

# CBO, CLO, CDO

## A PRACTICAL GUIDE FOR INVESTORS

*This guide is an introduction to CDO, presented from the investor's point of view. Only terms and concepts which are specific to CDO are discussed in this article. Terms relating to securitisation in general are in italics when they appear for the first time. They are defined in a "Practical guide for ABS" (SG, ABS RESEARCH 15/05/2000).*

### SUMMARY

- The CDO market has been developing rapidly since 1996, reaching an issuance volume of USD 100bn in 1999, i.e. approximately twice the securitisation volume of US credit cards, the most mature ABS market segment.

#### ■ Part I : How analyse a CDO ?

The main difficulty, for an investor used to standard US credit card type transactions or European MBS transactions, is to assess the value of a CDO, without spending much more time than would be required for analysing a traditional ABS.

This is actually quite simple, if before embarking on a detailed study, one takes the time to ascertain which type of CDO one is dealing with. This article proposes a division of CDO into six benchmark structures :

#### ■ Part II : Balance sheet CDO

The objective of the transaction is the optimisation of the seller's balance sheet. In most of the cases, it is a financial institution which seeks to deconsolidate a debt portfolio : loans to companies, securities portfolio, etc.

- ◆ Structure 1 : Traditional CDO
- ◆ Structure 2 : Synthetic CDO
- ◆ Structure 3 : Leveraged CDO

#### ■ Part III : Arbitrage CDO

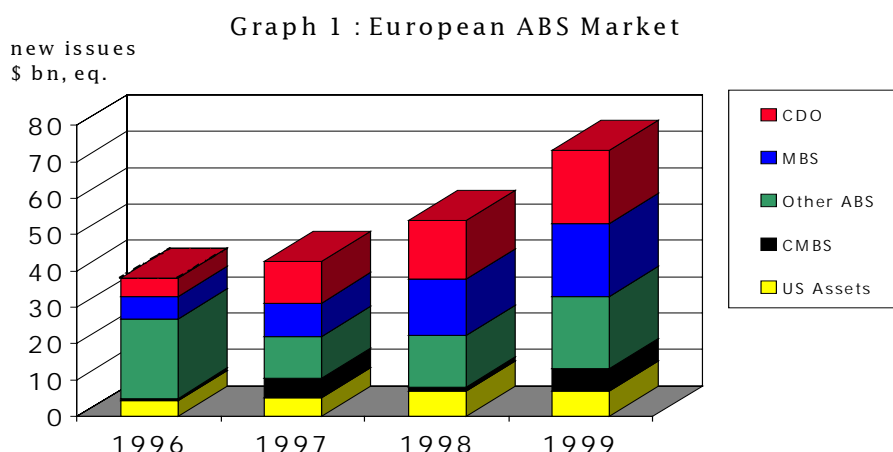
The objective of the transaction is to create an arbitrage between the price of purchase of a collateral and the cost of refinancing it after tranching it into various risk profiles, more suitable for investors.

- ◆ Structure 1 : Static Cashflow CDO
- ◆ Structure 2 : Market value CDO
- ◆ Structure 3 : Active Management CDO

#### ■ Part IV : Why purchase CDO ?

More and more investors are concentrating their research on this type of transaction. This trend, boosted in Europe by the growth in credit derivatives, can be explained by the following : Strength and Stability, Diversification, Standardisation, Liquidity, Yield, Transparency.

# CBO, CLO, CDO : A PRACTICAL GUIDE FOR INVESTORS



The CDO market has been developing rapidly since 1996, reaching an issuance volume of USD 100bn in 1999, i.e. approximately twice the securitisation volume of US *credit cards*, the most mature market segment.

MBS (*Mortgage Backed Securities*) and CDO are the 2 categories of ABS (*Asset Backed Securities*) which are growing fastest in Europe (see *Graph 1*). MBS are very standardised transactions which are very easy to compare with one another. However, CDO are harder to understand as there are many different structures, types of underlying assets and management rules.

This document provides six reference structures for CDO : three “balance sheet” structures and three “arbitrage” structures.

## How analyse a CDO ?

CDO stands for “Collateralized Debt Obligation”. A CDO is an ABS-type securitisation where the underlying portfolio is comprised of securities (a CBO or “Collateralized Bond Obligation”) or loans ( a CLO or “Collateralized Loan Obligation”) or possibly a mixture of securities and loans.

A CDO typically comprises of a limited number of commercial borrowers (from 20 to 500), as opposed to “traditional” ABS portfolios of between 500 and 100,000 individual debtors (mortgages and retail trade receivables). The majority of CDO assets are generated through the banking system : bond portfolios or commercial loans where the borrowers are large companies.

In terms of risk analysis, when there are a limited number of debtors, credit rating agencies carry out an issue-by-issue study of the portfolio, as opposed to the purely statistical analysis of traditional securitisations. This implies that the credit rating agencies estimate each underlying debtor’s credit rating. This analysis is greatly facilitated if some of the underlying credits are already rated.

## 2 main categories

CDO can be broken down into 2 main types of transaction, depending whether the transaction is to enhance the seller’s balance sheet or carry out an arbitrage transaction :

**Balance sheet CDO** : the seller is a financial institution which seeks to deconsolidate a debt portfolio : loans to companies, securities portfolio, etc.

This type of transaction is developing very fast, mainly in banks seeking to reduce their regulatory capital to meet growing ROE (Return On Equity) requirements. This transaction involves transferring the risks traditionally taken by the banking system to the final investors.

As in the majority of cases, portfolios sold are loan-secured portfolios, the term CLO is often associated with balance sheet management CDO, (even though balance sheet management CBO also exist).

**Arbitrage CDO.** The aim of the transaction is no longer to pay up regulatory capital, but to carry out a market arbitrage. The idea is to buy a portfolio which will act as collateral for a securitisation, possibly with tranches for the various levels of risk, more suited to the profiles sought by investors, so that the cost of refinancing the portfolio is lower than the asset purchase price.

By its very nature, the underlying asset of an arbitrage CDO is an asset which has been purchased and is therefore a negotiable asset. Often these are securities and therefore the term CBO is often associated with arbitrage CDO (even though it is possible to have arbitrage CLO).

Balance sheet management CDO are generally sizeable (USD 2bn) as the deconsolidated portfolio must be large enough to have an impact on the ROE of the selling bank. Conversely, arbitrage CDO are often private transactions associated with portfolios comprising several dozen illiquid lines with a total volume of approximately USD 150m.

Therefore, even though there are many transactions, arbitrage CDO account for a much lower market share in liabilities than balance sheet management CDO. This difference is even more marked in Europe where many banks issue balance sheet management CDO, while the majority of arbitrage CDO consist of US assets (High-Yield for example).

## How to find one's feet?

The main difficulty, for an investor used to standard US credit card type transactions or European MBS transactions, is to assess the value of a CDO, without spending much more time than would be required for analysing a traditional ABS.

This is actually quite simple, if before embarking on a detailed study, one takes the time to ascertain which type of CDO one is dealing with. In this document, we will divide CDO into six separate structures : in Part II of the document, balance sheet CDO will be broken down into three classic structures and in Part III, arbitrage CDO will be broken down into three classic structures.

After this preparatory work, it is simpler to make a more traditional type of analysis of securitisations. The article "Investor's guide to ABSs" (SG, October 98) provides a five-step breakdown : *underlying assets, credit enhancement, cashflow mechanics, legal structure and links with the seller.*



## Balance sheet CDO

This type of CDO, also known as "Bank CDO" or "Bank CLO" is by far the most common in Europe. There are 3 main classic structures : "traditional Master Trust", "Synthetic" and "Leveraged".

### Structure 1 : "Traditional CLO"

This structure was used for the first time by Nations Bank in 1997, then by LTCB (PLATINUM), IBJ (PRIME), Sumitomo (WINGS) BankBoston (BANKBOSTON), Bank of Montreal (LAKESHORE), Sanwa (EXCELSIOR), SG (POLARIS), and more recently by Crédit Lyonnais (LEAF) and Paribas (LIBERTE). All of these structures are very similar as they constitute the most direct application of the securitisation principle : the bank sells a homogenous commercial loan portfolio to a SPV, refinanced by the issuance of the most standard securities possible to attract the maximum number of investors.

The SPV is structured as a Master-Trust in order to enable the bank to sell another subsequent portfolio whilst keeping the same structure.

**Underlying assets.** They comprise 200 to 400 loans (often syndicated) to US companies with a total volume of USD 1 to 4bn. As the credit rating agencies carry out an issue-by-issue analysis of the debtors, at the same time as their statistical analysis, most of the debtors must already be rated (or they must at least benefit from a *scoring* system of the seller).

As most rated loans are on the books of the US branches of major banks, almost all transactions involve portfolios of US syndicated loans with Average Ratings ranging from BB to BBB, with a *Diversity Score* of 50 to 70.

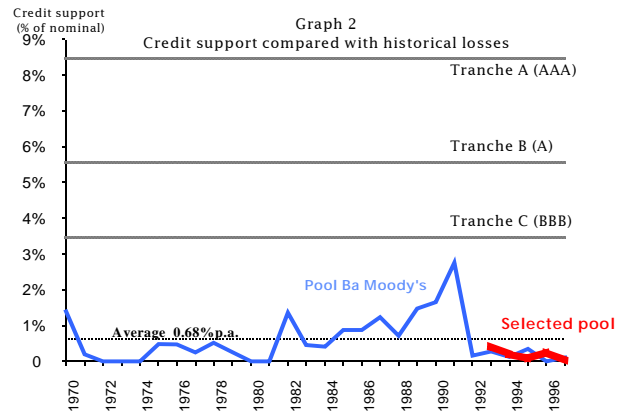
If the transaction entails a *Reinvestment Period*, the addition of further loans in the pool is controlled by continual monitoring of the overall quality of the portfolio : Average Rating and minimum Diversity Score. There are also eligibility criteria for each loan: minimum rating : B, maximum concentration per debtor : 2% and per business sector: 8%.

**Credit support.** These transactions have two constraints : minimising the overall cost of the securities issued, and minimising the size of the *subordinated* tranche kept by the seller. However, as the underlying assets are similar, all the transactions have more or less the same refinancing structure : 92% tranche AAA, 3% tranche A, 1.5% tranche BBB, 1.5% tranche BB, 1% subordinated tranche, and finally 1% cash deposit by the seller, subordinated to all the other tranches called *Cash Collateral Account (CCA)*. Each tranche benefits from credit support from all tranches with a lower rating. By keeping the subordinated tranche and the CCA, the seller keeps the first loss of portfolio up to 2%.

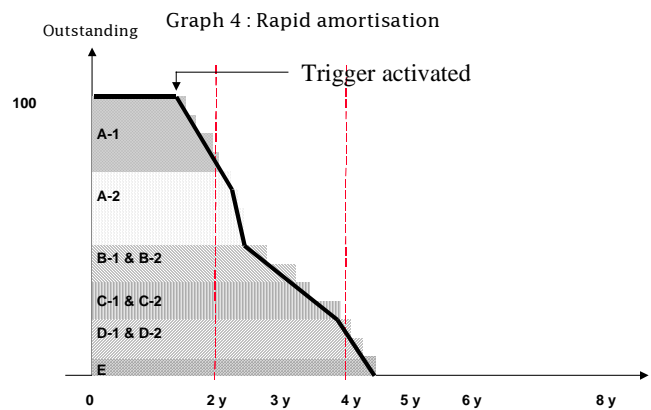
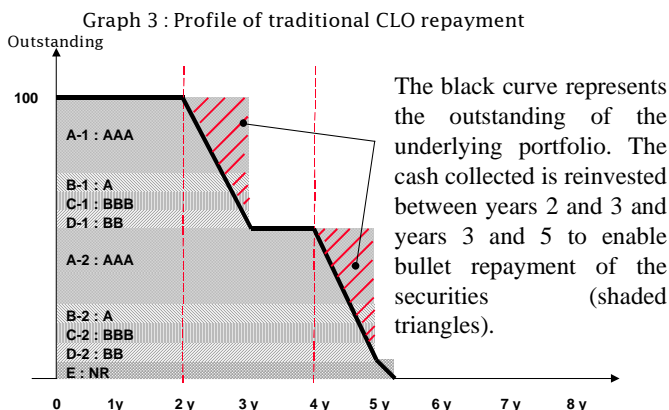
The second credit support is the *Excess Spread*, i.e. the difference between the cashflows collected by the SPV and the management costs and return of securities. Under normal circumstances, this amount of around 0.50% per year is paid to the bearers of the first risk, i.e. the selling bank. However, in the event of the quality of the structure worsening, the entire amount may be used to refund the securities issued, according to their seniority.

**Credit risk analysis (Graph 2).** The level of credit support for each tranche is comparable to data relating to historical net losses of the underlying portfolio. In general, the investor possesses data relating to net losses on the seller's portfolio for the past 4 or 5 years (red curve). It is possible to gain a broader view by obtaining past data from credit rating agencies. For example, the blue curve in Graph 2 represents the default rates after one year of a pool of Ba-rated securities, since 1970 (0.68% per year on average). These figures include all the existing Ba's, including for example LBOs (Leveraged Buy Out), responsible for the crisis in 90-91, and therefore greatly exaggerates the risk of the portfolio selected which does not contain this type of loan.

In this type of analysis, care should be taken to compare like for like : the majority of bank CLO use the drawing of revolving loans as assets. If the average duration of a drawing is one year, the performance of the portfolio is comparable to the default rate after one year. If the average duration of the portfolio loans was 5 years, it would be necessary to compare it with the cumulated default rates over 5 years (available from the rating agencies).



**Cashflow mechanics (Graph 3).** The selling bank retains the commercial relationship and continues to collect the cashflows on behalf of the SPV, and to select the new assets to be sold to the SPV, during the reinvestment period. The above is carried out within the clearly defined framework of the legal documentation relating to the transaction. In general, to reach the maximum number of investors, each *Class* is broken down into 2 maturities : 3-year (tranches A1, B1, C1 and D1) and 5-year (tranches A2, B2, C2 and D2). The structure includes a reinvestment period which finishes approximately one year before the repayment date. This means that the payments are reinvested at 100% between year 0 and 2. Between year 2 and 4, 50% of the payments are reinvested in eligible loans and the other 50% are stored in a cash account, while waiting to accumulate enough to repay the tranches in *bullet* payments. The reinvestment phase finishes completely in year 4 to accumulate the cash for a bullet repayment in year 5.



**Liquidation / Early amortisation.** Under normal circumstances, the *mezzanine* tranches B1, C1 and D1 are repaid at year 3. This is only possible if the 5-year tranches retain a sufficient level of overcollateralisation.

If one of the following three events (triggers) occurs : (i) the selling bank is no longer able to generate new loans, (ii) the rating of the selling bank, managing the cash, falls below A1/P1, (iii) the average quality of the portfolio falls below the pre-determined quality level (Average Rating and Diversity Score), the reinvestment period finishes and the collections in principle are allocated *pari passu* to the repayment of the senior AAA senior tranches (irrespective of their initial maturity) followed by the A, then BBB then BB and then subordinated tranches (*Graph 4*).

In the event of liquidation, the trustee organises the resale of the collateral for the benefit of the holders according to their level of subordination.

**Links with the seller.** In most cases the portfolio is fully sold to SPV (*true sale*). The CLO is “delinked”, i.e. there is no link with the seller : in that case, the structure is not affected by the seller’s credit quality. Some other transactions (Natwest’s ROSE and CSFB’s TRIANGLE) are known as “Linked” as the structure retains a link with the seller : to simplify the transfer, the bank sells the risk to the SPV via a sub-participation or via a Credit Linked Note which it issues; legally, the SPV only has recourse to the selling bank and is therefore exposed to a default by the latter. Therefore, “linked” structures have the disadvantage of exposing the holder of the senior tranche to a downgrading of the selling bank. The senior tranche of TRIANGLE, for example was downgraded from AA/Aa2 to AA-/Aa3 following the downgrading of the long-term rating of CSFB.

**Seller’s rationale.** The seller retains approximately 2% of the first risks by keeping the subordinated tranche and financing the CCA on his balance sheet but in return enjoys the Excess Spread of the structure. The maximum loss of the bank is limited to this amount.

For instance, let us take a bank with a portfolio of 100 million on its balance sheet and for which the average spread is  $\text{Libor}+1.00\%$ . Let us assume its cost is  $\text{Libor flat}$  : the gain is  $1.00\% \times 100$  million for a fixed capital of 8% of 100 million i.e. an ROE of  $1/8 = 0.125\%$ .

If this bank sells this portfolio to an SPV, the all-in refinancing level of the securitisation is no longer  $\text{Libor flat}$  but  $\text{Libor}+0.40\%$ . Under normal circumstances, the excess spread ( $1.00\%$  less  $0.40\%$ ) is paid to the selling bank, i.e. a gain of  $0.60\%$  on 100 millions. On its balance sheet, the bank keeps 2 million from the subordinated tranche deducted from its equity base, i.e. the regulatory capital to cover this position of 2 million is 2 million (and not 8% of 2 million, as on a traditional position). The new ROE is therefore  $0.6/2 = 30\%$ .

If the transaction has a volume of USD 4bn, these deals may have an impact on the overall level of the bank. The bank may continue its commercial activity with its “leading” corporate clients.

This type of transaction is also an opportunity to completely review the IT system and the scoring of the bank.

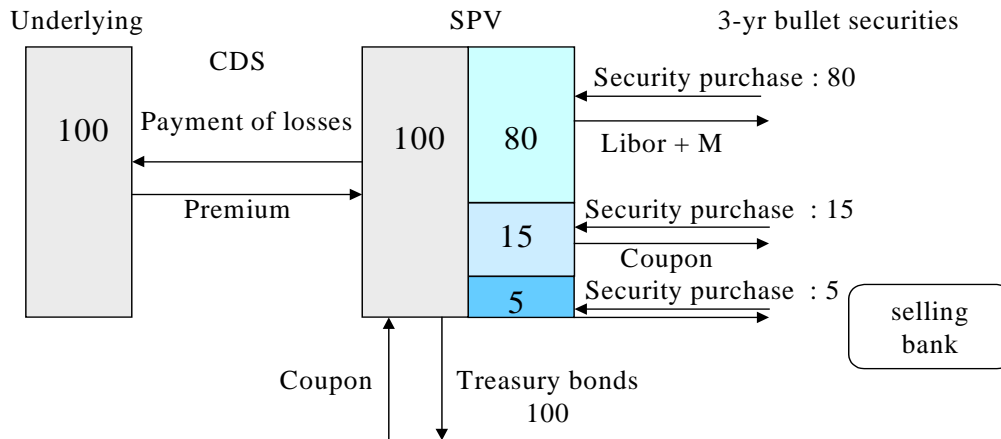
**The investor’s point of view.** For the investor, the traditional Master Trust structures have the advantage of being both standardised and transparent; the instruments sold are known (no off-balance sheet exposure), and liquidity is ensured through the size of the transaction.

On the other hand, beyond the default risk of the underlying asset, the investor is exposed to the risk of the bank’s performance : for example, the inability to generate new eligible loans, triggering early amortisation.

## Structure 2 : synthetic CDO

The main aim of banks which use CDO is to sell the risk to the markets to reduce their regulatory capital. However, they do not require cash or, if they do, they can finance themselves more economically by issuing securities in their own right. This is why “second generation” CLO were developed, in which the bank sells the risk of an underlying portfolio via a Credit Default Swap (CDS), without cash being transferred. The first transaction of this type was JP MORGAN’s BISTRO in 1998, other examples from among the numerous transactions which followed are Deutsche Bank’s CORE, BNP’s OLAN or more recently Hypovereinsbank’s GELDILUX.

Graph 5 : Synthetic CDO



**Structure.** An ad-hoc SPV issues securities with ratings from AAA to BB, such as the traditional CLO, but with a single maturity. Let us consider for example (*Graph 5*) an 80 million issue of senior securities, 15 million mezzanine securities and 5 million subordinated securities, all 3-year bullet. As in the traditional CLO, the subordinated securities are kept by the bank. The proceeds from this issuance are reinvested in risk-free assets (Treasury bonds) of the same maturity. At the same time, the SPV contracts a Credit Default Swap with the selling bank whose collateral is the underlying portfolio with a value of 100 million. The SPV thereby buys the risk from the bank and receives a premium and, in return, undertakes to pay any losses on the reference portfolio by drawing the necessary amounts from the maturing Treasury bonds.

For example, at the end of the third year, it is assumed that 2% of the underlying portfolio is in default : with the 100 million in cash received from the repayment of the Treasury bonds, the SPV pays (1) 2 million to the bank as the CDS to cover the reference portfolio defaults, (2) 80 million to the holders of the senior tranche, (3) 15 million to the holders of the senior tranche and finally, (4) the residual amounts, i.e. 3 million to repay the holders of the subordinated tranches, who in fact bear the first risk.

If the selling bank defaults, the CDS may be assigned to the new buyer of the assets (depending on legislations), thus the SPV continue to be committed to the losses of the pool, until the maturity of the CDS. If however, the bank or the new buyer does not pay the premium, the SPV has no more obligations under the CDS.

**Underlying assets.** This structure offers great flexibility as the credit sold by the bank to the SPV may be off-balance-sheet : undrawn exposure, guarantees, swap equivalent risks, etc. This makes it easier for the bank to collect a securitisable outstanding amount, which is very useful for European portfolios in which it would be difficult to collect a large outstanding amount from homogenous instruments ( such as syndicated loans).

The rating agencies analyse the underlying portfolio using the same method as that used for traditional CLO : a statistical approach (average rating and Diversity score) and a issue-by-issue approach (maximum concentration per credit, minimum rating). The rating agencies also take into account the type of instrument, considering, for example, in the event of a debtor defaulting, the recovery rate on a syndicated loan is greater than that of a swap.

**Seller's rationale.** As in the case of a traditional CLO, the bank keeps approximately 2% of the first risks, and its maximum loss is limited to this amount. Under certain legal frameworks, the prudential approach may be less favourable than the traditional approach whereby there is a physical disposal of assets. In France, for example, in order to benefit from the most favourable treatment, the SPV must hold OECD government bonds and the assets of the portfolio must at all times have a maturity shorter than that of the CDS (therefore less than 3 years in our example) : this explains why, in the majority of cases, it is the short-term revolving credit drawings that are securitised.

Under optimum conditions, the required regulatory capital is equal to the most subordinated portion, kept by the seller, and therefore the same amount can be saved as with a traditional CLO.

It can be seen that, with this structure, capital savings are not greater than with a traditional CLO, but the main advantage of this structure is that the seller transfers some of the risk and there are no actual cashflows to be monitored but only default levels, which considerably reduces the SPV's management costs. This enables the seller to launch a new issue with flexibility whenever necessary within a reduced amount of time.

**Variation.** To optimise the cost of cash replacement, some structures make provisions for reinvesting the issuance proceeds in Pfandbriefe, or even in AAA US credit cards, which generate higher yields than Treasury bonds. By the same token, the cash from lower-rated tranches : A, BBB and BB are backed for example by Medium-Term-Notes issued by the selling bank. These assets are considered compatible with the CDO tranche ratings, as if their credit decreased, they would be immediately replaced by other assets acceptable to the credit rating agencies.

This variation enables reducing the cost of negative carry but may be costly in terms of regulatory capital as the legislator may consider that the bank is selling a risk to a counterparty which is no longer guaranteed by a government credit (as the SPV's assets are no longer Treasury bonds) and applies a 20% B.I.S. weighting : this means that the bank must maintain a regulatory capital of 8%+20% on the portion sold to the market (which is, to all intents and purposes, greatly preferable to 8% of 100% if everything remains on the balance sheet).

**The investor's point of view.** The main advantage lies in the fact that these structures are becoming the new standard for European CLO. As they are easier to implement, the investor will be offered a wide range of transactions, with sellers frequently materialising.

On the other hand, as this technique makes it possible to sell all types of risk, the investor must pay particular attention to the types of instrument actually sold (even though, in practice, these are mainly loans).

Also it is important to see what the documentation stipulate in case of seller's bankruptcy, as the CDS can be assigned to new buyer and continue to be effective until the stated maturity, whereas for traditional CLO, a bankruptcy of the seller leads to early amortisation, which reduce the risk.

## Structure 3 : Leveraged CDO

Technically, this structure is a variation of Structure 2, but is very different in terms of the risk profile of the senior tranche.

This structure was principally developed by US banks, (JP. Morgan with BISTRO II and Citibank with C \* STAR) benefiting from their legislation which favours "Super Senior" tranches kept in portfolios.

**Structure.** (*Graph 6*) The principle consists in dividing the portion which would be AAA in the normal CLO into two tranches : a AAA-rated senior tranche, and a "super-senior" tranche, which benefits from the subordination of the senior tranche. This means that for the Super Senior tranche to be affected by a default, losses would have to be so great that the AAA senior tranche defaults completely, which is highly improbable. A AAA rating can be awarded to mezzanine tranches if the underlying asset has an average rating of between AA and BBB (as opposed to BB for traditional CLO).

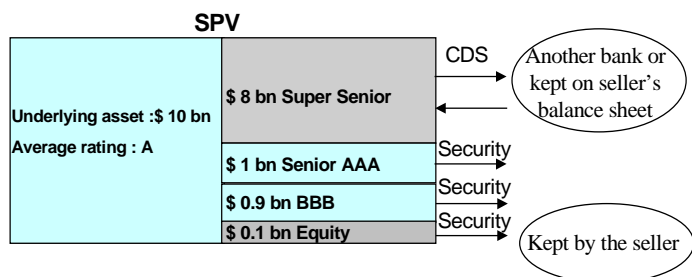
The super senior tranche is kept by the selling bank. The US authorities consider that this risk-free asset requires a regulatory capital of 20% instead of 100% (i.e. that the bank immobilises 8% of 20% instead of 8% of 100%). The most subordinated tranches are, as in the case of traditional CLO, kept by the selling bank.

The main advantage of this structure is that regulatory capital is reduced on very large portfolios, only having to sell a lower outstanding amount to the senior mezzanine tranches on the market (1.9bn out of 10bn, in our example).

**Variation.** European banks also use this method : instead of keeping the super-senior tranche on their balance sheet, they sell its risk via a CDS to another bank (US, for example). The portion of the portfolio sold will be weighted at 20% (instead of 100% initially).

Generally speaking, European banks are active sellers of large portions of their portfolios in the form of CDS. As no cash is exchanged, these transactions generally go unnoticed. The counterparty of the swap which buys the risk is frequently an insurance company, and it is therefore necessary to find a bank which is prepared to carry out a back-to-back between the two, so that the seller benefits from the 20% BIS ratio.

Graph 6 : Leveraged CDO



# Arbitrage CDO

**Leverage effect.** This type of structure has the same advantages as the other CLO. However, the investor in the AAA senior tranche must analyse his purchase in the same way as a mezzanine tranche, that is to say a risk concentration, even though the concentration carries very little risk. For example, if there are twice as many underlying portfolio defaults as expected, with the leverage effect this means that the loss level that the senior tranche is actually bearing is multiplied by 10, in relation to the previously expected level. The credit rating agencies take this lever effect into account by applying higher overcollateralisation factors. There may however be a danger that the rating obtained is less stable than in the normal senior tranche.

**The investor's point of view.** For a AAA senior tranche of a traditional securitisation, the decision of whether or not to purchase mainly depends on the analysis of the relative value in relation to other comparable securities : stability of the rating, liquidity, sensitivity to a business sector.

For a mezzanine tranche, as well as the relative value analysis, the investor must also analyse the intrinsic value of the security : this mainly implies finding out to which level the underlying asset would have to fall before the security defaults, and assess the probability of this catastrophic scenario occurring.

To simplify matters, an investor in US credit card debt is not concerned about the performance of the US economy as, in view of the safety mechanisms, his investment will be repaid well before the default. On the other hand, if he wishes to buy a subordinated or a mezzanine tranche, he will start to wonder at what point, if the US economy performs poorly, will there be a risk of a default or at least a downgrading of his security.

The advantage of arbitrage CDO can be analysed independently of any considerations relating to the seller. The aim is for the all-in cost of refinancing the CDO (i.e. the sale price of all the tranches, including the most subordinated) to be lower than the purchase price of the underlying asset.

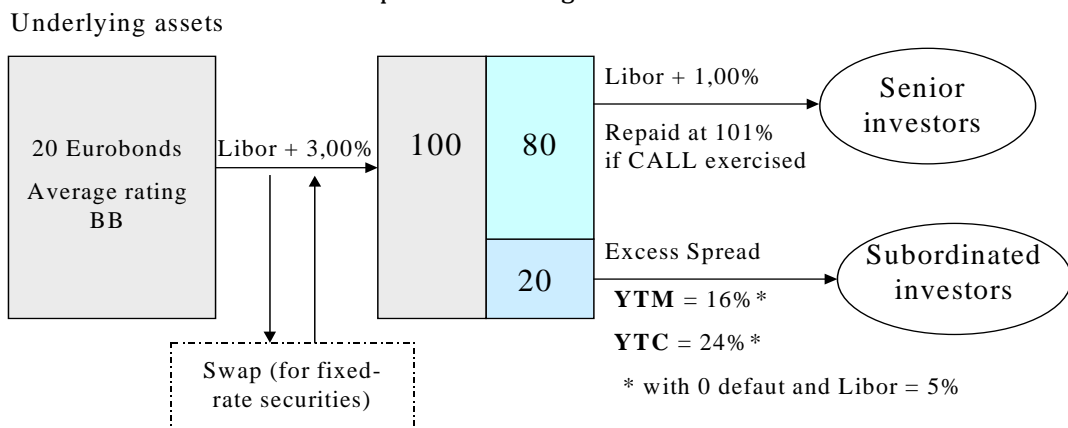
By its very nature, the underlying asset of an arbitrage CDO is an asset which has been purchased at a market price and is therefore a negotiable asset. Very often these are securities, and therefore the majority of arbitrage CDO are CBO, but it is entirely possible for the asset of an arbitrage CDO to be comprised of loans : for example syndicated US loans are sufficiently tradable for an arbitragist to buy them.

Underlying portfolios contain between 20 and 100 discount securities which can be refinanced under better terms by a breakdown into tranches suited to the investors.

To properly understand the different arbitrage CDO structures, we will give a detailed explanation of the basic structure, Structure 1 : "Static cashflow CDO" and we will then present 2 variations : Structure 2, known as "Market Value CDO" and finally Structure 3, "Active management CDO".

The three following examples are "cash" structures which offer investors securities in exchange for cash. There are "synthetic" variations on these 3 examples, in which the risk is sold to investors in the form of "Credit Default Swap" (CDS), without cash being exchanged. The principle and the analysis are identical. The only difference being, as there is no cashflow exchange, less management is required; however, the structure is exposed to the risk of default by the investor who becomes the swap counterparty.

Graph 7 : Arbitrage CBO



## Structure 1 : Static cash-flow CDO

An ad-hoc SPV purchases a portfolio with diversified securities such as bonds issued by emerging economies or US "high-yield" companies. Their average rating is generally around BB and these bonds are denominated in US dollars as there is still little depth for the emerging or high-yield papers in Euro. Underlying portfolios often have maturities of between 5 and 10 years as beyond 5 years, there is less liquidity and the securities are discounted, which make the arbitrage more interesting.

Table 1 : Credit support to obtain A2

Diversity Score	Collateral Rating					
	B 1	Ba 3	Ba 2	Ba 1	Baa 3	Baa 2
2	73%	68%	63%	55%	45%	41%
3	60	55	50	46	32	27
5	49	44	39	34	22	18
10	39	33	29	25	18	16
20	32	27	23	20	16	14
30	30	25	21	18	14	12
40	28	23	20	16	12	10

Source Moody's

**Credit support.** Credit rating agencies determine the credit support necessary in relation to the quality of the underlying portfolio, mainly measured by its Average Rating and its Diversity Score. *Table 1* is an indicative matrix produced by Moody's which shows that to obtain an A2 rating from an underlying portfolio with an average rating of Ba1 and a diversity score of 20, the structure would have to be able to withstand 20% net losses without the rated tranche being affected.

The rating agencies then take into account the type of underlying instruments by estimating the recovery rate. If, for example, the recovery rate used is 50%, a rate of defaults of 40% will lead to a net loss of 20%, whereas if the recovery rate is 0%, a rate of defaults of only 20% will lead to the same net loss of 20%.

The recovery rates usually used by the rating agencies are : security-backed senior debts : 50%, non-security-backed senior debts : 40%, non-security-backed subordinated debts : 30%, sovereign debts from emerging economies : 25% and corporate debts from emerging economies : 15%. These levels are below previously observed levels. The rating agencies also estimate the recovery time after the default.

**Simulation.** Let us take the example of a portfolio of 20 securities, each with a value of USD 5m and a total value of USD 100m, purchased at par and with a Libor + 3.00% yield. In order to illustrate this example using basic calculations, let us suppose that all the securities are one-year maturity bullet payments.

Our example (*Graph 7*) represents 20%, subordinated tranche, i.e. USD 20m and 80% senior tranche i.e. USD 80m. The senior tranche is rated A and pays Libor + 1.00%.

### Yield to Maturity (YTM) calculation

This is the yield to maturity of the subordinated tranche in relation to the various default hypotheses.

- If there have not been any defaults, at maturity, the SPV receives 100 million in principal and  $100 * (\text{Libor} + 3.00\%)$  in interest.** With this sum, it must first of all pay the holders of the senior tranche, i.e. 80 million in principal and  $80 * (\text{Libor} + 1.00\%)$  in interest. The residual sum available for the holders of the subordinated tranche is therefore :

$$100 * (1 + (\text{Libor} + 3.00\%)) - 80 * (1 + (\text{Libor} + 1.00\%)),$$

which, assuming Libor is 5.00% equates to :

$$100 * (1 + 8\%) - 80 * (1 + 6\%) = 23.20 \text{ million, i.e. } 20\text{m in principal and } 3.20\text{m in interest, which represents a yield of } 16\% \text{ (or Libor} + 11\%) \text{ added to the initial investment. The YTM of the subordinated tranche is therefore } 16\% \text{ for } 0\% \text{ default. This shows that the subordinated tranche, which absorbs the first risk, offers excellent yield prospects in return.}$$
- If 1 security has defaulted (i.e. 5% of the portfolio), it is then necessary to take into account the recovery rate (for example 50%) and the average recovery period, which in this case is assumed to be immediate. Our hypothesis is therefore a net loss of 2.50%. At the end of the first year, the SPV receives 95 million in principal,  $95 * (\text{L} + 3\%)$  in interest and recovers 50% of 5 = 2.50 m and with this sum it pays the holders of the senior tranche : 80m and  $80 * (\text{Libor} + 1.00\%)$ . For the holders of the subordinated tranche there remains :**

$$95 * (1 + (\text{Libor} + 3.00\%)) + 2.50 - 80 * (1 + (\text{Libor} + 1.00\%))$$

i.e. where Libor = 5.00% :

$$95 * 1.08 + 2.50 - 80 * 1.06 = 20.30\text{m, that is to say } 20\text{m in principal and } 0.30\text{m in interest, i.e. a yield of } 1.50\% \text{ (or Libor} - 3.50\%) \text{ in interest added to the initial investment. The YTM is therefore } 1.50\% \text{ for } 5\% \text{ default.}$$

This illustrates the fact that the performance of the subordinated tranche is very sensitive to the underlying asset performance.

3- If 8 securities default (i.e. 40% of the portfolio). Assuming an immediate recovery rate of 50%, this scenario represents a net loss of 20%.

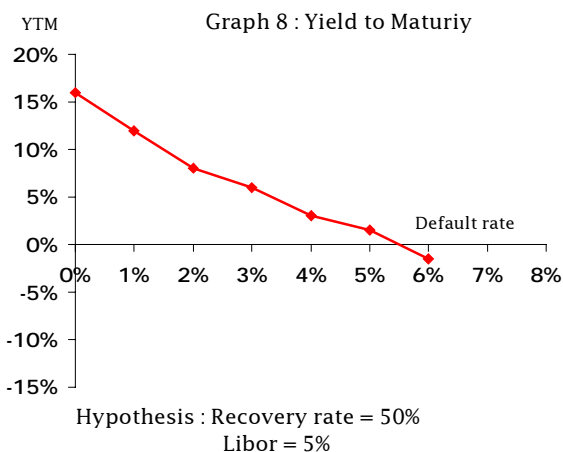
At the end of the first year, the SPV receives 60 million in principal and  $60 * (L+3\%)$  in interest and recovers 50% of  $40 = 20m$ ; with this sum, it pays the holders of the senior tranche : 80m and  $80 * (Libor + 1.00\%)$ , for the holders of the subordinated tranche there remains :  $60*(1+(Libor+3.00\%)) + 20 - 80* (1+(Libor+1.00\%))$ , i.e. where Libor = 5% :

$$60*1.08 + 20 - 80 * 1.06 = \text{zero}$$

There is therefore nothing left for the subordinated tranche (the YTM is -100%). The 40% default rate is therefore the default limit of the underlying asset above which the senior tranche face a default.

These various scenarios can be used to make a yield table of the subordinated tranche (Graph 8) : The return on investment only depends on the cashflows received by the SPV's asset; the only important item of data is the rate of net loss (i.e. the default rate and the recovery rate).

At no time does the mark-to-market of the securities have an effect : even if the security purchased at 100% is only worth 20% of its value following a crisis for example, this does not affect the holder as long as this security pays its coupon and repays at maturity.



**The investor's point of view.** The main advantage for the investor is that he has exposure to a diversified portfolio and is only exposed to the credit quality of the debtors, and not to their market value.

For example, Eurobonds from sovereign countries and emerging economies are well suited to this type of arbitrage. These securities have very volatile market prices; however actual defaults are rare with a relatively stable rate around 2%, as even when they re-negotiate their debts, governments always repay Eurobonds before traditional bank debts.

The second advantage is that it enables the investor to take a position on the diversified portfolio without management considerations.

Naturally, the subordinated tranches of these products are aimed at investors who have specific interests in the underlying asset. Above all, the risk of systematic default must be taken into account which would generally affect an entire market segment, irrespective of the industrial sector or geographical region. This risk is taken into account by the credit rating agencies in their diversity score calculation.

## Structure 2 : Market Value CDO

These are CDO, whose performance is linked to the variations in the market value of the underlying asset. Technically, there is no difference between a cash-flow CDO and a Market Value CDO, it is only the risk profile that changes, more related to the value of an asset in a given market than the fundamentals on a given credit.

For example, when attempting to securitise an underlying asset consisting of shares, the cashflows generated are only the dividends and the securities can only be repaid by reselling the shares. Therefore, the portfolio's yield will mainly be determined by an increase or a decrease in the market value of the shares.

The main performance indicator of an underlying asset of a Market Value CDO is the "Total Rate of Return" (TRR), which takes into account the cashflows, the losses and also variation of the market value of the underlying asset.

Table 2 : "Advance Rates" per asset

(20 issuers, 5 industries, 100% investment in one asset type, 5 year maturity)  
Target Rating

Asset Type	Aaa	Aa1	Aa2	Aa3	A1	A2	A3
Performing Bank Loans Valued \$0.90 and Above	0.870	0.890	0.895	0.900	0.905	0.910	0.915
Distressed Bank Loans Valued \$0.85 and Above	0.760	0.780	0.790	0.795	0.810	0.815	0.820
Performing High-Yield Bonds Rated Ba	0.76	0.79	0.80	0.81	0.83	0.84	0.85
Performing High-Yield Bonds Rated B	0.72	0.75	0.76	0.77	0.78	0.79	0.80
Distressed Bank Loans Valued Below \$0.85	0.58	0.62	0.63	0.64	0.67	0.68	0.69
Distressed Bonds	0.35	0.39	0.40	0.41	0.47	0.48	0.50
Reorganized equities	0.31	0.37	0.38	0.39	0.44	0.46	0.47

Source Moody's

Table 3 : Liquidity “Haircuts” by type of asset

Asset Type	Liquidity “Haircut” (%)
Performing Bank Loans	7
Performing High-yield Bonds	5
Distressed Bank Loans	12.5
Distressed Bonds	10
Reorganized Equities / Trade Claims	20

Source Moody’s

**Methodology used by rating agencies.**

Rating agencies take into account both the historical volatility of the relevant market and the liquidity of the instruments when resold. The models have been refined using data collected during various crises : Western stock markets in 1987, US high-yield bonds in 90-91, Mexico in 94, Asia in 97 and Russia and liquidity crunch in 98.

Moody’s, for example, takes into account volatility by applying a reducing ratio “Advance Rate”, to assess the value of a portfolio : *Table 2* shows that, when attempting to upgrade a 100 nominal value portfolio of B-rated High-Yield bonds to Aaa, it will be valued 72 for the rest of the analysis. Then, the rating agency will take into account various scenarios particularly, those relating to the actual ability of the SPV to sell in the event of a crisis. *Table 3* shows that a 5% bid/offer must be factored on high-yield securities in a crisis period.

**CALL.** To illustrate the concept of Market Value in relation to that of Cash-Flow, we will illustrate a technical variation which can be used to boost the sensitivity of a cash-flow CDO to the market value of an underlying portfolio by using a CALL.

Let us take the above example again (*Graph 7*): a SPV which purchases 20 BB-rated securities with a one-year bullet payment; they are purchased at par and pay a coupon of Libor + 3.00%. The long-term yield of the securities will depend on the default rate of the underlying portfolio, that is to say the cash-flows which the SPV may or may not receive.

The structure now has a CALL which can be activated after 6 months to benefit from the capital gain of the underlying portfolio. If it is exercised, the senior tranche is redeemed at par plus a pre-determined premium, for example 100.20% plus interest. The 0.20% constitutes an indemnity to compensate for the CALL being exercised. The holders of the subordinated tranche recover all the residual capital gain with a leverage effect.

In practice, maturities are over 5 years with a CALL exercisable at each coupon date between year 2 and year 4 for example. The triggering of the CALL may be automatic above a pre-determined market level or is left to the discretion of the holders of the subordinated tranche with a 2/3 majority on the proposal of the structure’s manager.

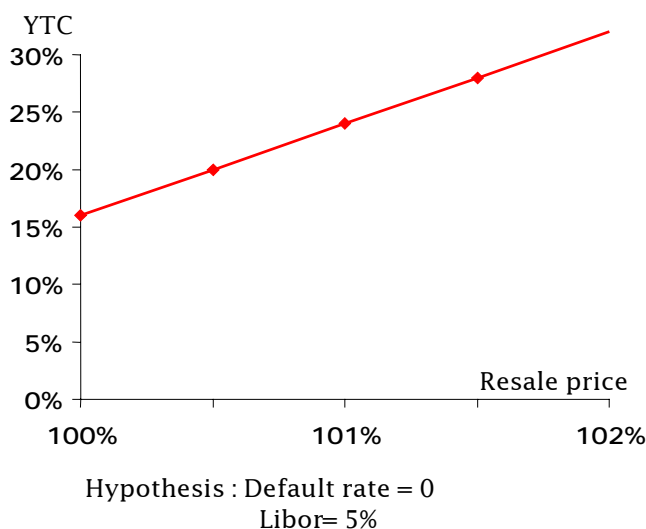
**Yield To Call (YTC) calculation**

This is the yield of the subordinated tranche in the event of a CALL being exercised, in relation to a hypothesis on the default rate and the resale value of the underlying asset.

Taking the previous example again, it is assumed that after 6 months, the market value of the portfolio is 101% of the nominal. The CALL is then exercised and the SPV receives 101 of the principal plus the interest generated by the securities over 6 months :  $100 (\text{Libor} + 3.00\%)/2$ . First of all, with this sum, it repays the holders of the senior tranche :  $80 \cdot 100\% m$  of the principal, plus  $80 \cdot 0.20\% m$  of the exercise premium of the CALL, plus  $80 (\text{Libor} + 1,00\%)/2$  for 6 months interest.

If Libor is 5%, to repay the subordinated investors there remains :  $101 + 100 \cdot 8\%/2 - 80 \cdot 100.20\% - 80 \cdot 6\%/2 = 22.40 m$ , i.e. 20m plus 2.40m in interest over 6 months, representing an annualised rate of 24% (Libor+19%). Different simulations make it possible to plot the various YTCs as a function of the resale value of the asset (*Graph 9*).

Graph 9 : Yield to Call



**The investor's point of view.** The investor takes a position on the performance of the underlying asset without being affected by negative performance of the market value. However, he has the free option to take a profit, with a lever effect, if the market price of the underlying asset appreciates.

Nevertheless, the CALL trigger mechanism and the asset sale process must be studied in detail. The investor should, for example, check that portfolio manager will ask quotations to independent counterparties.

## Structure 3 : Active management CDO

In the two previous examples, the portfolio is static : there are no unknowns in its composition and the investor only takes a position on the percentage of loss, or on the market value, but never on the quality of the portfolio management.

In practice, the overwhelming majority of arbitrage CDO have managers, whose job it is to manage the portfolio for the SPV in accordance with the management criteria which are defined in detail in the legal document : the Investment Management Agreement. This document makes provisions for the frequency and type of *reporting* that the manager must provide to the trustee and the credit rating agencies.

The manager's degree of involvement is very variable. Here are 4 typical examples of a management mandate : default management, reinvestment, default prevention and trading.

**Management 1 : Recovery.** The role of management is limited to recovering funds on behalf of the SPV in the event of a debtor defaulting. In a static CDO, this is often carried out by the bank arranging the transaction. The recovery will be all the more efficient if the manager has further exposure on the same debtor (i.e. a large commercial bank is in a good position to carry out this role).

**Management 2 : Reinvestment.** The role of management is limited to reinvesting the proceeds in new eligible assets, for a pre-determined reinvestment period. There are two main criteria for monitoring the activity of management : firstly, on a purchased security (minimum rating, maximum duration, maximum size and possibly business sector) and secondly, on the portfolio in general (minimum average rating and diversity score). Sometime, each new purchase must be explicitly validated by the rating agencies, but in general a monthly report on the data will suffice.

**Management 3 : Default prevention.** Another role of management is to resell all the securities in the portfolio at the highest price as soon as their credit risk worsens : to do so, the manager uses the ratings or other available information, or even his own intuition. When he decides to sell, he has the duty to sell at the highest price; in general 3 quotations from 3 independent banks are sought. Even though the manager's actions are governed by objective criteria (maximum loss permitted for the sale of a security), this will depend to a great extent on the quality and experience of the manager.

This preventive sales mechanism often forestalls major losses, but may be counter-productive : for example in October 97, when the Korean government was suddenly downgraded from AA- to B+, the manager would have probably sold very quickly with a significant loss, whereas if the securities had been held, he would have weathered the storm without any loss as Korea's credit returned to an acceptable level.

**Management 4 : trading.** This is the case for the majority of arbitrage CDO comprised of US high-yield securities managed by specialised funds able to actively manage the portfolio. The manager has to comply with constraints regarding maximum annual turn-over (for example 15% of the portfolio per year), and the obligation to maintain an average rating and a maximum diversity score.

The quality of the manager is a decisive factor. In these transactions, the investor purchases the manager's performance just as much as a view on the market. It is important to know about the manager's past performance on this type of instrument and compare it with the average indicators for the sector (i.e. Merrill Lynch's MLHY for the US High-Yield and JP Morgan's EMBI+ for emerging markets).

**Manager motivation.** In each transaction, it is very important to understand exactly how the manager is remunerated in order to gauge his degree of commitment vis-à-vis the investors.

The management premium varies greatly according to the type of management required. Often, the manager receives a premium of around 0.25% of the outstanding amount, before the payment of the senior tranches, then a second portion of the premium of around 0.35%, which is only paid if the investors in the subordinated tranche are paid as agreed. Sometimes, the manager purchases a portion of the most subordinated tranche of the transaction (for example 20%).

In general, managers are very familiar with managed portfolios, as they manage similar portfolios for themselves. Indeed, for them, the use of securitisation enables them to carry on managing a portfolio whilst continuing to receive management fees.

**Monitoring the structure.** It is important to monitor the development of the transaction over the life of the security : increasingly, these transactions publish a monthly report, validated by the trustee which includes the following information : (i) average rating of the portfolio (ii) diversity score (iii) for each tranche, overcollateralisation level available in principal (known as OC, or overcollateralisation ratio) (iv) for each tranche, overcollateralisation level available in interest (known as IC or Interest coverage ratio) (v) market value of the portfolio.

Changes in the value of the portfolio determine the performance of the manager and they should be compared with a benchmark index, i.e. MLHY, Merrill Lynch's high-yield index, or EMBI+, JP. Morgan's emerging market index.

However, it is important to speak to the manager from time to time to understand its strategy. For example, the yield may be lower than expected if the manager adopts a defensive strategy to limit losses.

**Investor's point of view.** Often the sellers are fund managers (as for example Templeton), in whose funds it is possible to subscribe directly. The advantage of buying a CDO instead of manager's funds directly is to obtain a tailor-made product : the holder of the senior portion will seek greater protection than the fund itself, whereas the holder of the subordinated portions applies to a leverage effect to his investment.

Table 4 : spread over \$ Libor for 5 years CDO

Structure	Traditional CLO	Active management CDO	Static CBO
<b>Asset type</b>	<b>Bank loans</b>	<b>US hi-yield</b>	<b>Emerging Markets Bonds</b>
<b>AAA</b>	30	45 / 50	60 / 80
<b>AA</b>	50	75 / 80	NA
<b>A</b>	70 / 75	120 / 140	NA
<b>BBB</b>	160 / 210	200 / 250	NA
<b>BB</b>	550 / 650	600 / 800	NA
<b>Equity</b>	NR	Approximative objectives for YTM and YTC : YTM = 15% / 20% p.a.      YTC = 20% / 25% p.a.	

These levels are rough estimation only, as each CDO needs a case by case analysis, especially for subordinated tranches and non investment grade underlying assets.

# IV Why buy CDO?

The numerous structures which we have described in Parts II and III illustrate the fact that CDO are still not standardised products, and require more detailed analysis on the investor's part than for traditional ABSs or plain-vanilla securities.

However, more and more investors are concentrating their research on this type of transaction. This trend, boosted in Europe by the growth in credit derivatives, can be explained by the following :

**Strength and Stability.** The first quality of a CDO is that it has all the advantages of securitisations compared with plain-vanilla securities : strength and stability of the rating due to rating agencies' conservative hypotheses and with the strong overcollateralisation criteria of the structures.

**Diversification.** CDO enable an investor who is already active in traditional ABS's to diversify his portfolio as they are a class of asset which is not correlated with traditional ABSs. For example, credit rating agencies consider traditional ABSs and CDO as being two separate sectors, when they calculate a portfolio Diversity Score.

**Standardisation.** CDO are a young product and follow changes in the regulatory framework and arbitrage possibilities, but after 4 years of development, some standards are beginning to appear (CDO using credit derivatives).

**Liquidity.** The massive requirements of banks have led to a spectacular development of this market, with more than USD 150bn issued in 1999, i.e. almost 40% of total securitisation world-wide.

**Yield.** At the same rating, CDO offer higher yields than traditional ABSs and, therefore, than plain-vanilla securities. For instance, the indicative spreads as of march 2000 for AAA 5 year CDO varies from Libor+30 to Libor+80, depending on the nature of the underlying and the management type.

**Transparency.** The risk of each transaction is represented by a limit number of commercial debtors that can be analysed on a issue-by-issue basis. In general, for investors in senior tranches, aggregate data suffice, but detailed information is given to investors in the more subordinated tranches who can fine-tune the monitoring of their investment carefully, or even model their risk profile themselves.

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