

The CDO market

Functioning and implications in terms of financial stability

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The result of relatively recent financial innovations, collateralised debt obligations (CDOs) are securities that represent a portfolio of bank loans and/or different financial instruments. Part securitisation instrument part credit derivative, these increasingly-popular structured finance products are used by financial institutions for various purposes, ranging from reducing their cost of financing to exploiting arbitrage opportunities or transferring credit risk. Irrespective of their form, CDOs are issued in different tranches that are tailored using securitisation techniques. The process of tranching allows credit risk and returns on their underlying portfolio to be redistributed to investors in an ad hoc fashion.

CDOs are part of an ongoing trend of converting credit risk into a marketable commodity. This process started with securitisation, and was then sustained by the development of credit ratings and corporate bond markets and, more recently, by that of credit derivatives. While CDO issuance represents at most the equivalent of a sixth of that of corporate bonds, the influence of these products has a far greater significance because of the amount of credit risk they allow to be transferred. The sharp growth in synthetic structures backed by credit derivatives, especially in Europe, has heightened this trend.

The rapid development of CDOs has improved non-bank investors' access to credit markets and has enabled them to overcome the obstacles posed by the size and limited diversification of the corporate bond market, notably in Europe where bank intermediation remains predominant. Investors can now choose portfolios with specific risk-return profiles and take exposures to credit risk previously confined to banks' balance sheets, such as SME loans.

Given that CDOs are credit risk transfer instruments, they facilitate the redistribution of this risk within the financial and banking sector and even beyond, while increasing the degree of completeness of the credit market. They should therefore have a positive impact on financial stability. However, as is often the case with financial innovations, evaluating CDOs and the risks they entail, particularly in the case of Synthetic CDOs, requires the use of complex techniques that are not always sufficiently tried and tested. Both investors and market participants may thus be exposed to relatively high potential losses. At present, this risk does not appear to be of a systemic nature given the size and relative newness of the market. Nonetheless, if this market continues to grow at its current pace, attracting increasing numbers of investors, in particular in Europe where CDOs are predominantly synthetic, systemic risk may emerge.

Moreover, growth in CDO issuance seems to have contributed to the marked narrowing of spreads over the past two years on all credit markets. This trend raises questions as to the links between the CDO market and the corporate bond and credit derivatives markets, and deserves particular attention with regard to the risk of the propagation and amplification of strains that may arise on the CDO market due to its still limited liquidity and transparency.

1 | THE MAIN CHARACTERISTICS OF CDOs

1|1 Mechanisms

Collateralised Debt obligations (CDOs) are securities that represent a portfolio of different financial instruments or assets. They constitute a class of credit risk transfer instrument in their own right and generally combine the three mechanisms common to all securitisation structures:

- the construction, by a financial institution, of a reference portfolio comprising a pool of bank loans and/or negotiable financial instruments (bonds, other debt securities, etc.), and/or credit derivatives. However, unlike traditional securitisation transactions that are backed by portfolios of homogenous assets comprising exposures to a large number of obligors (ABS, RMBS, CMBS, etc.), CDOs are usually backed by heterogeneous exposures to a limited number of names;
- the de-linking of the portfolio's credit risk with that of the originator of the portfolio *via* the use of a Special Purpose Vehicle (SPV), or fonds commun de créances in France¹, that issues the CDO and holds the underlying assets;
- the tranching of CDOs backed by this portfolio. Each tranche has a specific seniority rank in terms of the rights to the cash flows generated by the underlying assets or credit derivatives. The senior, mezzanine, and equity tranches have decreasing ranks in terms of these rights. The risk and return offered by these tranches increase symmetrically. Whereas the senior and mezzanine tranches generally have an original maturity of close to five years and offer bond-type returns, the equity tranche does not have a predefined maturity and offers a return linked to the performance of the underlying portfolio, which has no *ex ante* upper or lower bound.

The splitting of CDO into different tranches dictates a sequential allocation of the losses that may be sustained by the underlying portfolio. The equity tranche is the first to absorb losses in the event of

one or more defaults in the portfolio. If losses exceed the value of this tranche, they are absorbed by the mezzanine tranche. Lastly, if there are a large number of significant defaults, the senior tranche may be affected and sustain losses that have not been absorbed by the other tranches. This sequence means that the holders of each tranche (with the exception of the equity tranche) are protected from the risk of loss by one or more junior tranches. However, the senior and mezzanine tranches may also be protected by the use of specific mechanisms such as the overcollateralising of assets, reserve accounts or trapping excess spread. In all events, these credit enhancement techniques should allow the senior tranche to achieve a higher rating than the average rating of the underlying portfolio.

1|2 Types of CDOs

CDOs are generally classified according to (see Box 1):

- *the aim of the transaction*: balance-sheet CDOs or arbitrage CDOs;
- *the way in which the credit risk of the underlying portfolio is transferred*: this transfer can be achieved through the sale of the pool of assets to the issuing entity, or synthetically, through credit derivatives referencing names or assets included the underlying portfolio;
- *the composition of the underlying portfolio*. CDOs are generally backed by bank loans, corporate bonds or emerging sovereign bonds and, in the case of synthetic CDOs, credit derivatives. Over the past few years, the range of underlying instruments has broadened to other structured products (CDOs of ABS, CDOs of CDOs).

Balance sheet CDOs enable the originator to securitise assets such as bank loans or corporate bonds recorded on its balance sheet. Assets and/or credit risk can thereby be transferred to a separate legal entity, allowing the originator to manage its balance sheet: remove assets, free up regulatory capital², manage portfolio credit risk, diversify and reduce financing costs.

¹ Since the reform of the legal regime of the fonds communs de créances in November 2004; see Nesi (2005).

² See Joint Forum (2004), Appendix 3, for the supervisory treatment of CDO structures by credit institutions.

Box 1

Types of CDO

Criteria	Type of credit risk transfer	Types of CDO
Aim of transaction		
Balance sheet management	True sale/Credit derivatives	Balance sheet CDO
Arbitrage	True sale/Credit derivatives	Arbitrage CDO
Securitisation method/technique		
Cash	True sale	Cash-flow CDO
Synthetic	Credit derivatives	Synthetic CDO (CSO)
Underlying assets		
Bank loans	True sale/Credit derivatives	CLO
Bonds	True sale/Credit derivatives	CBO
CDS	Credit derivatives	CSO; single-tranche CDO
Structured products	True sale/Credit derivatives	CDO of ABS, CDO of CDO (CDO²)
Hybrid portfolios	True sale/Credit derivatives	CDO

Arbitrage CDOs allow the originator (in general the arranger)³ to take advantage of the positive spread between the average yield on the underlying portfolio and the interest rate paid on the tranches issued. Contrary to balance sheet CDOs, the originator of the transaction may or may not hold the underlying portfolio beforehand, and may construct it by purchasing the assets on the market, which means that the securities in question must be fairly liquid.

Even if the spread between the yield on the underlying portfolio and the tranches issued does not offer an arbitrage opportunity *per se* it nevertheless remains a key factor in the financial viability of the transaction as it makes it possible to generate, after covering the costs of setting up the structure (and in particular the payment of intermediation fees), an excess spread that can be used to compensate the equity tranche holders and if necessary to enhance the credit of the other tranches. Naturally, the lower the interest rate paid on the tranches, the larger the excess spread, which

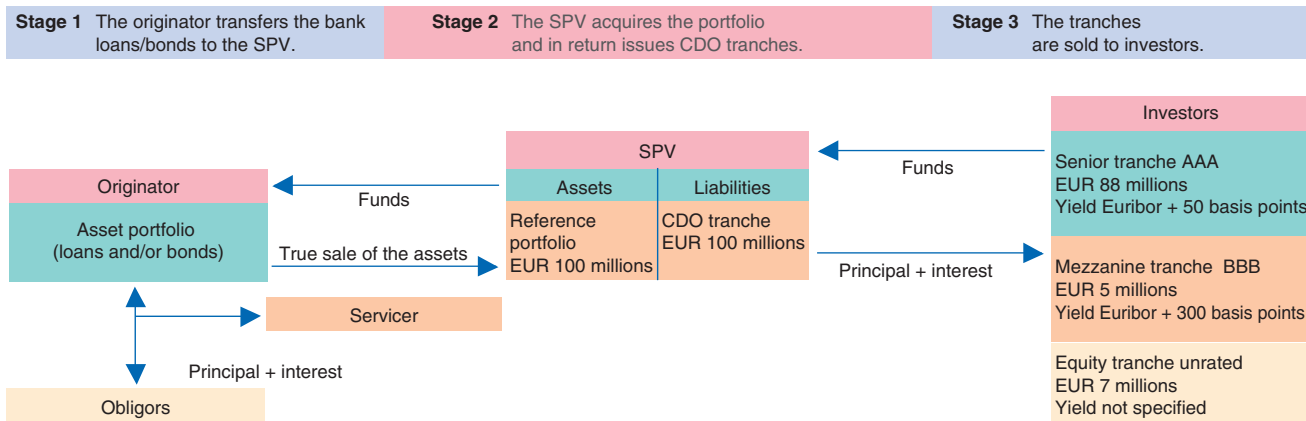
requires that the tranches be rated in the investment grade universe, in particular *via* the use of different *ad hoc* credit enhancement mechanisms.

In practice, however, the difference between balance sheet CDOs and arbitrage CDOs is not clear-cut. In the case of balance sheet CDOs, the originator of the assets may also attempt to take advantage of the excess spread by holding the equity tranche, which enables it to continue to capture a large part of the return on the assets transferred while improving its cost of financing.

In the case of both balance sheet CDOs and arbitrage CDOs, the credit risk on the portfolio may be transferred in two alternative or complementary ways: either *via* the true sale of assets and/or synthetically, by buying protection *via* credit default swaps with the vehicle issuing the CDO. In the case of cash-flow CDOs, which use traditional securitisation mechanisms (see diagram overleaf), credit risk is transferred *via* a true sale of assets.

³ The arranger is an investment bank or an asset management firm responsible for placing tranches with investors in return for a fee. In the case of arbitrage CDOs, it may also originate the transaction, or even actively manage the underlying portfolio.

Diagram of a cash-flow CDO



These structures serve both to raise funds and to transfer credit risk, *via* the sale of the underlying assets to the issuing entity. Furthermore, the servicer collects the cash flows from the portfolio on behalf of the SPV and this income is subsequently reallocated to the holders of the tranches.

Synthetic CDOs (see Box 2) are mainly used to transfer credit risk and/or for arbitrage purposes. They have the advantage of avoiding the transfer of ownership of the assets and are therefore not subject to notification requirements *vis-à-vis* the obligors (preserving relations with the client in question). This also means that cash flows produced by the underlying assets do not need to be managed.⁴

The credit risk on the reference portfolio is transferred *via* credit default swaps through which the SPV sells protection to the originator of the deal in return for periodic fees. The risk is then transferred to investors through the issuance of funded synthetic CDOs, or through credit default swaps (unfunded synthetic CDOs) or a combination of the two (partially funded CDOs).

In the case of arbitrage CDOs, their synthetic nature also reduces the costs of assembling the underlying portfolio, as credit derivatives are often more liquid than the bonds of the issuers concerned.

Lastly, the creation of the single-tranche CDO constitutes a major innovation in synthetic CDO

structures (See Box 3). In these vehicles, only one tranche of the structure – in general at the mezzanine level – is sold to the investor. These “truncated” structures enable arrangers to meet investors’ requirements, while reducing the time needed to set up the deals and sell the tranches. However, they involve very specific mechanisms, notably in terms of hedging requirements for the arrangers.

While they may be differentiated according to their functions or risk transfer mechanism, CDOs may also differ in terms of the types of underlying assets used. When backed by bank loans, they are known as collateralised loan obligations (CLOs) and when backed by corporate bonds, they are referred to as collateralised bond obligations (CBOs). Lastly, synthetic CDOs backed by credit derivatives are known as collateralised synthetic obligations (CSOs).

Moreover, the type of underlying assets may include structured products. In such cases, the CDO involves the securitisation of the structured products that are themselves derived from already existing securitisation structures (CDO of ABS). Such products may result from the securitisation of commercial or mortgage loans, consumer loans or credit card receivables. Furthermore, tranches of CDOs can themselves be securitised, which results in a CDO of CDOs (or CDO2). Despite their particularly complex nature, the latter have developed rapidly over the past two years.

⁴ Synthetic securitisation is now possible under French law since the reform, in November 2004, of the legal regime of the fonds communs de créances, which makes it possible to use credit derivatives for buying or selling protection. See Nési (2005).

Box 2

Funding structures of synthetic CDOs

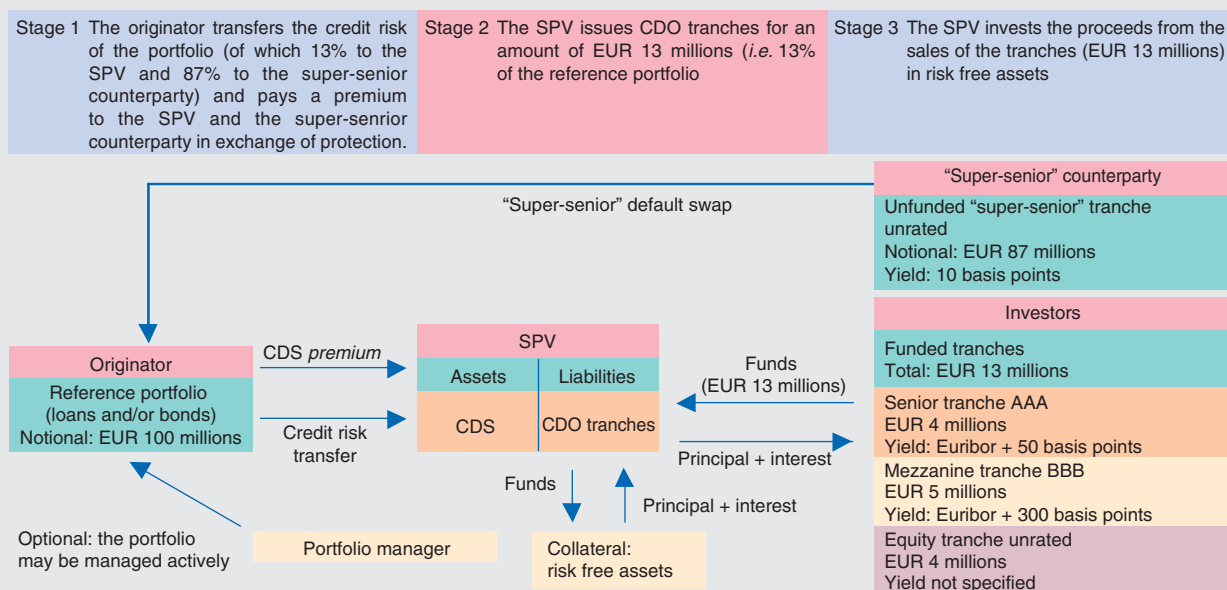
In synthetic securitisation structures, CDO tranches are issued in varying proportions. These structures may thus be funded, partially funded or unfunded. The main considerations in the design of these funding structures are the cost and management of counterparty risk. A fully funded structure incurs higher costs but is inherently less exposed to counterparty risk.

In the case of fully funded structures, the CDO encompasses a series of securities whose issuance amount is equal to that of the reference portfolio. Given that the underlying credit default swap between the originator of the transaction and the SPV does not entail cash payments (except for premia), proceeds from the sale of tranches are reinvested in risk-free assets (usually government bonds). Unless a credit event occurs on the underlying portfolio, the issuing entity can cover costs of setting up the structure as well as the interest payments to the tranche holders by using the interest from the collateral pool together with the premia from the CDS entered into by the SPV. In this way, investors “pre-fund” the structure, bearing in mind that, should a credit event occur, the SPV can compensate the originator by selling part of the risk-free assets. For the other tranche holders, this sale results in a loss in the form of a reduction in the repayment of the principal of the tranches.

In the case of unfunded structures, the CDO is entirely backed by CDS (equivalent to a basket of CDS). The ability of the SPV to compensate the originator if a credit event occurs therefore depends on the creditworthiness of the buyers of CDOs.

Lastly, in the case of partially funded CDOs, which are the most common type, risk is transferred to investors partly via CDS and partly through issuing securities (see diagram). These structures generally comprise a CDS whose notional amount is large in relation to the tranches issued, known as a “super senior swap” as it benefits from the subordination of the senior tranche and is therefore the part of the structure best protected against losses. The swap is nevertheless subject to counterparty risk and is thus entered into with a highly-rated entity (in general an insurer specialised in offering credit risk protection – known as a “monoline” insurer – or a prime bank). The main attraction of this type of structure for originating banks is that it enables them to transfer significant amounts of credit risk, and hence to free up large amounts of regulatory capital, at a much lower cost than that of funded CDOs thanks to the substantial reduction in the value of tranches to be placed with investors. Moreover, the cost of buying protection via a super senior tranche is much lower (a premium of 10 basis points) than the interest rate paid on a AAA-rated senior tranche (Euribor +50 basis points, due to super-senior counterparties’ preference (and in particular that of monoline insurers) for taking on credit risk without funding it.¹

Partially funded synthetic CDOs



¹ See Tavakoli (2003), Chapter 9

While in theory a very broad range of underlying instruments may be employed, the structure of the deal and the way in which risk is transferred largely determine the type of assets used. Indeed, certain underlying instruments (investment grade bonds, for

example) do not offer a high enough return, to say the least in the current environment, to back cash-flow CDOs. However, by using partially funded structures (see Box 2), assets with lower returns can be used while the vehicle's cost of financing can be reduced.

Box 3

Single-tranche CDO, hedging and leverage

Single-tranche CDOs are a recent but far-reaching financial innovation in the CDO market. These CDOs were created in 2003 and are synthetic in nature. The arranger sells a single tranche – usually at the mezzanine level – to a single investor, instead of selling all the tranches (equity, mezzanine and senior).

These CDOs, which may be funded or unfunded, have the following advantages:

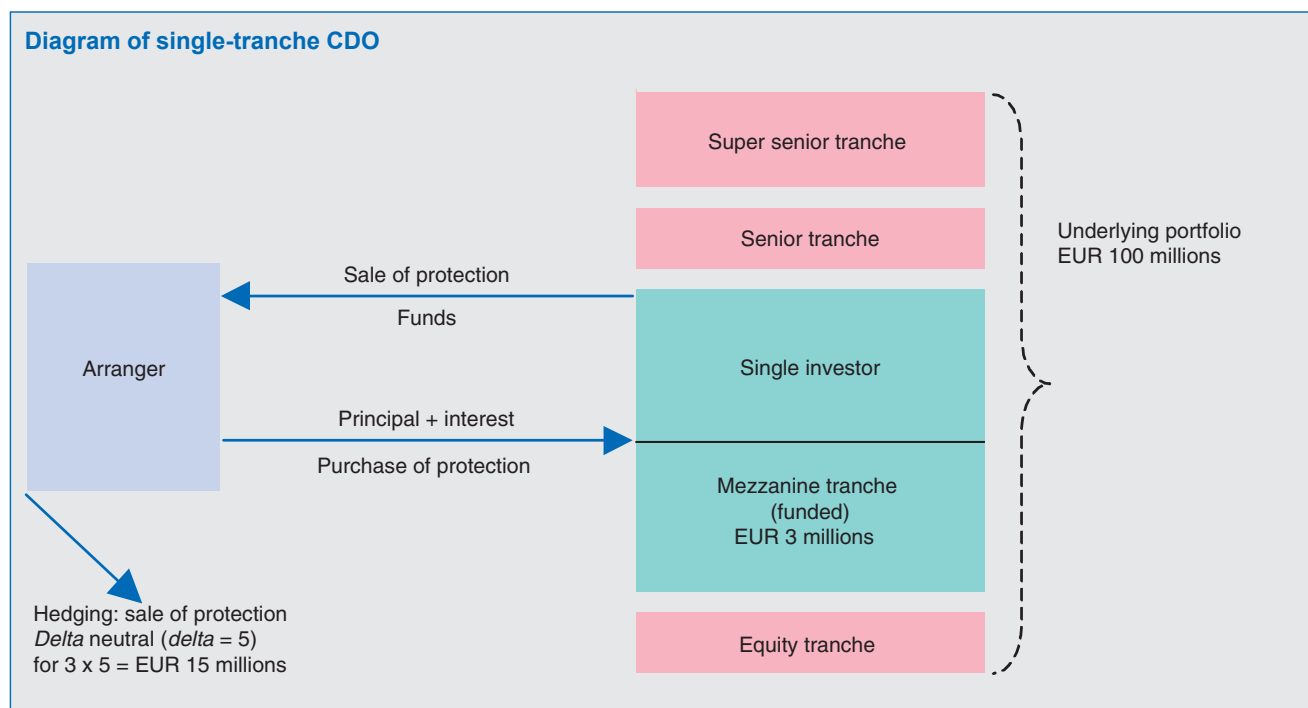
- *They are attractive to investors because the tranche is tailored to the requirements of the buyer, which can choose the names in the underlying portfolio, the subordination level of the tranche and its size. This avoids some of the dangers of traditional CDO structures, such as the risks of moral hazard or adverse selection in the choice of the names in the portfolio or conflicting interests between the holders of the different tranches.*
- *They are attractive to the arrangers because single-tranche CDOs are relatively easy to set up. Unlike traditional CDOs, they save the cost and the time of selling different classes of tranches. Moreover, selling costs are lower because in general the investor contacts the arranger, and not vice versa.*

Thanks to these advantages, single-tranche CDOs accounted for around 90% of the synthetic CDOs issued in 2003 and 2004, according to Standard and Poor's. However, they are becoming increasingly sophisticated and may have a major impact on credit spreads due to their leverage.

In a traditional CDO, the arranger does not take the risk: its role is mainly to sell tranches, or to originate the transaction in the case of arbitrage CDOs. The risk is fully transferred to the investors via the SPV. In a single-tranche CDO, however, the arranger becomes the direct counterparty of the investor because there is no vehicle in the structure. It is therefore the seller of the CDO and the buyer of protection on the single tranche of the CDO it sells, which makes it vulnerable to changes in credit spreads on the underlying portfolio of the CDO (market risk) and to defaults on this portfolio (default risk). It must therefore hedge its position by selling protection on the CDS market or through transactions based on CDS indices. The amount of protection sold is a multiple (the "delta") of the notional value of the tranche and enables the arranger to restore a neutral position. This delta is calculated using mathematical models and broadly represents the sensitivity of the tranche's value to changes in spreads on the names in the reference portfolio. Furthermore, the arranger has to frequently adjust its position to take account of changes in spreads using dynamic delta hedging.

Single-tranche CDOs, like all subordinated CDO tranches, are often presented as leveraged products, as their delta is higher than 1 (between 5 to 10 for the mezzanine tranche, according to its subordination level and its size). This leverage can be ascribed to the fact that much of the credit risk of the reference portfolio is concentrated in the subordinated tranches (mezzanine and equity), due to the sequential allocation of losses. For the mezzanine tranche, losses on underlying portfolio to the tune of 6% to 10% (depending on the size of the tranche) would be sufficient for investors to lose their entire stake. Naturally, investors are rewarded for taking more risk by receiving higher returns. However, in order to hedge this risk, arrangers have to sell protection for a multiple of the notional value of the tranche sold, which contributes to the narrowing of credit spreads on the CDS market.

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2 | MARKET DEVELOPMENTS

2|1 Measurement difficulties

The CDO market is particularly difficult to quantify and map due to the lack of sources that are reliable, consistent and representative of the market as whole. The available data, which are mainly produced by credit rating agencies and investment banks, show issuance volumes and not outstandings. Furthermore, they are often fragmented, heterogeneous and difficult to reconcile. Indeed, a sizeable part of the market is composed of unrated private deals. The increasingly wide-spread use of single-tranche CDOs has further strengthened this trend. Moreover, while cash-flow CDOs do not raise measurement difficulties, this is not the case for synthetic CDOs, due to the different funding structures of these products (see Box 2). For cash-flow CDOs, it suffices to measure the value of tranches issued, which more or less corresponds to that of the underlying portfolio. For a synthetic CDO, however, the value of the tranches issued may only correspond to a fraction of the underlying portfolio of derivatives.

Three competing measures can be used to assess synthetic CDO issuance:

- the first relates to the “funded” part of the issue, focusing on the value of the tranches issued. This measure is widely used because the data are easy to obtain and can be used to determine the relative size of CDO issuance, in particular with respect to corporate bond issuance. However, it underestimates the size of the synthetic CDO market in relation to that of the cash-flow CDO market as well as the magnitude of credit risk transfers through these products;
- the second measure centres on the value of the underlying portfolio. It makes it possible to determine the amount of credit risk transferred but overweights issuance volumes of single-tranche CDOs, for which only a fraction of the underlying portfolio is subject to risk transfer;
- the third measure focuses on the supply of credit protection stemming from hedging transactions resulting from synthetic CDOs issuance (CDO bid for credit). This relatively recent measurement method is particularly suited to single-tranche CDOs.

It measures synthetic CDO issuance on the basis of the delta neutral hedging requirements that they impose on arrangers (see Box 3). These requirements vary according to the size of the tranche issued, its subordination level and, hence, its leverage. In this way, it makes it possible to gauge the potential impact of CDO issuance on the credit spreads of the issuers traded on the CDS market. For example, for a reference portfolio with a value of EUR 100 million, a mezzanine tranche of EUR 3 million requires the arranger to hedge its position by selling protection to the tune of five times the amount ($\delta = 5$) on the CDS market. These protection sales therefore amount to EUR 15 million, *i.e.* a level between the size of the tranche and that of the underlying portfolio.

Measurement method and estimates of overall volumes of CDO issuance in 2004

(in USD billions)

Cash-flow CDOs	Synthetic CDO		
	Value of tranches issued	Value of funded tranches	Value of credit protection sold
137	260	1,700	627

Source: Creditflux, JP Morgan – figures including CDO tranches based on CDS indices.

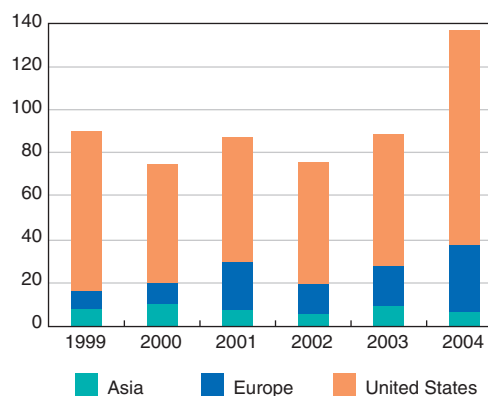
Methodology: see JP Morgan (2005).

2|2 Main segments of the market

The CDO market originated in the United States, and then rapidly developed in a number of forms in Europe and Asia.⁵ However, it remains difficult to determine the exact size of each market segment, due to the varying weight of synthetic CDO issuance in these areas and the differences in measurement techniques used for this segment (see above).

In 2004, the global cash-flow CDO market totalled over USD 100 billion in terms of issuance volumes, of which three-quarters in the United States, one-fifth in Europe and the remaining 5% in Asia.

Cash-flow CDO issuance by geographical area



Source: JP Morgan

There are few estimates of the size of the synthetic CDO market. The Creditflux database⁶ does provide information on this segment, but it does not cover the whole market. Using figures from this source and estimates by JP Morgan, it is nevertheless possible to estimate the size of the synthetic CDO market as a whole using the different measurement criteria available (see table). For funded structures alone, issuance volumes appear to be almost double those of cash-flow CDOs.

It is rare to find data breaking down the issuance of synthetic CDOs by geographical area. It is however possible to determine their volume in relation to that of cash-flow CDOs in each area: 94% of European CDOs rated by Standard and Poor's in 2004 were synthetic, compared with 31% in the United States. Synthetic CDO issuance may therefore be considered to be a largely European phenomenon.

⁵ The geographical classification of CDOs is determined by their place of issue and sale. For example, the European CDO market refers to CDOs issued in Europe for European investors, but may include US underlying assets.

⁶ Creditflux provides data and publishes a review of the credit derivatives and CDO market.

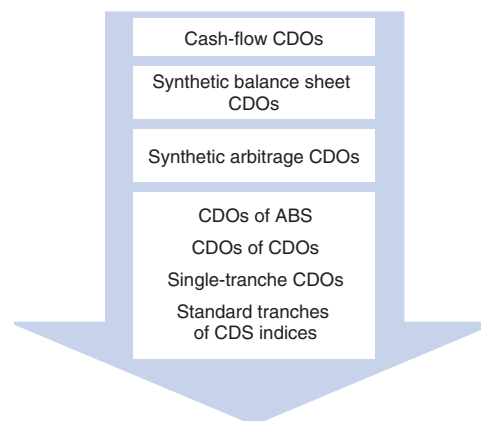
2|3 Increasing product sophistication

Since CDOs first appeared at the end of the 1980s in the United States, the range of structures and underlying assets has not stopped growing in size and complexity. However, the development of the market only started to gain pace as of the late 1990s, on the back of the boom in credit derivatives.

The growth of the credit derivatives market provided a new form of collateral, which was conducive to the expansion of the synthetic CDO market. Issuance of synthetic CDOs rapidly gained ground, as the use of credit derivatives gradually extended to several hundred underlying names. This growth was particularly marked in Europe, due to persistent legal and tax obstacles, in a number of Member States, to securitisation transactions involving the true sale of the underlying assets, as well as to the relatively limited interest in these transactions for refinancing purposes in view of the size of European banks' deposit base.

The boom in synthetic CDOs was also accompanied by a surge in arbitrage CDO activity. Indeed, by using a synthetic structure it is possible to generate a substantial yield spread between the underlying portfolio and the tranches issued, even though the narrowing of spreads since the end of 2002 has slightly reduced this source of "*arbitrage*". Firstly, as regards the yield on the underlying portfolio, CDS premia are often wider than the corporate bond spreads due to market imperfections.⁷ Secondly, the use of partly funded structures (see Box 2) reduces the CDO's cost of financing. As of 2002, the proportion of synthetic arbitrage CDOs in total issuance rose markedly. This trend was fuelled by banks declining interest in balance sheet CDOs due to both developments in their supervisory treatment (see prospect of Basel II)⁸ and to risk management considerations; banks tend to show a preference for managing the risk from their loans or corporate bond portfolios through individual credit default swaps rather than structuring CDOs.

Four generations of CDOs

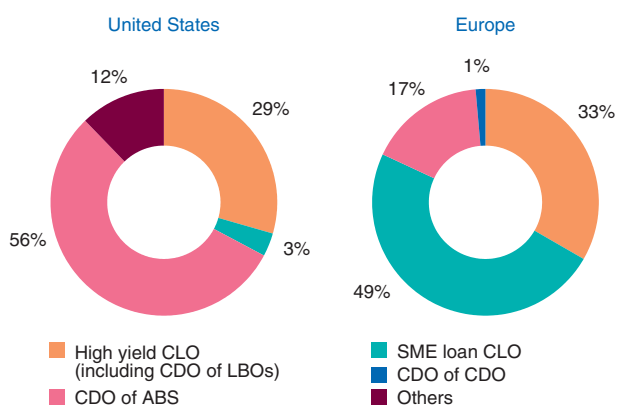


The broadening of the range of underlying assets was also largely associated with the rapid and pronounced narrowing of credit spreads as of late 2002: as spreads narrowed, increasingly few assets offered a sufficiently high yield to be worth securitising in *arbitrage* transactions, forcing CDO sellers to use more specific underlying instruments that provided additional yield due to their complexity or lack of liquidity. This gave rise to the securitisation of existing senior and mezzanine tranches of traditional structured finance products (CDOs of ABS, of RMBS, of CMBS, etc.). In 2004, structured finance CDO issuance stood at almost one-fifth of that of cash-flow CDO issuance in Europe and over half in the United States. Similarly, issuance of CDOs of CDOs (CDO2) emerged, above all in synthetic form. While, at the outset, these structures primarily stemmed from the restructuring of existing underperforming CDO portfolios, they then started to attract investors because of the yields and leverage they offered, despite their high correlation risk (see below). Lastly, the recent growth in leveraged buy-out transactions (LBOs) gave rise to the securitisation of syndicated loans originated as part of these transactions.

⁷ See Blanco, Brennan et Marsh (2004)

⁸ On the impact of the provisions of the New Basel Capital Accord with regard to securitisation, and in particular on the incentives for banks to transfer credit risk, see Joint Forum (2004).

Share of the different types of underlying assets in cash-flow CDO



Source: JP Morgan

Gradually, as investors became increasingly familiar with the CDO market, they started to target either tailored or standard products. The demand for tailored products resulted in the creation of single-tranche CDOs (see Box 3). Conversely, some market participants showed increasing interest in standard CDO tranches in order to maintain sufficiently liquid buy/sell positions for their active portfolio management strategies. To meet this requirement, synthetic CDOs based on standard tranches of indices representing CDS portfolios, such as the DJ iTraxx index (see Box 4), were created. Thanks to their standardisation and the transparency offered by the indices, these tranches are also likely to appeal to a wider array of investors seeking to increase their positions on credit markets. This polarisation between bespoke and standard tranches recalls that between the OTC and regulated segments of derivatives markets, while highlighting the increasing maturity of the CDO market.

While the above trends are general, a number of specific features have been observed on European and American markets. For example, although cash-flow CDOs remain slightly predominant in the United States, synthetic CDOs represent the bulk of the market in Europe (see above). The relative abundance of high yield assets (ABS, MBS, etc.) in the United States, which still makes it possible to construct viable cash-flow CDOs despite the low

level of spreads, goes some way to explaining their ongoing predominance. Conversely, in Europe, where bank intermediation remains high, CDOs backed by SME loans have developed further, especially thanks to the fact that the tranches issued sometimes enjoy *ad hoc* guarantee schemes, as is the case, for example, in Spain.

2|4 An increasingly diverse investor base

In the absence of reliable and comprehensive data, the universe of CDO market participants and its development can only be reconstituted on the basis of surveys or empirical observations. According to the annual Fitch Global Credit Derivative Survey, the main market participants appear to be credit institutions (net protection buyers and, hence, net sellers of CDOs) and insurance companies (net protection sellers and, hence, net buyers of CDOs).⁹ The latter include monoline insurers, which specialise in guaranteeing the credit risk of obligors. These insurers chiefly invest in unrated super senior tranches of synthetic structures. However, the involvement of insurance companies has tended to decline since 2002, in particular following the underperformance of the CDOs that they held in their portfolios. More recently, other market participants have stepped in, and the investor base has broadened to other players in the alternative and traditional asset management industry.

As the CDO market became increasingly complex, hedge funds and banks' proprietary trading departments seem to have strengthened their position. For example, they take advantage of the liquidity and the flexibility of standard CDS index tranches, to take long or short positions according to their views on levels of default correlation in the underlying portfolios (correlation trading). Likewise, they increasingly enter into hedging transactions with sellers of single-tranche CDOs (see Box 3). Lastly, they invest in unfunded tranches, which enables them to obtain a high degree of leverage with a minimal stake. Overall, Standard and Poor's estimates that hedge funds account for one-third of total activity on the CDO market.¹⁰

⁹ This observation is broadly corroborated by the "Results of the French market survey of credit risk transfer instrument", see Commission bancaire et alii (2004).

¹⁰ See Standard and Poor's (2005).

Recently, managers of traditional funds such as Undertakings for Collective Investment in Transferable Securities – UCITS – and pension funds also appear to have started to invest in CDOs, although this does not clearly emerge from available surveys. Against the current backdrop of low interest rates and the hunt for yield, some fund managers may have been attracted by the combination of the high ratings and much higher returns offered by CDOs than those of corporate bonds with the same rating. Moreover, investment banks are increasingly offering products¹¹ that enable them to sidestep the ban imposed, in some countries, on mutual funds on investing directly in synthetic CDOs, which are considered derivatives. In all events, the transposition of the UCITS III Directive into EU Member State law should facilitate mutual fund investment in credit derivatives and hence CDOs in the future. For these players, CDOs may rightly be considered a diversification tool for small portfolio allocations. However, there is no saying that all of these investors have the necessary competence to correctly assess and measure all the risks involved (see below).

3 | IMPLICATIONS IN TERMS OF FINANCIAL STABILITY

As credit risk transfer instruments, CDOs inherently facilitate the dispersion of this risk within the financial and banking sector and even beyond. By increasing the degree of completeness of the credit market, they are likely to have a positive impact from a financial stability viewpoint.

However, these instruments are also subject to specific risks, associated with the properties of the underlying portfolios and structures, which must be correctly understood and appropriately managed by investors.¹² But this is not always straightforward, as evaluating a CDO requires complex quantitative techniques that are all the more difficult to master due to the fact that they have not yet been implemented and tested over a sufficiently long period. Irrespective of their level of expertise, players on this segment may therefore be exposed to relatively high potential losses.

Moreover, the marked narrowing of credit spreads over the past two years seems to have been partly linked to the direct or indirect impact of the growth in CDO issuance, and in particular that of single-tranche CDOs. More generally, the various existing links between the CDO market, on the one hand, and the corporate bond and credit derivatives markets, on the other, raise questions as to the risks of the propagation towards the latter of strains that may arise on the CDO market due to its still limited liquidity and transparency.

3|1 A credit risk transfer instrument

As long as CDOs are backed by well-designed and robust structures, they can greatly facilitate the dispersion of credit risk across a wide range of investors. Their underlying portfolio can span many names and economic sectors, with the share of each name and each sector in the portfolio remaining limited to a very low level (typically 2%). Indeed, credit rating agencies have been particularly careful to verify these conditions, which are determinant in the process of rating CDO tranches.

Synthetic CDOs also enable investors to take positions on names that are not represented in the bond market, thus contributing to the completeness of the credit market and at the same time facilitating portfolio diversification. This is especially the case in the euro area, where the corporate bond market is concentrated in a small number of sectors (automobile, telecommunications, *etc.*), which are often overweighted in portfolios. Targeted acquisitions of synthetic CDO tranches are therefore a way of obtaining a more balanced and diversified exposure, making it possible to appropriately weight given names or sectors within a portfolio.

By allowing *ad hoc* exposure to a broader array of issuers, CDOs may also be very useful for managing bank portfolios that are not naturally diversified, such as those of regional banks or specialised banks whose risks are concentrated in certain sectors of activity. Such institutions can therefore determine, using internal models, the best names to ensure a good diversification of their portfolio and invest accordingly in CDOs referencing the names in

¹¹ In particular in the form of instruments whose principal is guaranteed and whose return is linked to that of the CDO market.

¹² For more details on the need for adequate risk management for credit risk transfer instruments, see Commission Bancaire et al. (2004).

question. Similarly, they can also issue balance sheet CDOs in order to reduce risks on sectors or names to which they feel overexposed.

3|2 Specific risks

CORRELATION RISK

It is much more difficult to assess the credit risk of a portfolio containing a number of names than that of companies taken individually. For the former, it is necessary to take into account the fact that the default of a given obligor may result, to different degrees, in the default of other obligors in the portfolio. This problem is particularly relevant in the case of CDOs, for which the performance of the individual tranches depends largely on the degree of correlation of the defaults that may occur in the underlying portfolio. The risk of CDO tranches must therefore be analysed in two stages: first, the probability of default (PD) of each obligor in the underlying portfolio is determined (usually using ratings), and, second, the potential loss distribution of the portfolio is estimated (using models and ad hoc assumptions on the degree of default correlation).

Indeed, depending on the assumptions used, the distribution of expected loss on the underlying portfolio varies considerably (see chart). For a low correlation, underlying names tend to display independent trends, and the distribution is centred

around a relatively low level of expected loss. Conversely, a high degree of correlation results in an asymmetric distribution with an increase in the probability of extreme events (either no obligor defaults, or all obligors default simultaneously).

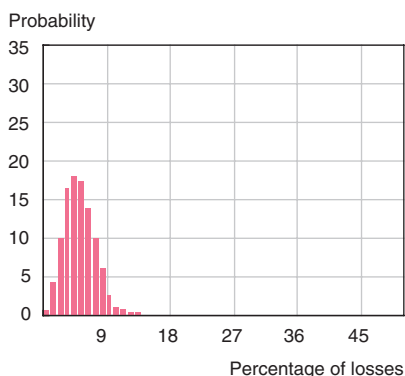
Consequently, the tranching of a CDO, according to an order that concentrates the risk in the most subordinated tranches, generates a variety of impacts of the default correlation on the performance of the different tranches. Each tranche – senior, mezzanine, equity – therefore has a different sensitivity to this correlation.

On the basis of their models and correlation assumptions, rating agencies determine the level of protection required for the senior tranche of a CDO to obtain a AAA rating. This is a key aspect of the structure, given that any estimation error of the default correlation may result in inappropriate structures that are exposed to sharp and sudden downgrades.

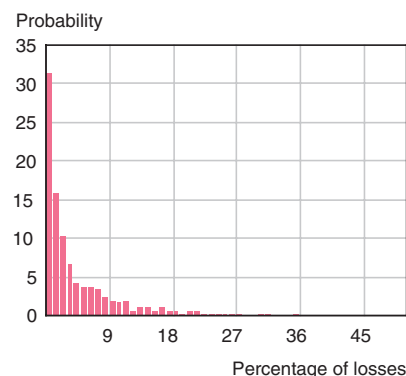
However, the choice of appropriate default correlation assumptions remains difficult. The correlation between two companies that have never defaulted is by definition very hard to estimate. Consequently, CDO structures are exposed to the risk that the correlation assumptions governing their design may be incorrect. This risk is particularly high in the case of CDOs of CDOs where a single name may appear several times in the underlying portfolio, thus potentially multiplying the effects of a correlation estimation error.

Degree of correlation and distribution of losses of a reference portfolio of a CDO

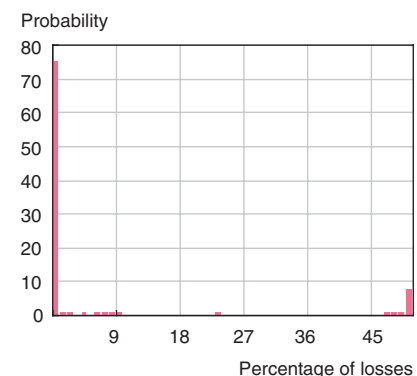
Low correlation (1%)



Average correlation (45%)



High correlation (99%)



Source: Merrill Lynch

The recent launch of standard tranches of CDS indices (see Box 4) provides an initial partial response to this difficulty associated with the measurement of the correlation. It makes it possible to derive an indicator of the level of default correlation from the price of tranches.

RISKS ASSOCIATED WITH THE STRUCTURES

Aside from risks associated with the composition of the reference portfolio, CDOs also entail risks more specifically linked to the structure used for transferring the income streams and/or the credit risk of the underlying assets to investors.¹³

Legal risk is of fundamental importance because legal and documentary issues are at the heart of both ensuring the efficiency of risk transfer and of clearly defining the role of the different parties involved in a CDO structure. In the case of cash-flow CDOs, the true sale of underlying assets to the SPV must be guaranteed, so as to ensure that investors enjoy their full rights in respect of these assets. Furthermore, the SPV must be legally protected from all consequences of a bankruptcy of the originator, in particular regarding its rights in respect of the underlying assets. Lastly, the role of third parties involved in the structure must be very clearly defined in order to prevent any operational or execution risks. This may require replacement mechanisms should one of the parties (in particular the servicer) no longer be able to meet its obligations.

In the case of synthetic CDOs, it is of the utmost importance to ensure the effectiveness of the legal documentation governing the derivative contract entered into by the SPV, in particular with respect to the definition of credit events. As a rule, the broader and less clear the definition of a credit event, the more CDO investors, which are protection sellers, are exposed to the risk of loss. However, progress has recently been made in this area, thanks in particular to ISDA efforts¹⁴, which resulted, in 2003, in the creation of standard documentation for credit derivatives. This documentation is currently widely used for CDOs and includes a clear and relatively narrow definition of credit events.¹⁵

Third party risk is also extremely important, as the inability of a third party to meet its obligations could jeopardise the viability of the transaction. This risk is particularly relevant in the case of cash-flow CDOs, where it takes the form of counterparty risk (*vis-à-vis* the counterparties of interest rate or foreign exchange swaps, or providers of external credit enhancers). This risk is less common for synthetic CDOs, where it only arises in partly-funded transactions *vis-à-vis* the counterparty of the super-senior swap. In order to manage this risk, highly-rated counterparties are usually chosen, and replacements are provided for whenever possible in the event of a rating downgrade or failure of a counterparty.

Lastly, if a cash-flow or synthetic CDO is actively managed, its performance and robustness naturally depend on the ability of the fund manager to construct an appropriate underlying portfolio, and if necessary to substitute some of the assets in the portfolio at any point in the life of the CDO. In this respect, it is important that these actions be duly framed by the CDO's legal documentation in order to avoid possible conflicts of interest and to ensure in all circumstances equal treatment for holders of the different categories of tranches.

3|3 CDO valuation is delicate and subject to model risk

Financial institutions investing in CDOs are often required to mark them to market. This requirement is expected to be bolstered by the application of IFRS. However, the secondary CDO market is very narrow, or even non-existent. Admittedly, a number of large investment banks have recently been providing quotations for certain CDOs. Other than these still rare cases, market prices are only available for tranches of CDS indices that cannot be used for valuing CDOs with a non-standard underlying portfolio. Investors must therefore calculate theoretical prices for CDOs. However, the correlation assumptions utilised in the valuation models are uncertain (see above), and there exists a range of models¹⁶ that are themselves complex and yet to prove their worth. Investors, including those using

¹³ For further details, see Cousseran et al. (2005)

¹⁴ International Securities Dealers Association

¹⁵ This definition includes the failure, default and some forms of restructuring. See ISDA (2003).

¹⁶ For example, they may use a number of types of copula functions, the most commonly used being the Gaussian function.

Box 4

Benefits of standard tranches of CDS indices for the European CDO market

In June 2004, the Dow Jones iTraxx(r) Europe index was created from the merger between two existing CDS indices. At the same time, standard tranches of CDOs based on the iTraxx were issued. These tranches replicate the behaviour of unfunded synthetic CDO tranches whose reference portfolio comprises names in the basket of the CDS index.¹

Improved transparency, liquidity and risk management

These standard tranches have greatly contributed to the maturity of the CDO market and have resulted in:

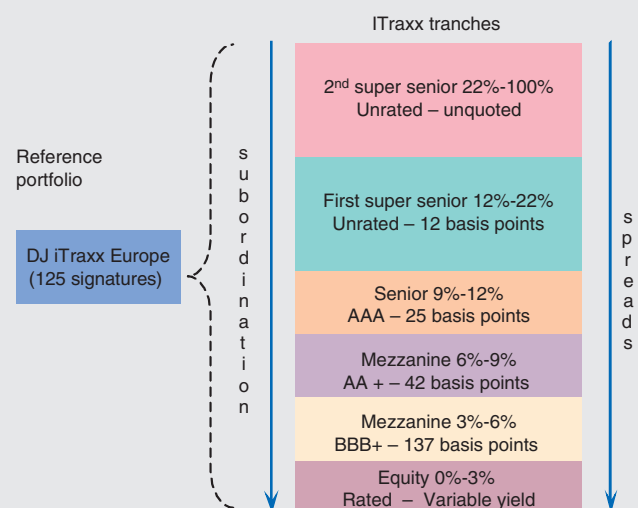
- an improvement in the transparency of the market, as tranche prices are continuously quoted;
- a significant increase in market liquidity (transactions totalled almost USD 90 billion in 2004, according to Creditflux), allowing protection to be bought and sold at a lower cost (bid/ask spreads of at most 5 basis points)
- an improvement in the management of market participants' risk, as they now have access to daily valuations from which they can obtain, using models, levels of implied correlation. In view of their liquidity, iTraxx tranches (or the iTraxx index itself) can also be used by arrangers for the dynamic hedging of single-tranche CDOs.
- a broadening of the investor base to new market participants such as hedge funds, which use these instruments for their sophisticated trading strategies (correlation trading).

A concrete example

An extract of an investment bank's trading screen is reproduced below, showing the price of 5 tranches of the iTraxx, by decreasing degree of subordination. From top to bottom: an equity tranche (0%-3%) two mezzanine tranches (3%-6%, 6%-9%), a senior tranche (9%-12%), a first super senior tranche (12%-22%). Furthermore, a second non-quoted super senior tranche (22%-100%) completes the structure.

Trading screen showing iTraxx tranches

iTRAXX EXOTICS - Tranched iTRAXX			
SY DJ ITRAXX EUROPE RUN (S2)			
TRANCHE	Running Spread	DELTA	MID IMPLIED CORREL
0% - 3%	500/500	18.1x	21.9%
3% - 6%	137/143	6.3x	6.8%
6% - 9%	42/47	2.4x	14.3%
9% - 12%	25/29	1.3x	21.4%
12% - 22%	12/14	0.7x	30.5%
Delta exchange	@ 37		
Index maturity	Mar-10		

Diagram of a standard CDO based on the iTraxx

Official ratings do not exist for iTraxx tranches. Those displayed above are implied ratings provided by Fitch.

This screen is interpreted as follows:

- If a client of the investment bank buys protection on the mezzanine tranche 3%-6%, it pays the bank a premium of 143 basis points per year. If the proportion of losses on the iTraxx exceeds 3%, the client will be compensated. Compensation is however limited (contrary to options) to the size of the tranche, i.e. 6%-3% = 3% of the notional amount of the transaction.
- The equity and mezzanine tranches are leveraged as their sensitivity to changes in credit spreads of the underlying index (delta) is much higher than 1. For example, the quotations show that a 1 basis point rise in the iTraxx results in an 18.1 basis points widening of the equity tranche spread (delta = 18.1).
- The levels of implied correlation appear to vary significantly across tranches.

¹ I.e. The 125 most liquid underlying names of the European CDS market. See www.djindexes.com.

sophisticated risk management tools, are therefore particularly exposed to model risk, especially in terms of estimating the default correlation of the underlying portfolio. Moreover, in the current low interest rate environment, some traditional investors (UCITS, pension funds, insurance companies, *etc.*) may have been investing in CDO tranches to capture the yield pick-up generated at a given rating level (see Box 5), without always being able to correctly value or manage the risk entailed. If such behaviour, favouring the search for yield over the safety of investments, started to become widespread, it could, given the losses that may be incurred, pose a risk to financial stability. Nevertheless, at present, these positions still appear sufficiently modest for such a threat to be significant.

3|4 Complex hedging techniques

Sellers of CDOs may be exposed to market risk on some structures that, in their design or management, require regular transactions on credit markets. This particularly applies to single-tranche CDOs in which the originator of the structure sells the tranche directly to an investor (see Box 3) and in doing so becomes a protection buyer, thus exposing itself to a risk associated with changes in credit spreads on the names in the underlying portfolio of the tranche it has sold.¹⁷

It must therefore use dynamic hedging techniques (*delta* neutral) by entering into individual credit default swaps and/or by purchasing corporate bonds and/or CDS indices to hedge market risk. Amounts for hedging are calculated using mathematical models that are still not sufficiently tried and tested and, moreover, are contingent on default correlation assumptions regarding the reference portfolio.

Market risk also entails liquidity risk, as dynamic hedging is only effective if the instruments used are sufficiently liquid. However, among the instruments presented above, only CDS indices have a appropriate degree of liquidity due to their standard nature. But due to this very fact, they do not allow for perfect hedging. The arranger must therefore refine the hedge by using individual credit default swaps. Yet single-name CDSs is a truly liquid market

for only around 500 to 1000 names. Therefore, the arranger often remains exposed to a liquidity risk that may exacerbate its losses in the event of a situation of stress on credit markets.¹⁸

The fact that the population of arrangers of single-tranche CDOs is very concentrated increases market risk and liquidity risk. Moreover, these risks may spill over, given that many players are involved in the risk management chain. These players include, in addition to the arrangers themselves, investors and the counterparties of hedging transactions, which are often hedge funds.

3|5 Impact of CDOs on credit spreads

The links between the CDO, corporate bond and credit default swap markets vary in terms of how direct they are, but all indicate that CDO issuance is a technical factor that now has a significant impact on the level of credit spreads.

Firstly, structuring non-synthetic *arbitrage* CDOs requires corporate bonds or ABS to be purchased, thus giving rise to a demand that may be significant in relation to the absorption capacity of the often narrow primary and secondary markets (in particular in Europe), and exerting downward pressure on spreads.

Secondly and more significantly, given the volumes involved, synthetic *arbitrage* CDOs create a close link with the CDS market. In the case of single-tranche CDOs, dynamic hedging is implemented by the arranger of the structure on the CDS market (or using CDS indices). Since the single tranches are usually at the mezzanine level, they concentrate much of the credit risk of the reference portfolio, which forces the arranger to hedge its position by selling protection for an exposure several times greater than the tranches' notional value (see Box 3). As a result of this mechanism (relating to the leverage of the single tranche), arrangers tend to lower the price of protection, and hence the CDS *premia*. This mechanism suggests that the boom in volumes of single-tranche CDOs might have significantly contributed to the marked narrowing of credit spreads since mid-2003.

¹⁷ It is also at risk from the possibility of sudden defaults on the underlying portfolio (*jump-to-default risk*), but this risk is far more difficult to hedge.

¹⁸ See Fitch Ratings (2004)

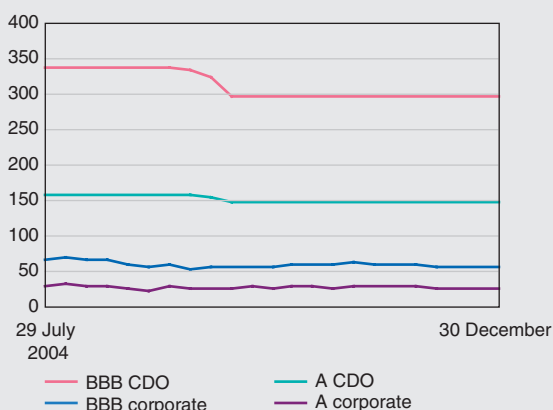
Box 5

Are ratings a reliable measure of the risk of CDOs?

It is not uncommon for investors to assess the risk of an instrument in which they wish to invest chiefly on the basis of its rating. Indeed, ratings reflect, in the form of a simple alphanumeric symbol, the creditworthiness of a security, making it easy to rapidly compare the securities of different issuers across countries and sectors. As senior and mezzanine tranches of CDOs benefit, by construction, from investment grade ratings (typically AAA or A), they may appear to be an attractive and apparently low risk investment, especially since they offer much higher returns than those of corporate bonds with the same ratings. However, the structured nature of CDOs limits the significance of their rating, as it only reflects certain aspects of their credit risk.¹ While ratings reflect a security's average level of risk, they do not factor in the dispersion of risk around its mean.

Synthetic CDO and corporate bond spreads

(euro area, in basis points over Euribor)



Source: JP Morgan

Average annual proportions of ratings downgraded, upgraded and left unchanged by category of security

	(en %)			
	Downgrade rate	Upgrade rate	Unchanged rate	Withdrawn rate
ABS 1991-200	2.95	1.27	86.59	9.19
CDO 1991-2002	10.88	0.57	83.35	5.20
CMBS 1991-2002	1.57	3.49	88.72	6.22
RMBS 1991-2002	1.88	3.61	89.18	5.34
All structured products 1991-2002	2.99	2.52	87.66	6.84
Corporate bonds 1983-2002	8.88	3.90	81.49	5.73

Source: Cantor and Hu (2003)

Yet, the sequential allocation of losses to CDO tranches results in expected loss being concentrated in subordinated tranches, which consequently have a very different risk profile, for the same rating, from that of corporate bonds. For the latter, the probability of extreme events, such as the loss of an investor's entire stake, is very low. Conversely, for the mezzanine tranche of a CDO, a fairly low proportion of losses on the underlying portfolio (around 6%-10%) would suffice for an investor to lose its stake. This also applies, to a lesser extent, to AAA-rated senior tranches of synthetic CDOs that, despite their name, are often subordinated to the super-senior tranche. Investors in CDOs that focus on excess returns, only using ratings to assess the risk, might thus be exposing themselves to greater-than-expected losses.

Furthermore, CDO ratings, like corporate bond ratings, have proven much more volatile than those of traditional securitisation products (see table). They are also liable to be downgraded more frequently and more severely than traditional securitisation products or corporate bonds. While records available in this area are still too incomplete to draw definitive conclusions, this pattern nevertheless shows the difficulty of the task of rating agencies, given the wide range of factors that influence CDO ratings.

In order to interpret the pattern of CDO rating changes it is necessary to take account of both structural and cyclical factors. The main structural factor is the concentration of the CDS market, which comprises 500 to 1000 liquid names, forcing arrangers of synthetic CDOs to constantly draw on the same pool. Some names are found in dozens of CDOs and, consequently, if they default (or their rating is downgraded) the impact would be greatly amplified. On the cyclical side, CDOs designed in the 1990s and the early 2000s often contained design flaws, in particular in terms of diversification, which led rating agencies to step up their requirements. The combination of these two types of factors explains the 2002 episode, the "annus horribilis" for CDOs, during which the rating of a quarter of European structures was downgraded; 90% of tranches downgraded were synthetic and 60% had an insufficiently diversified portfolio (less than 100 names).

¹ See Committee on the Global Financial System (2005)

To date, this mechanism does not seem to have resulted in major distortions in the pricing of the risk of the names concerned. Admittedly, though, credit market fundamentals have been continuously improving. Nevertheless, it is possible that, in the long term, the success of single-tranche CDOs may cause spreads to narrow further, to the extent that investors may no longer be sufficiently rewarded for the risk they take. At the same time, we cannot rule out, in the event of a heightening of credit risk or a general reassessment of this risk by the market, a reversal in this leverage-related mechanism, which would then amplify the correction of the market and contribute to a substantial widening of credit spreads.

In view of the ever closer links between the CDO market and the other segments of the credit market, strains affecting one segment may spill over to other segments with an amplifying effect, thus increasing the risks of contagion in the financial system. The still relatively limited liquidity and transparency of the CDO and CDS markets may exacerbate this *phenomenon*, and could lead to sharp price swings and then prevent these markets from being able to reallocate risk appropriately.

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GLOSSARY

ABS (Asset backed security): A security that represents an interest in non-mortgage financial assets (consumer loans, credit card debt, etc.).

Arranger: In a CDO structure, the arranger is the entity (an investment bank or an asset management firm) responsible for placing tranches with investors in return for a fee. In the case of “arbitrage” CDOs, it may also be the originator of the transaction, or even the entity which actively manages the underlying portfolio.

CBO (Collateralised Bond Obligation): Type of CDO where the underlying portfolio comprises bonds.

CDO (Collateralised Debt Obligation): A security backed by a pool of bank loans and/or negotiable financial instruments (bonds, other debt securities, etc.), and/or credit derivatives.

CDO² (CDO of CDO): Type of CDO where the underlying portfolio is itself made up of CDO tranches.

CLO (Collateralised Loan Obligation): Type of CDO where the underlying portfolio comprises bank loans.

CSO (Collateralised Synthetic Obligation): Type of CDO where the underlying portfolio comprises credit derivatives.

CDS (Credit Default Swap): A financial contract between two parties in which a protection buyer pays a premium to a protection seller in exchange for protection against the occurrence of a credit event on the reference entity.

Seller: In a securitisation structure, the seller designates the entity (usually a bank) selling its assets to the special purpose vehicle.

CMBS (Commercial Mortgage-Backed Security): A debt obligation that represents claims to the cash flows from pools of mortgage loans on commercial property.

Reserve account: In a securitisation structure, a reserve account is used to provide credit enhancement. Excess cash flows from the transaction are progressively deposited in this account.

Equity (tranche): In a securitisation structure, this tranche absorbs the first losses arising from defaults on the underlying portfolio.

Copula Fonctions: These functions have recently been introduced in applied finance to obtain a broader and more realistic range of joint distributions describing the dependence structure between a number of variables.

Originator: The entity setting up a securitisation vehicle. Depending on the type of securitisation, the originator may be the arranger or the seller.

Mezzanine (tranche): In a securitisation structure, this tranche absorbs the losses arising from a default on the underlying portfolio if they exceed the value of the equity tranche.

Monoline: An insurer that provides financial guaranty insurance for bond issuance or securitisation transactions.

Servicer: In a securitisation structure, the servicer is the entity charged with collecting cash flows on the underlying portfolio on behalf of the vehicle, which are subsequently paid to the tranche holders. This function is generally performed by the seller.

RMBS (Residential Mortgage-Backed Security): A debt obligation that represents claims to the cash flows from pools of mortgage loans on residential property.

Senior (tranche): In a securitisation structure, this tranche absorbs the losses arising from a default on the underlying portfolio if they exceed the amounts of the equity and mezzanine tranches.

SPV (Special Purpose Vehicle): In a securitisation structure, an SPV is a standalone ad-hoc vehicle with a finite life, which holds the underlying asset portfolio and issues securities representing this portfolio.

Super-senior (tranche): In a partially-funded synthetic CDO, this unfunded tranche benefits from the subordination of the senior tranche. Therefore it represents the piece of the deal that offers the best protection against losses.