NATIXIS
ASSET MANAGEMENT

CLO 2.0

Mechanism, modelling and management

Intended for professional clients as defined by the MiFID directive

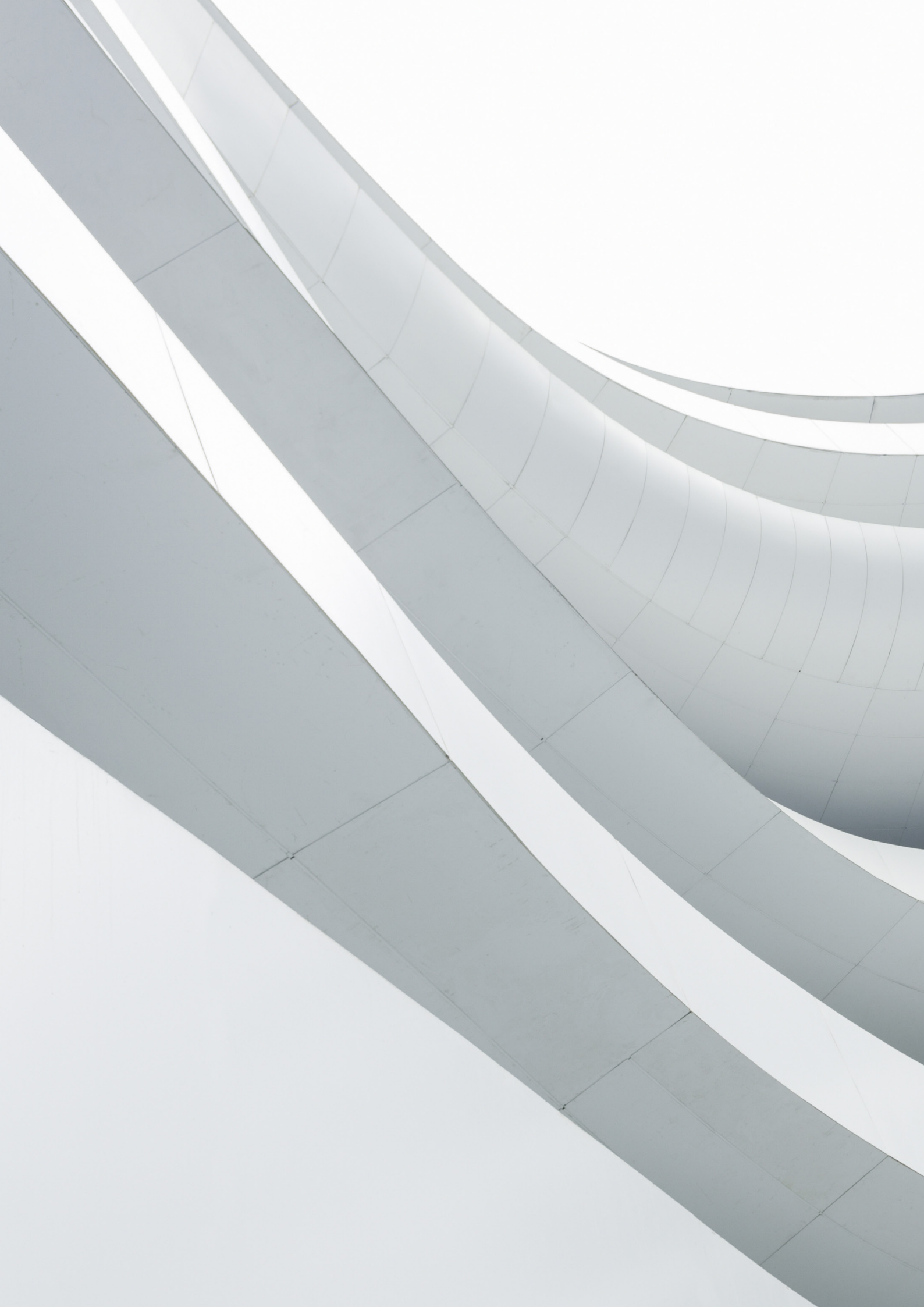


TABLE OF CONTENTS

INTRODUCTION

Among the wide class of structured credit derivatives, **the Collateralized loan obligations** (CLOs) form a specific type of securitizations, backed by **a pool of leveraged loans.** These loans are loans to large to middle-sized corporations, syndicated by banks. They are referred to as leveraged loans because the level of debt of the corporation is generally significant, for instance through leveraged buyout operations (LBO). These loans are, generally, **senior secured loans.**

Similar structures, based on home mortgages, were issued in the early eighties, and this securitization mechanism has been applied to a large scale of loans (leases, credit cards, auto-loans…). The common feature is the "tranching" mechanism. The payments of the loans (interest and principal) are used to pay interest and principal of notes, with **a specific order of seniority.** Each note represents a certain part - **a tranche**[1] - of the initial capital and is protected against the defaults (which may occur in the pool of loans) by all the tranches of lower seniority. **The most senior and mezzanine tranches are rated,** while the lowest – **the subordinated tranche also known as "equity"** – is not, and receives the extra-outcome of the pool. By the securitization mechanism, the highest tranche in the structure can be rated AAA, while the underlying loans are typically around BB rating. Moreover, there are two main types within CLOs: static CLOs where the pool of loans remains the same throughout the life of the transaction; and managed CLOs that have dynamic pool of loans where assets are actively bought and sold by the manager. Static CLOs are balance sheet CLOs created to securitize certain loans in order to remove them from balance sheets and therefore reduce regulatory capital requirements. On the other hand, managed CLOs, known as arbitrage CLOs, are created to generate additional income from the pool of loans over the average return of the issued tranches. **CLOs are usually managed,** with a reinvestment period where loans can be purchased to offset prepayments.

This securitization mechanism has several benefits for banks, borrowers and investors:
- It lowers the risk for banks, as they can issue loans and sell them to investors through CLOs
- As a consequence, it eases the lending of money and its costs for borrowers.
- It provides investors with a range of notes, with different profiles of risk/return.

The internal consistency of the structure is maintained by internal tests, based on principal and interest. The breach of certain tests triggers a sequential amortization of the tranches, starting from most senior. The payment structure is referred to as **the payment waterfall.**

The CLO issuance nearly stopped in the aftermath of the credit crisis of 2008-2009. In the US, the rebound in the CLO market occurred as soon as 2012, whereas in Europe the recovery was slower (cf. Larsson and Bakke (2013)). New CLO issuances incorporate more conservative features (sometimes referred to as CLO 2.0), in order to prevent from the massive downgrade and huge loss in market value:
- The rating agencies have revised their rating methodologies
- Accordingly, the tranching is different with smaller highest tranches and larger equities, and the value in the structure has significantly moved with larger margins for AAA notes
- Reinvestment periods tends to be shorter
- Retention rules have been put in place by the regulators, in order to obtain a convergence of interests between the investors and the manager.

In Section I, we study the mechanism of the CLO, with a focus on the waterfall, and a case study of a typical CLO structure. Section II deals with the structuring and the management of CLOs. Section III investigates the modeling of risk and the mark to model of CLOs. Section IV gives a short overview of the Solvency II treatment of CLOs. Section V investigates the accounting treatment of CLO notes.

(1) From the French word « tranche » which means slice.

Publishing Director:
Ibrahima Kobar
Co-chief Investment Officer,
in charge of Fixed income
investment division

Written by
Quantitative Research
and Analysis
Fixed income:
Nathalie Pistre,
PhD, Head of the team,
Deputy Head of
Fixed income investment division

Guillaume Bernis,
PhD and **Kaouther Salhi**

With the contribution of
Sébastien Boulegue,
Alexandre Boulinguez,
Sébastien Kessas and Jean-Luc Simon

01

COLLATERALIZED LOAN OBLIGATIONS MECHANISM

A SPECIFIC TYPE OF STRUCTURED FINANCE INSTRUMENTS

Structured finance instruments are a way to pool assets together and issue securities to be sold to investors who would not be interested or able to purchase directly the underlying assets. There are several types of structured finance instruments.

- **Asset backed securities (ABS)** are securities whose payments are collateralized by a pool of small and illiquid assets such as small loans, leases, credit card debts, and so on.
- **Mortgage backed securities (MBS)** are collateralized by mortgage loans.
- **Collateralized debt obligations (CDO)** consolidate a group of debt assets such as loans and bonds into a pool, and then divide it into various tranches with different risk/return profiles. The tranches are issued by an ad hoc structure known as the securitization vehicle and called the special purpose vehicle (SPV). The most common types of CDOs are the CLOs which are backed by leveraged bank loans and the collateralized bond obligations (CBOs) which are backed by corporate bonds.

A CLO is therefore an effective way to securitize loans and resell them on the market in the form of various tranches, for different classes of investors. In other words, a CLO can be characterized as a way of creating multiple assets with various risk characteristics from a same portfolio of loans. The most senior note – i.e. the highest tranche in the structure – is generally rated AAA, while the underlying pool of loan is generally high yield (B/BB ratings). This enhancement of credit quality holds because investors of less senior tranches bear more risk. In particular, the equity holders accept to bear the first loss, in return for a higher expected return. As each tranche is protected from the losses in the pool of loans by the tranches which are below in the structure, the returns of the tranches increase from the most senior to the equity.

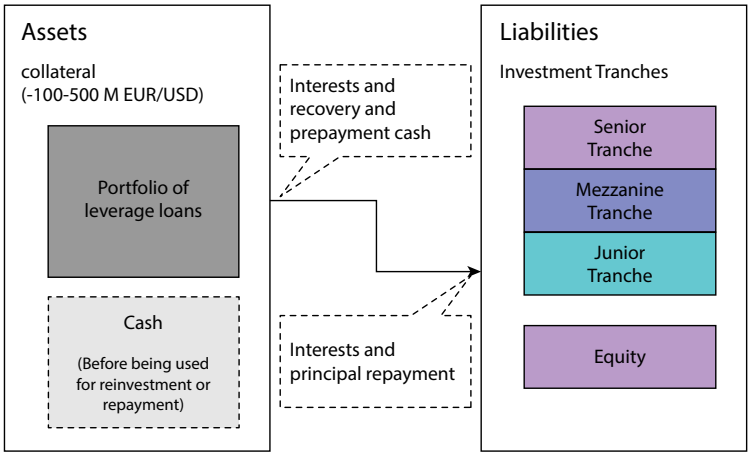
WHAT IS A BASIC CLO STRUCTURE?

The CLO structure is made up of two parts: the pool of loans or the portfolio of assets, also known as the **collateral,** and various tranches forming the liabilities of the CLO. Like other securities backed by assets, a CLO can be thought of as a promise to pay investors in a predefined order of priority. In fact, the CLO is sliced into tranches forming various debt notes with different ratings and one non-rated tranche called the **equity** or the **first loss tranche. The tranches receive interest and principal payments based on interests and other cash flows that the CLO collects from its pool of loans.**

- The first loss tranche or equity covers x% of collateral's principal and absorbs the first default losses accounting for x% of the total collateral. The equity tranche is similar to shares issued by corporations as it provides no coupon payment and no principal repayment at the end.
- The second tranche (junior tranche) covers y% of collateral principal. It is protected by equity tranche against x% of losses and absorbs the next y% default losses on the portfolio of loans. The junior tranche is usually rated between BB and B.
- The third tranche (mezzanine tranche) covers z% of collateral principal. It is protected by equity and junior tranches against (x+y)% of losses and absorbs the next z% default losses on the portfolio of loans. The mezzanine tranche is usually rated between AA and BBB.
- The last tranche (Senior tranche) is usually rated AAA and is protected against (x+y+z)% of losses by equity and junior and mezzanine tranches. It is therefore affected only by the last defaults on the pool of loans.

Figure 1: Assets-liabilities structure of a CLO

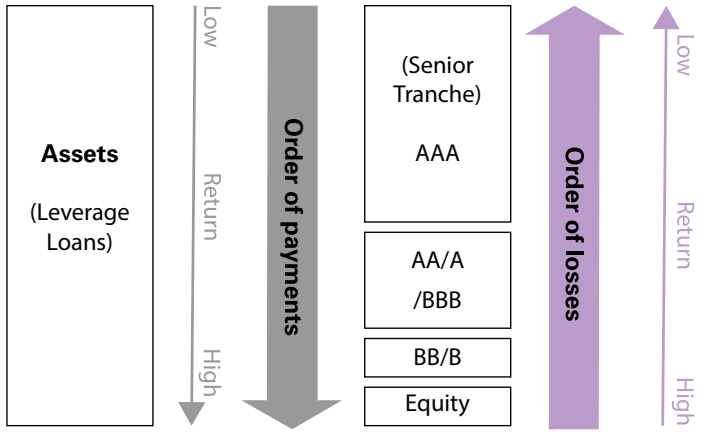
Source: Natixis Asset Management



Interests paid to tranches reflect their level of risk. Indeed, the most junior tranches, located at the lowest part of the structure, are the first to suffer from losses, in the case of loans defaults and insufficiency of interests collected from the pool of assets to pay all its investors. The last to incur losses due to non-payment of interests are the most senior which are the safest tranches. Therefore interest rates or spreads over a predefined interest rate paid to tranches depend on their exposure to default risk so that the safest tranches receive the lowest rates and the lowest tranches receive the highest rates to compensate for higher default risk. A weaker rating indicates a higher risk and therefore a higher reward.

Figure 2: Risk/Return profiles in CLO

Source: Natixis Asset Management



To illustrate this feature, consider a European CLO having an initial collateral amounting to 415.6 M euros and issuing the following tranches in order of seniority (priority of payments): Senior sized 57% of the total and rated AAA; Mezzanine sized 24% of the total and rated AA; A; BBB; Junior sized 8% of the total and rated BB; B; Equity sized 11% of the total. Each rated tranche has a defined fixed coupon or a spread over a defined interest rate. CLOs issued recently generally include floors on the interest rate to guarantee a minimum interest to noteholders. The structure and the spreads are presented in the Table 1 and will be used for following numerical applications. Investors in equity tranche can be thought of as the shareholders of the CLO structure since their investment is directly affected by defaults on the portfolio of loans and they get paid the excess of interest remaining after paying interests due to all other tranches if any, although, technically, there is an actual, minimal, "equity capital" in the SPV (held by the legal owners of the SPV, e.g. a charitable trust for an Irish fund).

Table 1: European CLO 2.0. example of structure

Source: Natixis Asset Management

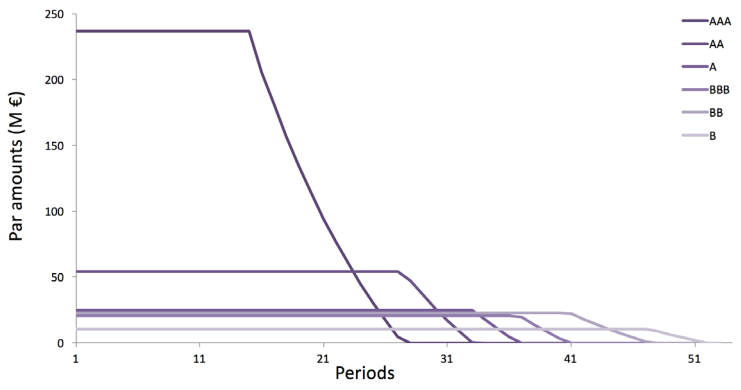
Liabilities	S&P Rating	Moody's Rating	CCY	% of total	Coupn Libor +	Floor
Senior Tranche	AAA	Aaa	EUR	57	0.96%	0%
Mezzanine Tranche	AA	Aa2	EUR	13	1.67%	0%
	A	A2	EUR	6	2.40%	0%
	BBB	Baa2	EUR	5	3.30%	0%
Junior Tranche	BB	Ba2	EUR	5.5	5.70%	0%
	B	B2	EUR	2.5	7.65%	0%
Equity Tranche	NR	NR	EUR	11	Excess	-

PRIORITY OF PAYMENTS AND "WATERFALL"

Payments to the noteholders and other parties are made in a predefined sequence in order to meet the priority of payments also known as the **payment waterfall.** This means that the most senior tranches receive their interest first and as shown in the Figure 3 their principal is repaid fully before starting to repay the next tranche. Therefore, junior tranches can miss receive interest and are not amortized until all more senior tranches are fully repaid. The CLO structure also pays other expenses and fees each having a defined order in the waterfall.

Figure 3 – Evolution of the par amounts of tranches of the CLOEXP (Annual CDR = 5%, Recovery rate = 50%, Prepayment rate = 25% p.a.). These graphs show that the senior tranche is repaid initially and must be fully repaid before starting to reimburse other tranches.

Source: Natixis Asset Management



The cash flows collected from the collateral as well as the payments made to the noteholders are **divided into interest payments and principal payments.** Therefore we can distinguish two sub-waterfalls in the overall waterfall of the CLO: **waterfall of interest and waterfall of principal.** First, the waterfall of interest defines the priority within the payment of interest to tranches and the payment of fees and is made first in the global payment sequence. Second, the waterfall of principal relates to the repayment of principal on tranches using prepayment and recovery cash flows collected from the pool of loans.

In normal cases, where no exceptional event occurs on the portfolio of loans, payments among the two sub-waterfalls do not interfere. This means that interests paid to the loans will be used only for payment of interests and fees. However, in some specific cases, interests can be used to reinvest in collateral or to repay the principal of the most senior tranche in the structure. The definition of such cases depends on the result of three internal tests in the CLO structure that are presented in the next section.

INTERNAL TESTS: A SELF-CORRECTION MECHANISM

The CLO structure has a self-correction mechanism. In fact, it contains internal tests calculated each period for all tranches, except equity, before any payment is made to noteholders. These tests are done in order to enhance the match between assets and liabilities and to test the ability of the structure to meet its commitments to interest payment and principal repayment. We can distinguish between two main types of tests according to the impact of their results on the waterfall. First, the coverage tests consisting of: Overcollateralization (OC) tests and Interest Coverage (IC) tests are generally done for all tranches. The structure also includes Interest Diversion Test (IDT) generally done only for the most junior rated tranche. When coverage tests are breached, the priority of payments changes so that any available cash is used to pay down the rated tranches sequentially. When the interest diversion tests are breached, a part of the excess of interest that was going to be paid to the equity tranche is diverted to reinvest in collateral or to repay the rated tranches until the test is met. In order to limit the losses on the equity tranche in the case of breaches on IDT test, the diverted excess of interest cannot exceed half of total excess.

Overcollateralization tests

Overcollateralization refers to the amount by which the par amount of the collateral must exceed the total par amount of the issued notes. Overcollateralization is generally expressed as the ratio of the total par amount of available assets to the par amount of each tranche and the tranches senior to it in the payment waterfall. The par amount of available assets is the total amount of assets adjusted by defaults and recoveries and prepayments.

$$OC\ Ratio = \frac{Par\ amount\ of\ assets}{Outstanding\ amount\ of\ related\ tranche\ and\ all\ tranches\ senior\ to\ it}$$

Trigger thresholds of OC tests depend on the initial par amount of the tranche relative to the initial total par amount of the collateral. Triggers are usually more conservative on the US market compared to European thresholds.

Interest coverage tests

Interest coverage test is a ratio of the total interest payments collected from the pool of assets to the interest due on each tranche and all tranches senior to it in the priority of payments.

$$IC\ Ratio = \frac{Interest\ collected\ from\ assets\ (net\ of\ senior\ expenses)}{Interest\ due\ on\ related\ tranche\ and\ all\ tranches\ senior\ to\ it}$$

IC tests are generally done only for tranches rated BB and above.

Interest diversion test

The interest diversion test is calculated for the most junior rated tranche the same way the OC test would be calculated. However, the IDT test has a more conservative threshold than the one used for the OC test on the same tranche.

$$IDT\ Ratio = OC\ Ratio$$

The Table 2 presents indicative trigger thresholds for OC, IC and IDT tests for European and US CLO, based on several observations of existing deals in the market. The triggers for the European example relate to the example given in the Table 1 and are used in the following applications.

Table 2: Indicative CLO structures and corresponding tests thresholds for Euro and US markets

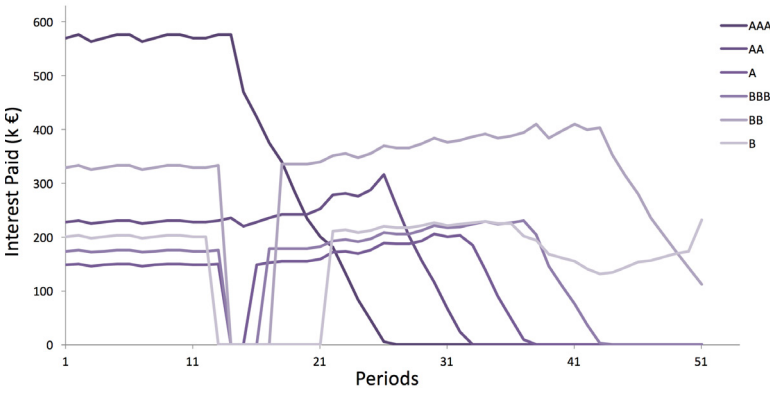
Source: Natixis Asset Management

	Euro CLO 2.0				US CLO 2.0			
Rating	**% of total**	**OC Trigger**	**IDT Trigger**	**IC Trigger**	**% of total**	**OC Trigger**	**IDT Trigger**	**IC Trigger**
AAA	57	128.00%	-	120.00%	62	121.60%	-	120.00%
AA	13	128.00%	-	120.00%	14	121.60%	-	120.00%
A	6	119.60%	-	115.00%	7	113.50%	-	115.00%
BBB	5	112.80%	-	110.00%	5	108.60%	-	110.00%
BB	5,5	106.70%	-	105.00%	4	104.70%	105.70%	105.00%
B	2	103.61%	104.11%	-	0	-	-	-
Equity	11	-	-	-	8	-	-	-

For an illustration of the impact of breaches of coverage tests, we compute the cash flows assuming that the annual constant default rate is 5%, the constant recovery rate is 50% and that we have 25% per annum of prepayment rate on the pool of loans. The Figure 4 shows that a breach of a coverage test occurs on period 13 on the tranche AA since on this period interest payments are interrupted after paying AAA and AA tranches. The remaining excess of interest is therefore used to repay the tranches in the predefined seniority in order to pass the coverage tests. Coverage tests continue to fail in subsequent periods and all coverage tests are met on period 21.

Figure 4 – Impact of defaults on interest payments to CLO tranches. The CLO structure is presented in Table 1 (Annual CDR = 5%, Recovery rate = 50%, Prepayment rate = 25% p.a.)

Source: Natixis Asset Management

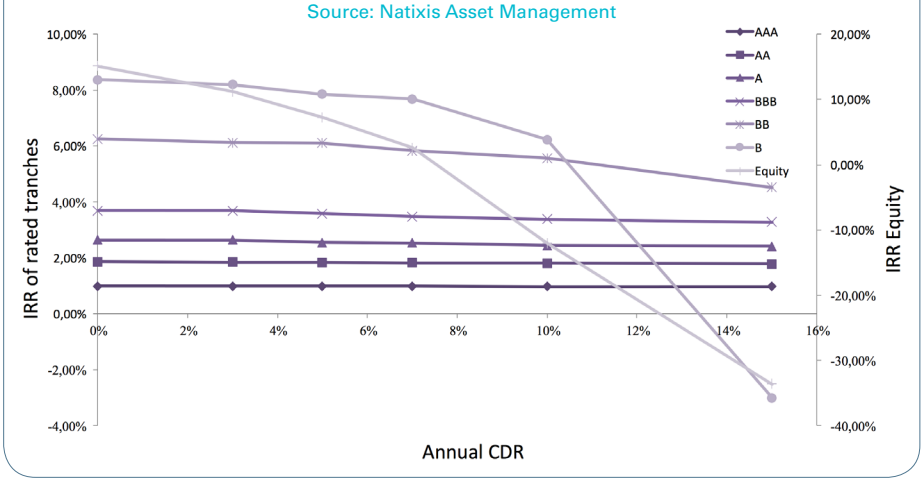


INTERNAL RATE OF RETURN OF TRANCHES

The impacts of the defaults that occur on the portfolio of loans depend on the seniority of the tranche since junior tranches absorb the first defaults to protect the tranches senior to it. Figure 5 shows the internal rate of return (IRR) of tranches rated AAA to B and equity tranche as a function of annual constant rate of default (CDR). We assume that the recovery rate is 75% and the prepayment rate equals 25% per annum and that all tranches are issued at par and we compute the IRR of each tranche for different defaults scenarios where CDR equals: 0%; 3%; 5%; 7%; 10%; 15%. As shown in the figure, the senior tranche (rated AAA) is not affected by defaults, the mezzanine tranche (rated AA to BBB) is slightly affected but maintains an IRR similar to the one obtained with no defaults assumption, even with extreme cases (for example, the IRR of the tranche rated A slightly decreases from 2.65% to 2.42% when the annual CDR increases from 0% to 15%), whereas the junior tranche and the equity tranche are significantly impacted by default events (for instance, the tranche rated B has a flat IRR when the annual CDR is almost 13% and the tranche equity has a negative IRR once the annual CDR exceeds 8%). The figure also shows that with no or little defaults the junior tranches have a better return compared to tranches with better ratings (in the case where there are no defaults: IRR equity is 15.12%; IRR B is 8.37%; IRR BB is 6.26%; IRR BBB is 3.69%; IRR A is 2.65%; IRR AA is 1.86%; IRR AAA is 1.00%).

Figure 5 – IRR of tranches as mappings of annual constant default rates (CDR) (Prepayment rate = 25% per annum, Recovery rate = 75%, all tranches are issued at par)

Source: Natixis Asset Management



FEES AND OTHER COSTS

In addition to the payment of interest to the noteholders, the SPV pays various fees and other ongoing costs and also pays upfront costs before issuing the debt notes. Legal costs and part of the structuring expenses are generally paid initially. The remaining structuring costs are paid as ongoing fees and are senior to all other payments in the waterfall. They can be a fixed or a nominal amount. The management fees are usually a nominal amount (about 0.5% per annum of the par amount of the collateral) and are split into two parts: a fee senior to interest payments on rated notes and a larger fee subordinated to them (often 0.15% and 0.35% or 0.2% and 0.3%). The asset manager can also get paid additional incentive fees once the equity tranche has reached a targeted internal rate of return. The SPV do not pay corporation taxes if it is located in a tax-free zone which is usually the case (VAT may be applied).

02

CLO STRUCTURING AND MANAGEMENT

HOW TO MAKE IT HAPPEN?

Firstly, the securitization vehicle uses proceeds of the notes to purchase the assets and to pay the upfront costs. Generally the SPV also gets initial funding support to start purchasing the loans before finding investment commitments. The SPV then issues notes against periodical interest payments. Structuring and issuing of a new CLO transaction require the involvement of many parties:

- **The arranger** which is an investment bank, defines the structure of the CLO, prices the tranches (defines the spreads, the tests and the issuance prices), creates the SPV and establishes the legal contract of the deal.
- **The originator** which is one or more investment banks issuing the loans of the collateral.
- **The manager** chooses the assets and manages the collateral throughout the life of the transaction and is allowed to replace the assets in order to keep the initial rating of the tranches or to enhance the return of the equity tranche. The manager can also reinvest the collected cash into the collateral during a predefined number of years in the beginning of the transaction. The manager generally participates in the negotiation of the legal contract of the transaction.
- **Rating agencies** audit the portfolio manager and rate the debt assets issued by the CLO transaction.
- **Investors** purchase the rated notes as well as the equity tranche and provide funding commitment before the issuance of the tranches.
- **The collateral Administrator** controls the collateral tests defined at the beginning of the transaction and provides the investors with monthly reports.
- **The trustee** plays a key role in the transaction as it protects the interests of the investors by administrating the duties of the SPV and holding the investors notes on trust.
- Other parties including settlement agents, accountants and law firms are involved in the transaction.

LIFE STORY OF A CLO

The lifecycle of a CLO includes several phases from cradle to grave (from the purchase of the first asset to the repayment of all assets and all tranches). These phases are defined by key dates spread throughout the life of the product.

- **Pricing date** often four weeks before the closing date, on which the arranger prices the notes by computing the issuance spreads and prices.
- **Closing date** is the date on which the CLO transaction comes into legal existence, the tranches are issued and their interests start to accrue and the assets are transferred to the SPV.
- **Effective date** is the date on which the portfolio of assets is 100% ramped-up, generally 3 to 6 months after the closing date.
- **Legal maturity date** displays the date at which the notes reach their contractual maturity, although the actual expected repayment date of the notes is often much shorter. The legal maturity date is dictated by the assets underlying the structure.
- **Call date** is a date on which the CLO is called before its legal maturity date at the option of the "equity" investors by vote.
- **Warehouse phase:** a period during which the manager purchases the loans several months before the launching of the transaction until purchasing at least 50% of total collateral amount. The manager often arranges a credit facility with an investment bank (generally the arranger) to finance the acquisition of the first loans of the collateral. The warehouse is securitized by issuing two tranches: a senior tranche paid a defined spread and an equity tranche paid the excess of interest. This securitization is a means of financing the ramp-up of the portfolio before launching the CLO transaction and gives more flexibility in the timing and the speed of the ramp-up process. The warehousing lasts between six months and two years and allows the manager to purchase loans in the primary market where it is more likely that the assets offer an original issue discount than in the secondary market.
- **Ramp-up:** is the period subsequent to the warehouse phase during which the manager purchases the remainder of the loans portfolio after the issuance of the CLO (the closing date) and until the full ramp-up of the portfolio (the effective date).
- **Non-call period:** typically lasts two years, during which the equity holders cannot direct the issuer to ask for liquidation of the portfolio and total redemption of the tranches nor for the reset or the refinancing of the structure.
- **Reinvestment period:** begins on the effective date once the portfolio of loans is fully ramped-up and typically lasts 4 years. During this period the manager can reinvest in new assets principal repayments and recoveries collected from the pool of loans and potentially some of the excess of interest (in the case of breaches on the interest diversion test).
- **Amortization period:** commences at the end of the reinvestment period if the CLO is not called by the majority of the equity holders and therefore the transaction is still in use. During the amortization period the manager uses the cash of prepayments and recoveries and the diverted interest to repay the tranches subsequently instead of reinvesting into the collateral. This period lasts until the legal maturity of the deal even though the deal is generally called six or seven years after its effective date.

After the non-call period, equity investors can ask to reset the structure or to refinance some selected tranches or to redeem all tranches of the CLO. The reset and the refinancing features allow to reprice one or more tranches when the spreads in the primary market drop significantly in order to adjust the interest payments and to enable the equity investors to get similar payments to what they would have been paid in a new transaction. To reset and to refinance the tranches, the issuer ends the original transaction and issues a new CLO with lower spreads. The proceeds of the new notes are used to redeem the reset or the refinanced notes. Original investors have no obligation to purchase the new tranches. The difference between both features is that in a reset the new CLO have the same lifecycle as a new transaction except the warehousing phase since the portfolio is already 100% ramped-up while in a refinancing the issuer changes only the spreads without starting over the reinvestment period and extending the maturity of the CLO. The new spreads are generally slightly lower than the spreads of new issues as the repriced structure has a lower risk related to the composition of the collateral. Equity investors can also ask the issuer to liquid all the assets in the portfolio to refund the repayment of the notes.

RISKS RELATED TO CLOS

Investors in CLO tranches face several risks related to their investment. Exposure to these risks defines the risk/return profile of each investment. The main risks are described below.

- **Credit risk** is the risk that a change in the credit quality of the loans counterparties would affect the value of the assets underlying the CLO structure. The credit risk related to CLOs is mainly inherent to the default risk which is the possibility that one or more companies will be unable to pay the contractual interests or to repay the par amount of the loan at the end. Senior tranches are generally not concerned with defaults since they are protected by lower tranches in the structure.
- **Reinvestment risk** comes from the possible difficulties that the manager might face to find suitable assets to reinvest the principal proceeds during the reinvestment period. Reinvestment risk in very significant since the leverage loans market in very illiquid.
- **Asset manager risk** relates to the ability of the asset manager to manage the collateral. In fact the asset manager has a key role in enhancing the performances of the tranches and reducing the exposure to the credit risk.
- **Liquidity risk** captures the fact that the investor might not be able to sell a tranche on the secondary market quickly enough to avoid losses. This risk is important for CLO investors. A part of the high returns of the AAA tranche, when compared to sovereign bonds of same rating, may stems from the liquidity risk. This risk also applies to the collateral, which may be quite illiquid too, especially in connection with the reinvestment risk described above.
- **Prepayment risk** relates to the fact that companies can repay the loan's principal in advance. Therefore, future interests on that part of the collateral will not be paid. Prepayment risk has an impact even during the reinvestment period as the new purchased loans may not yield as much interests as the prepaid ones. After the reinvestment period, the prepayments of the loans accelerate the repayment of the notes. Hence, the noteholders may face additional risk related to possible difficulties to reinvest the repayment cash received in advance in other sources of return.
- **Interest rate risk** is difficult to capture because it stems from both collateral and notes. A risk of mismatch between interest payment in assets and in notes may arise (fixed vs. floating rates, difference of frequencies…). Interest rate risk is generally marginal since it can be hedged using swaps within the CLO structure. However the implementation of the hedge is complex du to defaults and prepayments on the loans. It should be observed that most notes have a floor on their coupon. It means that, implicitly, the note holder buys a floor option on the underlying rate. Hence, a dependence on interest rate implied volatility. Generally, most of the loans in the underlying portfolio have interest payments based on a floating interest rate. The same is true for the tranches.
- **Currency risk** may appear in certain transactions where it is possible to invest in loans with different currencies. Currency risk is hedged within the structure, but this hedge is difficult to implement due to default or prepayment risks the loans. Anyway, this category of deal is not the mainstream in CLO issuance.

MINIMUM RISK RETENTION REQUIREMENTS: 5% OF CREDIT RISK

Risk retention requirements are designed to apply skin in the game rule and therefore to avoid potential conflict of interest between investors and other parties such as the originator and the asset manager.

EU risk retention:

Under the capital requirements directive (2011) by reference to the alternative investment fund managers directive (July 2013), EU alternative investment fund managers (AIMFs) are not authorized to have exposure to any securitization throw alternative investment funds managed by them unless the "sponsor or originator or initial lender" of the transaction comply the risk retention requirements by retaining a credit risk of at least 5% in the securitization cf. Ng (2013).

Guidelines to Article 122a of the Capital Requirements Directive defines an 'originator' as "an entity which, either itself or through related entities, directly or indirectly, was involved in the original agreement which created the obligations or potential obligations of the debtor or potential debtor giving rise to the exposure being securitized; or an entity which purchases a third party's exposures onto its balance sheet and then securitizes them". In the guidelines, a 'sponsor' is defined as "a credit institution other than an originator credit institution that establishes and manages an asset-backed commercial paper programme or other securitization scheme that purchases exposures from third party entities".The term 'original lender' remains undefined in the Directive and is typically considered as the same entity as the 'originator'.

In final Capital Requirement Regulation (2013), when the securitized exposures are created by multiple originators, the retention must be fulfilled by each originator in relation to the proportion of the total securitized exposures for which it is the originator. However, Regulation also specifies that the retention may be fulfilled in full by a single originator provided that either: the originator has established and is managing the programme or securitization scheme; or the originator has established the programme or securitization scheme and has contributed over 50% of the total securitized exposures.

The Directive highlights that a 'sponsor' must be a 'credit institution' which is an EU investment bank or an 'investment firm' which is by reference to the Markets in Financial Instruments Directive (MiFID) "any legal person whose regular occupation or business is the provision of one or more investment services to third parties and/or the performance of one or more investment activities on a professional basis" [Article 4(1)]. The MiFID-regulated portfolio managers are considered as 'investment firms' and are therefore allowed to act as the retainer of the risk.

In order to finance the risk retention, the asset manager can create an independent vehicle that purchases the assets for a defined minimum period and then sells them to the SPV. The created retention vehicle is therefore "an entity which purchases a third party's exposure for its own account and then securitizes them" and is therefore interpreted to be an 'originator' under the definition of the Guidelines.The benefit of this structure is that third party investors may participate in the risk retention financing and the asset manager is not obliged to fully finance the risk retention.

US risk retention:

In US under the Wall Street reform and Consumer Protection Act of 2010 (the "Dodd-Frank Act") there is a minimum of 5% risk retention requirements. In fact, Section 941(b) of the Dodd-Frank Act requires 'securitizers' to retain 5% of the credit risk associated with a securitization transaction and defines the 'securitizer' as the 'sponsor' of the transaction. Under the rules a "Sponsor means a person who organizes and initiates a securitization transaction by selling or transferring assets, either directly or indirectly, including through an affiliate, to the issuing entity". The definition of a 'sponsor' includes the 'originator'. The Regulation has also made it clear that the asset manager is viewed as the 'sponsor'. Moreover, a 'majority owned affiliate' of the sponsor is also allowed to be the retainer.The rules define the 'majority owned affiliate' as 'an entity (other than the issuing entity) that, directly or indirectly, majority controls, is majority controlled by, or is under common majority control with, the CLO manager'. Where, 'majority control' is determined as 'ownership of more than 50% of the equity of an entity, or ownership of any other "controlling financial interest" in the entity'. In US, the asset manager can also create a retention vehicle which is a 'majority owned affiliate' and therefore partially finance the risk retention.
US risk retention rules became effective in Dec 2016 and include 5% of minimum risk retention like the AIFMD and the Capital Requirement Directive in EU. However, the approach is different, as in US the originator is the one required to retain the risk while in EU the investor is required to not invest unless the originator retains the risk. Moreover, the minimum risk retention in EU is 5%, on an ongoing basis, of the par amount of the collateral while in US the minimum is 5% of the initial fair value of the collateral.The risk retainer has the choice either to hold the minimum risk retention amount in the form of equity tranche ('horizontal retention') or to hold exposure on each tranche in relation to the proportion of total size of the transaction ('vertical retention').

Main impact on asset managers:

The main innovation introduced by risk retention rules is that asset managers may become required to provide their own capital in order to take a place on the CLO market. Using capital is a part of the financing activity which has been done so far by investment banks not by asset managers. As a consequence, small asset managers may not be able to remain on the market which would lead to a full recomposition of the capitalist system, and on the other hand asset managers capable of satisfying the risk retention requirements need to develop a new expertise in CLOs.

03

CLO MODELLING AND PRICING

This section is dedicated to the risk modeling for CLO. Little academic work concerns the valuation of this specific class of securitizations, which do not fall in the scope of the standard asset pricing theory. They are illiquid assets based on specific waterfall mechanism, and not synthetic derivatives. In such a context it is impossible to harness on the specific theory of asset replication. However, a large literature has emerged in the early 2000s, which covers the modeling of defaults among a pool of assets, in the perspective of assessing the underlying risk. This question has a clear connection with the risk models used for rating the tranches. In a first section, we present a short synthesis of classical pricing models, most of them being developed in the case of synthetic credit derivatives (CSO). Then, we investigate the representation of defaults in the pool of loans, with a comparison between global methods and loan-based methods. We also have a look of utility-based methods to define a market price. Examples of pricing are given for a standard CLO.

A LARGE VARIETY OF PRICING MODELS

The modeling of defaults among a pool of issuers has been the topic of a huge literature since the late 90's to the aftermath of the 2008 crisis. These academic works deal with both cash CDO, such as CLO, and synthetic CDO (CSO), even if, with the emergence of the base correlation framework, these studies became less meaningful.

In order to understand the technical problems at stake, let us go back to the previous attempts to model the default of a firm. The most famous of these models is certainly Merton's structural model of defaults (Merton (1974)). It is based on the capital structure of the firm and defines the default as the time when a log-normal diffusion reaches a given level. The log-normal diffusion is the unobservable value of the assets of the firm, the default level if the debt materialized by a zero-coupon bond. The equity is represented as the price of a call in the Black & Scholes framework on the value of the firm, with a strike equal to the debt. This model shows two main drawbacks: first it is based on unobservable data (the so-called value of the firm), second it rules out sudden jumps to default. This last point is of great importance and requires some technical precisions. The default time in Merton's model (a stopping time, in mathematical language) is predictable. Basically, it means that it is possible to see the arrival of the default as the diffusion comes closer and closer to the barrier. In particular, for short term-maturity securities based on the time of default, the price quickly tends to 0, which is not what is observed in financial markets.

With the growing importance of credit derivatives, securitizations and synthetic CDOs at the end of the 90's, it became more and more crucial to turn to tractable models, which integrate the "unpredictability" of defaults.

These new models belong to a family of **intensity-based models**, where, basically, the default is exogenous (not based on micro-economic firm data) and calibrated either with historical or market (i.e. risk-neutral) data. The general form of these models has been masterfully treated in a series of papers by Jeanblanc and Rutkowsy (1999, 2000). These works intensively resort to the theory of filtration enlargement. There is a small filtration corresponding to all financial information but default (rate, equity…), and a large one corresponding to the whole information (including default). The underlying idea is that the default is triggered by a random variable distributed according to an exponential law with parameter 1, independent from the small filtration. Let us denote by θ the random variable following the exponential law. There is an **intensity,** say λ, adapted to the small filtration, and the default time τ is defined as the first time t such that

$$\int_0^t \lambda(s)\mathrm{d}s \geq \theta$$

The fact that the intensity is a function of the time implicitly creates **a term-structure of default,** which is compatible with the term-structure observed either on bonds or CDS.

These models are originally written in a single issuer setting. Several authors investigated the case of a pool of issuers. Duffie and Garleanu (2001) focus on the case where the intensity λ follows a diffusion process with jumps, in the setting of affine model. The aggregation of several issuers is obtained in a factorial model, exploiting the properties of the affine models.

Following another path, many authored investigated the nature of **the structure of dependence of defaults,** represented by **generalized correlation functions or copulas** (see Sklar (1959), for the original concept). Frey and Mc Neil (2000) consider several copula functions in the case of defaults driven by latent variables. This category of default risk model knew a certain popularity as it was at the core of the methodology used by certain rating agencies. Among other works in the same vein, let us cite Das et al. (2002), in which an empirical study on default dependencies is carried out, and Laurent and Gregory (2005).

Also very well suited to capture refinements in the dependence structure and marginal default probabilities, this class of models may be hard to use from a practical point of view when the underlying debt instruments are loans, i.e. private debt with poor liquidity, included in structures which are managed. In the case of CLO, many practitioners prefer to focus on the internal rate of return of the tranches under several scenarios of **constant default rate (CDR),** recovery rates and constant prepayment rates (CPR). Basically, it consists in a simple but robust modelling of the underlying rate of default among the pool.

If we want to go one step further and define a mark-to-model, we need to define the dynamics of the rate of defaults. In Bernis (2012), a **Gamma process** is used to represent the cumulated default rate, and an indifference pricing approach is developed to make the link between expected cash flows and price. This last step is an attempt to overcome the high liquidity premium involved in loan markets and especially in CDO. This question is the topic of the third subsection.

Next section provides examples of these various representations of defaults among the collateral.

DISTRIBUTION OF DEFAULTS

In this section, we investigate the form of various distribution functions of losses among a pool of issuers. In particular, we compare the models which take into account every credit instrument in the pool to the models based on the global default rate. As already noticed in the previous section, the first type is based on a certain structure of dependence of the individual defaults. The second type requires a dynamic evolution of the number of defaults across time.

Consider a pool consisting of n equally weighted debt instruments. Assume that every debt instrument in the pool has the same default rate $\gamma>0$, which means that its survival probability, up to time t, is $q(t):=e^{-\gamma \times t}$. Accordingly, the default probability is $p(t)=1-q(t)$.

First assume that all the defaults are independent, in this case the distribution of the total number of defaults among the pool follow a **binomial distribution** of parameters *(n, p(t))*. The average default rate at time t is, therefore, $n \times p(t)$. When, n is large enough, this distribution can be approximated by a **Poisson distribution** (more precisely, there is convergence in law), the intensity of which is given by

$$\lambda_p \times t = n \times p(t)$$

Now, let us add a **dependence structure** on the individual defaults. In this case, we consider a very simple Gaussian copula model, driven by one factor: every single issuer is based on a Gaussian random variable with constant correlation ρ to some unique Gaussian random variable, representing the common factor. This approach does not change the average number of defaults, at any time t, but it spreads the initial density on a wider range, as displayed in Figure 6. The limit case, $\rho=1$, only puts weight on two values 0 and n: either all the basket defaults or no issuer defaults.

The Poisson approximation introduced above is interesting for several reasons. First, it represents the defaults among the pool as a single random variable. Second, it enables a dynamic approach, as the distribution at time t can be considered as the realization of a Poisson process. Therefore, it opens the door for a purely dynamic representation of the defaults among the pool with a one dimensional point process. At this stage, two approaches can be adopted.

First, we can deal with **"pure jump" processes with finite activity** (finite number of jumps on any finite interval) and jumps of constant size 1. This category involves the **Poisson process, the Cox process, the Hawkes process** (studied below) and many other examples. In particular, this topic has been extensively studied in the perspective of population dynamics. Thus, this case is well suited to represent the defaults among the pool. It can be refined to involve the recovery as a "mark" of the point process.

Second, we can deal with pure jump processes with **infinite activity** (a sub-class of **Lévy processes**). This class cannot be used to represent directly the number of jumps (because it is not integer-valued), but gives rise to a representation of the instantaneous rate of default: cf. Jönsson, Schoutens and Van Damme (2009). A particularly simple example is the Gamma process. See, e.g. Joshi and Stacey (2006) for an application to credit derivatives.

In this section, we focus on an example of the former category: the **Hawkes process**. The Hawkes process is a **self-exciting process.** When a jump occurs, the intensity jumps. Then, it goes back to its initial value with an exponential decay. Hence, this process shows a specific feature, which has a natural economical meaning: the **clustering effect.** A default generates a cluster of other defaults. Each of them also generates its own cluster and so on. This feature has a natural meaning in the context of population dynamics or, alternatively, seismology. It also reflects, in a very elegant manner, the so-called **default contagion effect,** and the **cyclical aspects of historical default rates.** For the seminal paper on Hawkes processes, see Hawkes and Oakes (1974), and for the simulation algorithms see Ogata (1979). Applications to CLO can be found in Bernis, Salhi and Scotti (2017). Figure 6 displays the distribution of a Hawkes process. A first remark need to be raised: the expectation of the Hawkes process is not linear in time, as it is the case for a Poisson process. In order to clarify this point, let us provide the basic equations of the model. The intensity of the Hawkes process can be represented through a 3 parameter model:

$$\lambda(t)=\lambda_0+\alpha\sum_{T_i<t} e^{-\beta(t-T_i)}$$

We have denoted by T_n the n^{th} jump of the point process. The parameters λ_0, α and β are positive real numbers. In order, to obtain a process with an asymptotic stationary case, we must take $\alpha<\beta$ (see below). The limit case $\alpha=0$ gives back the Poisson process. It is important to notice that the sum in the previous equation is taken over the jumps which occur strictly before t: a jump does not immediately change the intensity. The first order moment is given by

$$m_1(t)=\frac{\lambda_0\times\beta}{\beta-\alpha}+e^{(\alpha-\beta)t}\times\left[\lambda_0-\frac{\lambda_0\times\beta}{\beta-\alpha}\right]$$

We can see that, as $\alpha<\beta$, $m_1(t)$ tends to the limit value $\overline{m}_1:=\frac{\lambda_0\times\beta}{\beta-\alpha}$. It means that the Hawkes process admits some stationary state, when the clustering effect driven by α is dominated by the decay effect, driven by β. Contrary to Poisson process, the expected number of jumps by unit of time is not constant. It is interested to notice that the amortization rate which appears for $m_1(t)$ is not β, as the dynamics of $\lambda(t)$ would suggest, but $\beta-\alpha$.

Let us add a word on a classic continuous distribution which can be used to approximate the number of defaults among a pool of issuers: the Gamma law. Basically, it depends on two positive parameters: the first one controls the asymmetry (which is inversely proportional to the square root of this parameter), the second one is a scale parameter:

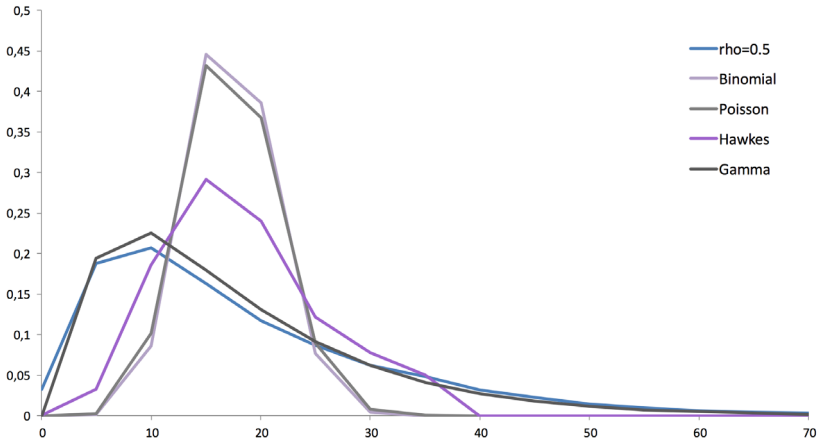
$$X\sim\Gamma(x,\theta)\Rightarrow\forall t>0, t\times X\sim\Gamma(x,t\times\theta)$$

Moreover, the Gamma law is infinitely divisible with respect to the first parameter (with a fixed second one). The average

of a law $\Gamma(x,\theta)$ is simply given by $x\times\theta$. This distribution can be used, either to fit the discrete correlated binomial distribution, or the Hawkes process distribution, while keeping a constant average. An example is given in Figure 6. As already pointed out above, there exists a Lévy process, the marginal distribution of which is the Gamma distribution.

Figure 6 – Exemple of loss distributions among a pool of 110 issuers, for a correlated binomial distribution, a binomial distribution, a Poisson process, a Hawkes process and a Gamma distribution.

Source: Natixis Asset Management



Another example of point processes with stochastic intensity is given by **Cox processes.** In this case, the intensity is a **positive process, independent from the jumps**. Conditionally to the intensity, the Cox process is an (non-homogeneous) Poisson process. Even if fruitful applications of Cox processes can be found in the literature (such as Lando (1998)), these processes do not have the natural economic meaning of the self-exciting processes.

Another interesting approach is based on a discrete approach and the use of **Beta distributions.** For each interest period, $]t_{i-1},t_i]$, $1\leq i\leq m$, we consider a random variable D_i, following a Beta distribution over [0,1] with (positive) parameters α_i and β_i. The variables D_i, $1\leq i\leq m$, are assumed to be two by two independent. They represent the default rate over the period, to be applied to the outstanding amount at the beginning of the period. The expectation and the variance of variable D_i are given by

$$E\{D_i\}=\frac{\alpha_i}{\alpha_i+\beta_i},$$
$$V\{D_i\}=\frac{\alpha_i\beta_i}{(\alpha_i+\beta_i)^2\times(\alpha_i+\beta_i+1)}.$$

There exists a natural link between Gamma and Beta laws. If X and Y follows two independent Gamma laws with parameters $(\alpha,1)$ and $(\beta,1)$, then $\frac{X}{X+Y}$ follows a Beta law with parameters (α,β).

If we consider the same parameters for the Beta laws, we obtain a two parameter model which is rather easy to calibrate and simulate. It has to be observed that the total default rate at the last period is given by

$$1-\prod_{i=1}^{p}(1-D_i).$$

The law of this variable is not explicit, but it can be approximated by a Monte Carlo method.

FROM RISK-NEUTRAL TO HISTORICAL MODELLING

Most models cited in previous sub-section consider the prices as expectations under a given probability measure: **a risk-neutral probability,** i.e. a measure under which the discounted price of the asset is a martingale. This approach stems from the theory of asset pricing under no-arbitrage condition. Under precise mathematical assumptions, it states that the existence of a risk-neutral probability **rules out arbitrage** (i.e. strategies which yield positive pay-off, without initial cost). The existence of a risk-neutral probability is, actually, equivalent to a larger concept (Free lunch with vanishing risk), introduced by Delbaen and Schachermayer (1994), which states there is no strategy converging to an arbitrage without potential unlimited losses.

The existence of the risk-neutral probability depends on the ability of the investor to buy and sell the assets without **neither limitation nor friction costs.** Put any restriction on these conditions and the existence of the martingale measure vanishes, replaced by weaker concepts. In the case of CLO, the limitation of the market in terms of volume, liquidity and bid-offer clearly indicates that this theory should not be used in this case.

A simple risk-neutral methodology consists in considering a loan representative of the assets portfolio of a CLO (with same average characteristics) and assuming that the price of this loan equals the expected value of its future cash flows discounted at the risk-free rate. The price calculated in this manner is then inverted to obtain the CDR that gives the

market price of the loan (market value of the collateral) as a result. The resultant CDR is obtained under given recovery and prepayment rates. The limitation of this methodology is that **the implied CDR is generally much higher than the level of default that has been observed on the loan market** since a long period and therefore cannot be used in the modelling of the waterfall of payments.

The following example illustrates the fact that the risk-neutral methodology cannot reflect the market prices of a loan. For the numerical application, we use the CLO structure presented in the first section and we assume that the weighted average spread of the assets is 4.35% and that the constant annual prepayment rate equals 20%. Then, we compute the CDR for different recovery rates. We obtain: 5.1% if the recovery rate is zero; 10.2% if the recovery rate is 50%; 20.5% if the recovery rate is 75%. In the three cases, the resultant CDR is too high to represent the market level of the losses on the subordinated tranches, when used in the waterfall of a CLO.

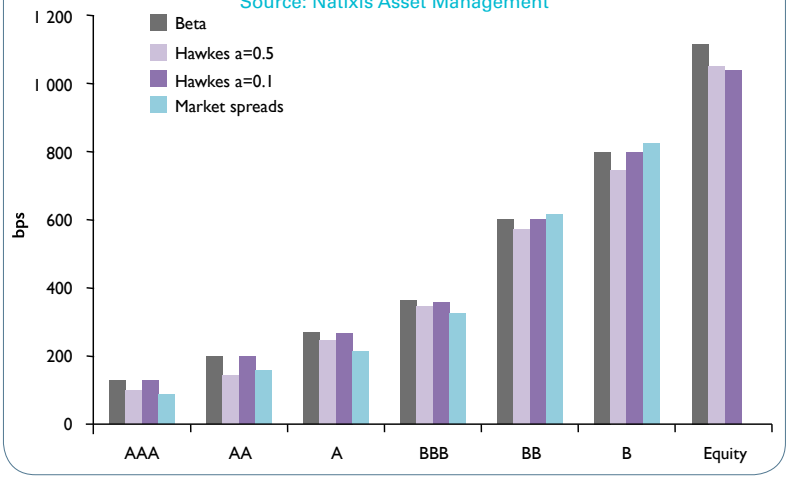
An alternative methodology consists on pricing the tranches of the CLO based on historical defaults on the collateral. The historical average annual default rate used is 3% (source Moody's). We assume that: the recovery rate is 75%; the annual prepayment rate is 25%; the weighted average spread of the assets is 4.35%. The prices of the tranches computed under these assumptions are significantly higher than the market issuance prices. Therefore, we compute for each tranche a spread (over the risk-free rate) to adjust the price. These spreads can therefore be used to price the tranches on later dates. When issuance prices are not available for some tranches, we can follow two approaches:

- We adjust the price of the tranche using **the spread of the loan stemming from the collateral**
- We adjust the price of the tranche by **the market spread of a tranche of a CLO with the same rating.**

The Figure 7 shows the spreads for tranches rated AAA to B and for equity tranche, all assumed to be issued at par in this example. As shown in the diagram, the spreads calculated under the model of defaults based on Beta distributions and the spreads calculated under the Hawkes model (using different parameters) are not significantly different. We stress the fact that both models were calibrated to have an expected default rate equal to historical average defaults. The same graph also shows that the model spreads of the rated tranches have similar levels to market spreads of new issues, which validates the pricing methodology.

Figure 7 – Spreads of tranches for two defaults model: Model 1 uses Beta distributions; model 2 uses Hawkes processes. All tranches are assumed to be issued at par. Average annual default rate = 3%; prepayment rate = 25% p.a.; recovery = 75%. Hawkes parameters: $\beta = 0.8$; $\theta = 3$; maturity = 13 years, reinvestment period = 4 years.

Source: Natixis Asset Management



Other methodologies based on **representative risk-adverse agents** can be put in place, for instance using expected utility functions. As an example, the use of the indifference price is used in Bernis (2012). In this case, the part of the **spread which is not given by the historical default probability** is **captured by the risk aversion of the representative agent.**

04

SOLVENCY II AND CLO NOTES

The impact of **Solvency II** on securitization is important. The **Solvency Capital Requirement (SCR)** for the spread risk-sub module sets out specific shocks on securitizations, which are much more conservative than the shocks on bonds and loans of same rating. These shocks and the general methodology is defined in the Commission Delegated Regulation (EU) 2015/35, Articles 177-178.

Before a specific overview of the SCR spread for CLOs, we will describe briefly the principles of the SCR spread for a debt. Basically, the SCR spread is a function of

- The **spread duration** (sensitivity with respect to a decrease of the credit spread, divided by the price of the debt), expressed in years. The spread duration is floored at 1 year.
- The **Credit Quality Step,** which is based on the second best rating among the ratings attributed to the debt by External Credit Assessment Institutions (ECAI). A CQS equal to 0 is equivalent to a second best rating of AAA, a CQS of 1 to a rating of AA, etc.

A securitization, for which there is only one rating available, is considered as unrated.

An overview of the SCR for debt instruments can be found in Solvency II Capital Requirements for Debt Instruments, Natixis Asset Management Fixed Income (2016).

The SCR spread is the sum of 3 categories, with no possible mitigations at this stage between categories: bonds and loans, derivatives and securitizations. This third category, which is the one under scrutiny in our case, is divided into 3 types of securitizations, with an increasing level of shocks: Type 1, Type 2 and re-securitizations. Type 1 category only concerns notes which are the most senior in the structure, for certain categories of securitizations and underlying assets.

It seems that the **CLO, as described in this note (CLO based on senior secured loans) are excluded from Type 1,** whereas CLO of loans for small and medium sized firms are eligible. Thus, hereafter, we will focus on the treatment of Type 2 securitizations.

The contribution to SCR spread of a Type 2 securitization, with a CQS c, is obtained by multiplying its market value by:

$$\min\{b_2(c)\times\max\{duration,1\};1\}$$

Here, b_2 is equal to the value set out below for the relevant CQS:

Table 3: b_2 value by CQS

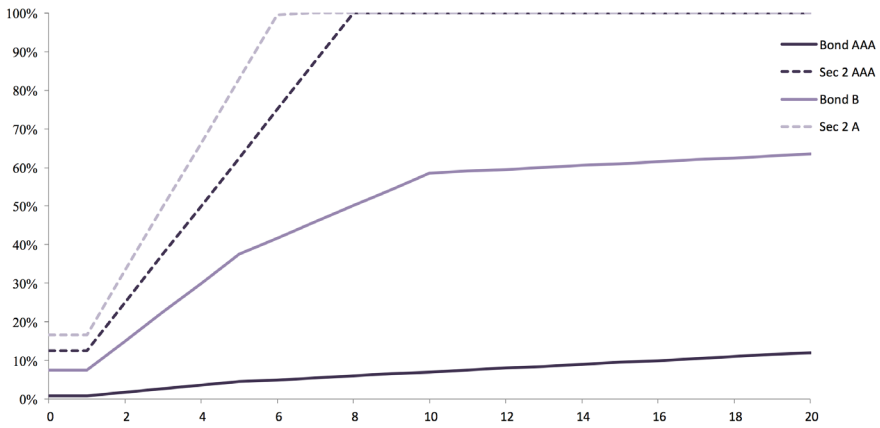
Source: Natixis Asset Management

CQS	0 (AAA)	1 (AA)	2 (A)	3 (BBB)	4 (BB)	5 (B)	6 (CCC)	Non-rated
B_2	12.5%	13.4%	16.6%	19.7%	82%	100%	100%	100%

The shocks displayed by Table 3 are much larger than those applied to corporate bonds (whatever their seniority). Figure 8 illustrates this gap, with a comparison of the shocks for both types of instruments, for several ratings. In particular, a type 2 securitization with a CQS of 0 (AAA) and a duration above 8 years will be charged 100% of its market value, whereas a bond with a CQS of 5 (B) and the same duration will only be charged 50% of its market value.

Figure 8 – SCR spread as a function of the spread duration for Bonds with CQS equivalent to AAA and B ratings, and for Type 2 securitizations with CQS equivalent to AAA and A.

Source: EIOPA, Natixis Asset Management



Even if the CLO may seem penalized by Solvency II, this element must be put in perspective with the profitability of certain tranches, and especially equity. The following example compares the profitability of:

- A EUR corporate bond with a CQS equal to 5 (BB) and a spread duration of 6 years.
- An equity of CLO, with approximately the same duration.

The profitability, for an insurer, will be measured by the RAROC (cf. Natixis Asset Management Fixed Income (2016)). Let T denote the maturity, y the yield and SCRs the SCR for spread of the instrument. The RAROC writes

$$RAROC = \left[\frac{(1+y)^T + SCR_s}{1+SCR_s}\right]^{\frac{1}{T}} - 1$$

EXAMPLE

A corporate bond, has a second best rating of BB+, a yield equal to 2.2% and a spread duration of 6.2 years. The SCR spread is 25.5%, and the RAROC is 1.77%.

An equity of CLO, with the same duration, has approximately a return of 12% for a maturity of 8 years. Its SCR spread is equal to 100%. It yields a RAROC of 7.1% (Source: NAM. Data as-of 20/02/2017).

For the AAA tranche, with a return comparable to corporate bond yields, the profitability of this investment can be questioned, once the SCR is integrated. However, **the insurer can resort to mitigation strategies,** as specified in Article 209 of EIOPA (2014). For instance, it is possible to buy a guarantee from a reinsurer, in order to be protected against the losses on the AAA tranche. The protection cost is generally significantly smaller than the margin of the AAA tranche. In this case, the specific risk of the tranche can be removed by this mitigation technique.

Under the prudential rules Solvency II, insurers' investment in CLO notes is constraint by additional capital requirements. Moreover, CLO notes are concerned by accounting rules IFRS, defining how to measure and to treat this type of instruments in accounts.

05

IFRS 9: NEW ACCOUNTING TREATMENT FOR CLO NOTES

WHAT IS IFRS 9?

International Financial Reporting Standards (IFRS) are a set of international accounting standards published by the international accounting standards board (IASB) since 2001 to complete the preexisting standards: the International Accounting Standards (IAS) that were first written in 1973 by the international accounting standards committee. IFRS state how accountants must present and maintain their accounts in order to guarantee greater transparency and readability of accounts and to establish a common accounting language to facilitate comparison and understanding between companies and countries. 122 countries have adopted IFRS.

IFRS 9 is the international financial reporting standard that deals with the accounting for financial instruments. It has three basic pillars: classification and measurement of financial instruments, impairment of financial assets and hedge accounting. IFRS will become effective in January 2018 and will replace IAS 39.

IFRS 9 specifies two criteria to determine how financial assets should be classified and measured:

- The business model used by the entity for managing the financial assets in order to generate cash flows: a criterion that determines whether the cash flows result from collecting contractual cash flows (held to collect contractual cash flows), selling the financial assets (held for selling), or both (held to collect contractual cash flows and for sale).

- The contractual cash flows characteristics of the financial asset: a criterion that aims to identify whether the contractual cash flows are 'solely payments of principal and interest on the principal amount outstanding'. Therefore, the standard refers to the assessment as the 'SPPI test'.

Moreover, IFRS 9 includes an option that allows the entity to choose to measure the financial liabilities at a fair value through profit or loss if some conditions are satisfied. This is referred to as a fair value option (FVO).

Financial assets are classified with these two criteria into the following three categories that specify how to measure the asset and how variations are counted in profit and loss.

- Amortized cost: the asset is measured at amortized cost and changes in the amortized cost of the asset are recognized in profit and loss.
- Fair Value Thru Profit and Loss (FVTPL): the asset is measured at market value and changes in the fair market value of the asset are recognized in profit and loss.
- Fair Value Thru Other Comprehensive Income (FVOCI): the asset is measured at market value, changes in the amortized cost of the asset are recognized in profit and loss and changes in fair market value (net of changes in amortized cost) are recognized in other comprehensive income (OCI) and have therefore an impact on the shareholders' equity but not on profit and loss.

Business model	SPPI OK	SPPI fail
Held to collect (HTC)	FVTPL (if FVO) Amortized cost (if not FVO)	FVTPL
Held To Collect and Sale (HTCS)	FVTPL (if FVO) FVOCI (if not FVO)	FVTPL
Neither HTC Nor HTCS	FVTPL	FVTPL*

ACCOUNTING TREATMENT OF SECURITIES

Currently, securities are accounted under IAS 39 depending on their nature and their holding horizon. When IFRS 9 becomes effective, accounting of securities will be based on business model and SPPI test. Securities are generally liquid assets (often notes issued by securitization vehicles are more liquid than bonds). Therefore, securities should be treated under FVTPL or FVOCI when the business model and the SPPI test result allow.

A security passes the SPPI test only if the following four conditions are met:

- The security, seen as an independent asset, passes the SPPI test.

- All assets that constitute the collateral of the structure satisfy the SPPI test.

- The assets in the underlying portfolio cannot change in a way that would not satisfy the SPPI test.

- The exposure to credit risk in the security is equal to or less than the exposure to credit risk of the underlying portfolio of the structure.

In the case of CLO, when the tranches meet the SPPI test and the underlying portfolio consists only of loans that are SPPI, the condition related to the exposure to credit risk remains to be considered. A possible comparison of the exposure to credit risk between the tranches and the underlying portfolio is to compare the cumulated default rate of the tranches to the cumulated default rate of the underlying portfolio under the most conservative assumptions (for example a set of market data that cover the period of the credit crises).

** Option to be considered FVOCI without recycling of gains and losses recognized in OCI to profit and loss.*

CONCLUSION

After the turmoil of the 2008-2009 credit crisis, CLOs have evolved to integrate more prudent features. After the revival of the US market in 2012-2013, CLOs are still very popular securitization products, which provide investors with a full range of risk/return profiles. CLOs are impacted by several new regulations (Solvency II, risk retention rules, IFRS 9…), which should be taken into account in the analysis of the structure. The complexity of the waterfall of payments requires specific modelling of the risk to price these products.

CLOs are technical and sophisticated instruments that need expertise in structuration, but also in pricing or risk assessment, in addition to the essential capacity of selecting the adequate loans for the portfolio. These expertises are now completed by the need of capital to answer new rules about retention, which is a new challenge for asset managers.

BIBLIOGRAPHY

- A cluster process representation of a self-exiting point process. **Hawkes, A.G. and Oakes, D. 1974.** 1974, Journal of Applied Probabilities, Vol. 11, pp. 493-503.

- **A. Kronman, Weil Gotshal & Manges LLP. 2015.** Financing CLO Risk Retention — Options And Concerns. law360. 2015.

- Basket Default Swaps, CDOs and Factor Copulas. **Laurent, J.-P. and Gregory, J. 2005.** 4, 2005, Journal of Risk, Vol. 7, pp. 103-122.

- **Committee of European Banking Supervisors. 31 December 2010.** Guidelines to Article 122a of the Capital Requirements. 31 December 2010.

- Complete text of the US rules. **Office of the Comptroller of the Currency, the Board of Governors of the Federal Reserve System, the Federal Deposit Insurance Corp., the U.S. Securities and Exchange Commission, the Federal Housing Finance Agency and the Department of Housing and Urban D. December 24, 2014.** December 24, 2014.

- Correlated Default Risk. **Das, S.R., et al. 2003.** 2003. EFA 2003 Annual Conference Paper. Vol. 928.

- **EIOPA. 2014.** Commission Delegated Regulation (EU) 2015/35. [Online] 10 10, 2014. http://eur-lex.europa.eu/legal-content/En/TXT/PDF/?uri=OJ:JOL_2015_012_R_0001.

- **European Banking Authority. 17 Decembre 2013.** EBA Final Draft Regulatory Technical Standards On the retention of net economic interest and other requirements relating to exposures to transferred credit risk (Articles 405, 406, 408 and 409) of Regulation (EU) No 575/2013. 17 Decembre 2013.

- **—. 29 Septembre 2011.** Q&A on Guidelines to Article 122a of the Capital Requirements Directive. 29 Septembre 2011.

- **—. Decembre 2014.** Securitisation risk retention, due diligence and disclosure. Decembre 2014.

- **EY. May 2015.** Classification of financial instruments under IFRS 9. May 2015.

- Fixed Income and Credit risk modeling and Management. **Jeanblanc, M. and Rutkowski, M. 2000.** New York : Springer, 2000. Congrès Bachelier. pp. 281-312.

- Fonctions de répartition à n dimensions et leurs marges. **Sklar, A. 1959.** 1959, Publ. Inst. Statist. Univ. Paris, Vol. 8, pp. 229–231.

- **International Accounting Standards Board (IASB). July 2014.** IFRS 9 Financial Instruments. London : s.n., July 2014.

- **Larsson, K. and Bakke, E. 2013.** The rebirth of the collateralized loan obligations, a case study of the dynamics in the European collateralized loan obligation market. University of Gothenburg, school of business, economics and law. 2013.

- Mark-to-model for cash CDOs through indifference pricing. **Bernis, G. 2012.** 1, 2012, Quantitative Finance, Vol. 12, pp. 39-48. 10.1080/14697688.2011.620977.

- Models for default risk: An overview. **Jeanblanc, M. and Rutkowski, M. 1999.** s.l. : Higher education press, 1999. Shanghai summer school August 1999, Mathematical finance: theory and practise.

- **Natixis Asset Management Fixed Income. 2016.** Solvency II Capital Requirements for Debt Instruments. [Online] 05 02, 2016. http://www.nam.natixis.com/Content/Documents/Publications/Research%20paper/SII%20Debt%20Instruments%20Final.pdf.

- **Official Journal of the European Union. 27 June 2013.** REGULATION (EU) No 575/2013 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012. 27 June 2013.

- On cox processes and credit risky securities. **Lando, David. 1998.** 3, 1998, Review of Derivatives Research, Vol. 2, pp. 99-120.

- Risk and Valuation of Collateralized Debt Obligations. **Duffie, D. and Garleanu, N. 2001.** 1, January/February 2001, Financial Analysts Journal, Vol. 57. https://ssrn.com/abstract=265223.

- Risk retention requirements under the AIFMD: a difference in approach. **L. Ng, Sidley Austin LLP's Financial Service Regulatory Group. June 2013.** London : Butterworths Journal of International Banking and Financial Law, June 2013.

- Sensitivity Analysis for Marked Hawkes Processes - Application to CLO Pricing. **Bernis, G., Salhi, K. and Scotti,** S. 2017. SSRN: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2989193

LEGAL INFORMATIONS

This document is intended for professional clients as defined by the MiFID. It may not be used for any purpose other than that for which it was conceived and may not be copied, diffused or communicated to third parties in part or in whole without the prior written authorization of Natixis Asset Management.

No information contained herein shall be construed as having any contractual effect. This document is produced purely for informational purposes. It constitutes a presentation conceived and created by Natixis Asset Management from sources that it regards as reliable. Natixis Asset Management reserves the right to change the information in this document at any time and without notice. Natixis Asset Management may not be held liable for any decision taken or not taken on the basis of information contained in this document, or for any use of this document that may be made by a third party.

The figures provided refer to previous years. Past performance is not a reliable indicator of future performance. References to a fund's ranking, price or rating offer no indication as to future performance.

The contents of this document are issued from sources which Natixis Asset Management believes to be reliable. However, Natixis Asset Management does not guarantee the accuracy, adequacy or completeness of information obtained from external sources included in this material.

The analyses and opinions referenced herein represent the subjective views of the author(s) as referenced, are as of the date shown and are subject to change. There can be no assurance that developments will transpire as may be forecasted in this material.

This material is provided only to investment service providers or other Professional Clients or Qualified Investors and, when required by local regulation, only at their written request.

• **In the EU (ex UK):** This material is provided by NGAM S.A. or one of its branch offices listed below. NGAM S.A. is a Luxembourg management company that is authorized by the Commission de Surveillance du Secteur Financier and is incorporated under Luxembourg laws and registered under n. B 115843. Registered office of NGAM S.A.: 2, rue Jean Monnet, L-2180 Luxembourg, Grand Duchy of Luxembourg. France: NGAM Distribution (n.509 471 173 RCS Paris). Registered office: 21 quai d'Austerlitz, 75013 Paris. Italy: NGAM S.A., Succursale Italiana (Bank of Italy Register of Italian Asset Management Companies no 23458.3). Registered office: Via Larga, 2 - 20122, Milan, Italy. Germany: NGAM S.A., Zweigniederlassung Deutschland (Registration number: HRB 88541). Registered office: Im Trutz Frankfurt 55, Westend Carrée, 7. Floor, Frankfurt am Main 60322, Germany. Netherlands: NGAM, Nederlands filiaal (Registration number 50774670). Registered office: World Trade Center Amsterdam, Strawinskylaan 1259, D-Tower, Floor 12, 1077 XX Amsterdam, the Netherlands. Sweden: NGAM, Nordics Filial (Registration number 516405-9601 - Swedish Companies Registration Office). Registered office: Kungsgatan 48 5tr, Stockholm 111 35, Sweden. Spain: NGAM, Sucursal en España. Registered office: Torre Colon II - Plaza Colon, 2 - 28046 Madrid, Spain. • **In Switzerland:** Provided by NGAM, Switzerland Sàrl, Rue du Vieux Collège 10, 1204 Geneva, Switzerland or its representative office in Zurich, Schweizergasse 6, 8001 Zürich. • **In the UK:** Approved for use by NGAM UK Limited, authorized and regulated by the Financial Conduct Authority (register no. 190258). Registered Office: NGAM UK Limited, One Carter Lane, London, EC4V 5ER. • **In the DIFC:** Distributed in and from the DIFC financial district to Professional Clients only by NGAM Middle East, a branch of NGAM UK Limited, which is regulated by the DFSA. Related financial products or services are only available to persons who have sufficient financial experience and understanding to participate in financial markets within the DIFC, and qualify as Professional Clients as defined by the DFSA. Registeredoffice: Office 603 - Level 6, Currency House Tower 2, PO Box 118257, DIFC, Dubai, United Arab Emirates.• **In Singapore:** Provided by NGAM Singapore (name registration no. 53102724D), a division of Natixis Asset Management Asia Limited (company registration no. 199801044D). Registered address of NGAM Singapore: 10 Collyer Quay, #14-07/08 Ocean Financial Centre, Singapore 049315. • **In Taiwan:** This material is provided by NGAM Securities Investment Consulting Co., Ltd., a Securities Investment Consulting Enterprise regulated by the Financial Supervisory Commission of the R.O.C. Registered address: 16F-1, No. 76, Section 2, Tun Hwa South Road, Taipei, Taiwan, Da- An District, 106 (Ruentex Financial Building I), R.O.C., license number 2012 FSC SICE No. 039, Tel. +886 2 2784 5777. • **In Japan:** Provided by Natixis Asset Management Japan Co., Registration No.: Director-General of the Kanto Local Financial Bureau (kinsho) No. 425. Content of Business: The Company conducts discretionary asset management business and investment advisory and agency business as a Financial Instruments Business Operator. Registered address: 2-2-3 Uchisaiwaicho, Chiyoda-ku, Tokyo. • **In Hong Kong:** This document is issued by NGAM Hong Kong Limited and is provided solely for general information only and does not constitute a solicitation to buy or an offer to sell any financial products or services. • **In Australia:** This document is issued by NGAM Australia Pty Limited (NGAM Aust) (ABN 60 088 786 289) (AFSL No. 246830) and is intended for the general information of financial advisers and wholesale clients only. • **In New Zealand:** This document is intended for the general information of New Zealand wholesale investors only and does not constitute financial advice. This is not a regulated offer for the purposes of the Financial Markets Conduct Act 2013 (FMCA) and is only available to New Zealand investors who have certified that they meet the requirements in the FMCA for wholesale investors. NGAM Australia Pty Limited is not a registered financial service provider in New Zealand. • **In Latin America:** This material is provided by NGAM S.A. • **In Mexico:** This material is provided by NGAM Mexico, S. de R.L. de C.V., which is not a regulated financial entity with the Comisión Nacional Bancaria y de Valores or any other Mexican authority. This material should not be considered an offer of securities or investment advice or any regulated financial activity. Any products, services or investments referred to herein are rendered exclusively outside of Mexico. • **In Uruguay:** This material is provided by NGAM Uruguay S.A., a duly registered investment advisor, authorised and supervised by the Central Bank of Uruguay. Registered office: WTC – Luis Alberto de Herrera 1248, Torre 3, Piso 4, Oficina 474, Montevideo, Uruguay, CP 11300. • **In Colombia:** This material is provided by NGAM S.A. Oficina de Representación (Colombia) to professional clients for informational purposes only as permitted under Decree 2555 of 2010. Any products, services or investments referred to herein are rendered exclusively outside of Colombia. The above referenced entities are business development units of Natixis Global Asset Management, S.A., the holding company of a diverse line-up of specialised investment management and distribution entities worldwide. The investment management subsidiaries of Natixis Global Asset Management conduct any regulated activities only in and from the jurisdictions in which they are licensed or authorised. Their services and the products they manage are not available to all investors in all jurisdictions. • **In Canada:** NGAM Distribution, L.P. ("NGAM Distribution"), with its principal office located in Boston, MA, is not registered in Canada and any dealings with prospective clients or clients in Canada are in reliance upon an exemption from the dealer registration requirement in National Instrument 31 – 103 Registration Requirements, Exemptions and Ongoing Registrant Obligations. There may be difficulty enforcing legal rights against NGAM Distribution because it is resident outside of Canada and all or substantially all of its assets may be situated outside of Canada. The agent for service of process in Alberta is Borden Ladner Gervais LLP (Jonathan Doll), located at Centennial Place, East Tower, 1900, 520 – 3rd Avenue SW, Calgary, Alberta T2P 0R3. The agent for service of process in British Columbia is Borden Ladner Gervais LLP (Jason Brooks), located at 1200 Waterfront Centre, 200 Burrard Street, P.O. Box 48600, Vancouver, BC V7X 1T2. The agent for service of process in Ontario is Borden Ladner Gervais LLP (John E. Hall), located at Scotia Plaza, 40 King St. W, Toronto, ON M5H 3Y4. The agent for serviceof process in Quebec is Borden Ladner Gervais LLP (Christian Faribault), located at 1000 de La Gauchetiere St. W, Suite 900, Montreal, QC H3B 5H4. • **In the United States:** Provided by NGAM Distribution L.P. 399 Boylston St. Boston, MA 02116. Natixis Global Asset Management consists of Natixis Global Asset Management, S.A., NGAM Distribution, L.P., NGAM Advisors, L.P., NGAM S.A., and NGAM S.A.'s business development units across then globe, each of which is an affiliate of Natixis Global Asset Management, S.A. The affiliated investment managers and distribution companies are each an affiliate of Natixis Global Asset Management, S.A. This material should not be considered a solicitation to buy or an offer to sell any product or service to any person in any jurisdiction where such activity would be unlawful. Investors should consider the investment objectives, risks and expenses of any investment carefully before investing.

Limited Liability Company
Share Capital: €50 434 604,76
RCS Paris 329 450 738
Regulated by AMF: GP 90-009
21 quai d'Austerlitz 75634 Paris Cedex 13 - France

www.nam.natixis.com

GROUPE BPCE