify and hedge their credit risks are helping the financial system to become more efficient and stable."

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