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Résumé de l'article

Dans un article précedent paru dans *Assurances et gestion des risques*, Boyer et Papageorgiou (2004) ont discuté des implications du nouvel accord de Bâle sur la gestion du risque de crédit. Dans le présent article, nous examinons les divers instruments et marchés financiers qui ont été développés en vue de répondre à une demande croissante à cet égard. Nous décrivons les principaux instruments de crédit et produits structurés qui ont fait l'objet d'une demande croissante sur les marchés financiers. Ils donnent aussi au lecteur un aperçu des principales tendances dans le domaine du risque de crédit.

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Martin Boyer and Nicolas Papageorgiou

ABSTRACT

In a previous article in *Assurances et gestion des risques*, Boyer and Papageorgiou (2004) discussed the implications of the new Basel accord to credit risk management. In this column, we will look at the financial markets and instruments that have been developed in order to satisfy the ever growing demand for credit risk management tools. We will describe the main credit derivatives and structured products that have become increasingly important in financial markets, and provide some insights into the latest trends in credit risk.

RÉSUMÉ

Dans un article précédent paru dans *Assurances et gestion des risques*, Boyer et Papageorgiou (2004) ont discuté des implications du nouvel accord de Bâle sur la gestion du risque de crédit. Dans le présent article, nous examinons les divers instruments et marchés financiers qui ont été développés en vue de répondre à une demande croissante à cet égard. Nous décrivons les principaux instruments de crédit et produits structurés qui ont fait l'objet d'une demande croissante sur les marchés financiers. Ils donnent aussi au lecteur un aperçu des principales tendances dans le domaine du risque de crédit.

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1. INTRODUCTION

The development of credit derivatives is a logical extension of two of the most significant developments of our present times: Securitization and derivatives. In order to study the market for credit derivatives and collateralized debt obligations, it is best to distinguish two classes of products: single issuer products and multi-name (or basket) products. The market for single issuer products is more mature and there exist numerous standardized derivatives in the market. On the other hand, the market for multi-name credit derivatives and collateralized debt obligations is very much in its infancy and much research is still being done in order to properly understand and model the risks of these credit linked products.

It is therefore extremely important to conduct extensive and continuing research on the measure and pricing of credit risk in the economy. At the current time credit derivative products are being traded without anyone having a clear and homogenous idea of how to price them correctly. Trading may thus be due more to the traders' unsubstantiated models than by the necessity to hedge credit risk. In other words, trades are model driven rather and financially driven. Is a catastrophe brewing? Only time will tell.

The rest of this paper will be set up as follows. Section 1 introduces and defines the different products available to hedge single- and multi-name credit products. Section 2 focuses on the market for these products as well as on the current trends in the credit risk transfer market. In section 3 we discuss some of the concerns regarding the use and the evaluation of some of these credit derivatives products, and we provide our views on what the future holds for the fast growing industry of credit risk management. We also present in Section 3 a management tool for practitioners (for example pension funds, insurers and other institution present in the credit derivatives market) that are interested in investing in the high growth and high return market of structured debt finance, and in particular in the collateralized debt obligation market.

2. THE PRODUCTS

The International Swaps and Derivatives (ISDA) first publicly introduced credit derivatives in 1992. These innovative instruments allowed investment banks to isolate and hedge efficiently credit risk in the market. Buyers of credit derivatives free up credit lines

by reducing counterparty exposure and sellers enhance returns by assuming greater credit risk exposure. All types of credit derivatives can be classified as either single-name or multi-name credit derivatives, depending on the number of entities being referenced. We first present the single-name derivative instruments before discussing the more complex multi-name products available in the credit derivatives market.

2.1 Single name credit derivatives

There are three main types of credit derivatives that are written on single issuers. These are credit default swaps, total return swaps, and credit spread options. A 2002 report by the British Bankers Association[1] estimates that in terms of the notional principal amounts outstanding around 45% of all credit derivatives are credit default swaps.

> **Credit default swap:** A plain vanilla Credit Default Swap (CDS) is a bilateral agreement between the counterparties, in which one party offers the other party protection against default by a third party ('the reference name') in return for premium payment.
>
> **Example:** The RBC lends money to Bombardier to buy new planes. RBC wants to reduce the risk of a Bombardier default on this loan. RBC buys protection on the Credit Default Swap market from Credit Inc. that indemnifies RBC in such an event.

More specifically, a CDS is a refined form of a traditional financial guarantee, with the difference that a CDS need not be limited to compensation upon an actual default but might even cover events such as credit-rating downgrades, insolvency or bankruptcy. In a credit default swap, the protection seller agrees, for an upfront or continuing premium or fee, to compensate the protection buyer upon the happening of a specified event. Credit default swaps cover only the credit risk inherent in the asset, while risks on account of other factors such as interest rate movements remains with the originator. Marketable bonds are the most popular form of reference asset because of their price transparency.

> **Total rate of return swap:** A Total Return Swap (TRS) is a transaction in which one party pays the other party the return on a reference asset (any coupons and capital gain, be it negative or positive) in return for a floating leg, usually adjusted by a spread.

Example: Capital Oka Canada (COC) owns a USAA variable interest bond denominated in US dollars. COC does not want to assume the interest and/or the exchange rate risk inherent to the bond. COC then enters into a total return swap contract with Supremum by which the latter pays a fixed payment to the former against all payments (including the case of a zero payment in the event of default) associated with the USAA bond without the bond ever being traded nor ever changing hands.

As the name implies, a total return swap is a swap of the total return out of a credit asset against a contracted prefixed return. The total return out of a credit asset can be affected by various factors, some of which may be quite extraneous to the asset in question, such as interest rate movements, exchange rate fluctuations etc. Nevertheless, the protection seller here guarantees a prefixed return to the originator, who in turn, agrees to pass on the entire collections from the credit asset to the protection seller. That is to say, the protection buyer swaps the total return from a credit asset for a predetermined, prefixed return. If a credit event occurs prior to maturity, the TRS usually terminates, and a price settlement is made immediately.

Spread options - A credit-spread option is an option on the spread of a 'defaultable' bond over a reference instrument. At maturity, a credit-spread option will enable its buyer to buy/sell the defaultable bond at the price implied by the strike-spread.

Example: The pension fund of Hydro-Québec is afraid that the credit quality of Cascades will deteriorate within five years. The Fund still wants to own the debt of Cascades, but does not want to assume the financial loss associated with a downgrade. The Fund then purchases a spread put option that will be exercised if Cascades is indeed downgraded: The counterparty then assumes all the risk associated with a downgrade of the Cascades debt, but the Fund keeps all the upside.

The most common type of credit spread options are the credit-spread put option contracts: they isolate and capture devaluations in the reference asset that are independent of shifts in the general yield curve. Essentially, they can be considered a type of default swap that specify the widening of credit spreads as a triggering event. The advantage of the credit spread put is that its payoff is detached from a specific credit event and therefore acts as a good hedge against spreads widening in the absence of a typical event specified in CDS documentation.

This characteristic is particularly attractive during periods such as the late 1990s, when credit spreads became increasingly large and volatile due to circumstances in Asia and Eastern Europe. On the down side, credit spread options are more complicated to price and model[2] than CDS, hence many investors and hedgers will tend to opt for the latter.

The structure of credit spread options is very flexible. This flexibility allows investors and issuers to design the single-name derivative product as an Asian style, lookback, knock-in and/or knock-out barrier options or any other tailor-made structure. This increase flexibility comes at the price of added complexity, however, just as we stated before.

2.2 Multi-name (basket) derivatives

The products we have discussed so far are *single-name* credit derivatives; they are targeted on the credit worthiness of a single obligor. These derivatives are very well suited for the management of specific risk exposures, however are not tailored towards managing credit risk on a portfolio basis. Multi-name products, such as first (or n^{th}) to default swaps,[3] have become increasingly popular tools to help hedge the risk of idiosyncratic, or clustered defaults in a portfolio. It is important to keep in mind that in a portfolio context we are not looking to eliminate credit risk through the use of derivatives (this could be easily achieved through the purchase of single-name CDS on each issuer). What we seek protection against is the possibility of several defaults occurring over a small time period; the main concern is default clustering.

The available products on portfolios of issuers are considerably more varied; so for the sake of parsimony we will focus on the two most common structured products: Basket default swaps and collateralized debt obligations (CDO).

Basket default swaps - The basket default swap is essentially a CDS based on a portfolio of corporate bonds. For example, in a first-to-default swap payoffs are triggered and the basket swap terminates when the first bond included in the portfolio defaults. Effectively the long position pays a premium for protection against a portion of the default risk in the portfolio of corporate bonds. Basket swaps are particularly attractive to those holding portfolios of corporate bonds where the incidence of default is thought to be idiosyncratic rather than systematic. In other words, through the purchase of basket default swaps, one seeks protection against unanticipated default clustering.

Collateralized debt obligations - Collateralized debt obligations (CDO) are a financial innovation to securitize portfolios of defaultable assets: loans, bonds and other debt instruments. These assets are generally sold by the sponsor to a Specialized Purpose Vehicle (SPV), who finances the purchase through the sale of notes (or obligations) that are collateralized by the purchased debt portfolio. The notes issued by the SPV are structured in order to offer risk/return profiles that are specifically tailored to satisfy the needs of specific investors.

Figure 1 presents an example of a basic CDO structure.[4] In this example, the CDO has five tranches, although the number of tranches is usually much larger. The width of the tranches also varies a lot from one CDO to the next. The width of a tranche is the proportion of the CDO's nominal value that is included in a tranche (3.75% in the case of the *Senior* tranche below).

CDO are generally categorized on the motivation of the sponsor of the transaction. If the motivation of the sponsor is to earn the spread between the yield offered on the collateralized assets and the payments made to the various tranches in the structure, then we refer to it as an arbitrage CDO. If the motivation of the sponsor is to remove debt instruments (primarily loans) from its balance sheet, then we refer to it as a balance sheet CDO. Sponsors of balance sheet CDO are typically financial institutions such as banks and insurance companies seeking to reduce their capital requirements by removing loans due to their higher risk-based requirements. This issue of securitization to reduce capital allocation costs (often referred to as regulatory arbitrage) was discussed extensively in the previous column by Boyer and Papageorgiou.[5]

The CDO is constructed so that defaults impact the lowest creditworthy tranches first (the equity tranche in the case of Figure 1) until the depth of the lowest tranche has been exhausted. Then default is assumed by the next-to-worst creditworthy tranche until its depth has been exhausted and so on. Another way to look at the CDO is to say that cash flows are first assigned to the most creditworthy tranche, then to the second-to-most creditworthy and so on, as long as cash flows are available.

This assignment of cash flows in a CDO is known as the cash flow waterfall as illustrated in Figure 2.[6]

In CDO considered so far, we assumed that the special purpose vehicle is purchasing the pool of underlying assets from the sponsor in order to collateralize the CDO. However an increasing number of CDO transactions are being carried out without the actual purchase of the asset pool taking place. Through the use of credit derivatives,

FIGURE 1
TRANCHING OF A TYPICAL CDO

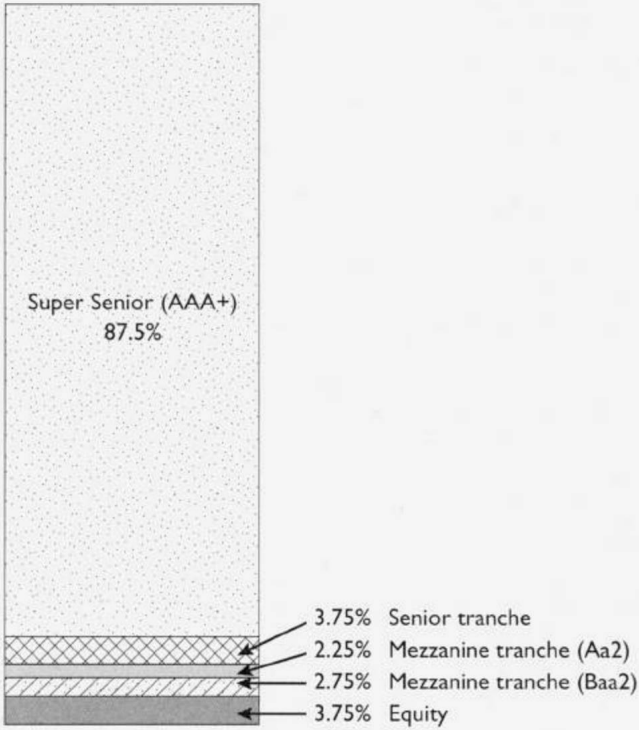
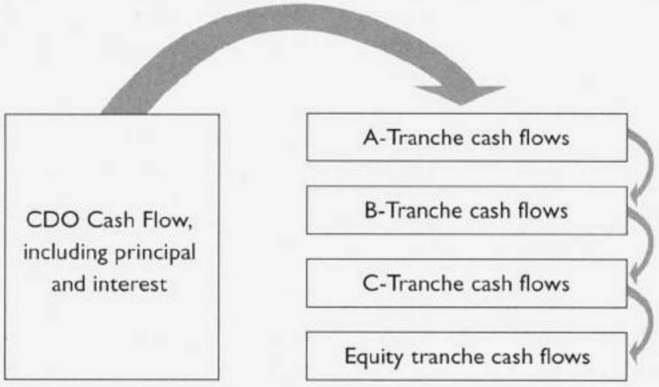


FIGURE 2
CDO CASH FLOW WATERFALL



a synthetic CDO can absorb the economic risks, but not the legal ownership, of the reference credit exposures. This approach gives the structure a much larger degree of flexibility and reduces greatly the transaction costs associated with the construction of a cash flow CDO. Synthetic CDO are now widely used in both arbitrage and balance sheet transactions.

3. THE MARKETS AND MAJOR PLAYERS

3.1 Single name derivatives

The market for single name credit derivatives has expanded dramatically over the last decade, with the notional value of outstanding credit derivatives estimated to be $4 800 billion in 2004. This represents an almost 20 fold increase from 1995, although exact figures are hard to estimate due to the over-the-counter nature of most of these products. One fact that is clear nonetheless is that the market for credit risk management and credit risk transfer has come of age. Credit derivatives such as credit default swaps are becoming standardized and liquidity is ever increasing. Nonetheless, certain concerns still exist over the ability to adequately mark-to-market such derivative products.

Recently, two competing groups, iBoxx and Dow-Jones TRAC-X, launched credit default swap indices which have quickly become benchmarks for the overall performance of credit markets. TRAC-X was the first CDS index to be created and was originally promoted by JP Morgan Chase and Morgan Stanley. It consists of the average CDS price of the 100 investment grade companies selected for inclusion in the index. At the close of the market each day, the participating dealers report closing prices for five and ten year maturities. Average prices are calculated for each constituent of the index, and the weighted average of the constituents is then calculated and made available. The iBoxx consortium of eleven leading global dealers, which includes Citigroup, Deutsche Bank and Goldman Sachs, was launched in October 2002 after certain dealers were not satisfied with the selection criteria for inclusion in the TRAC-X. The iBoxx consortium collectively selects the 125 names to be included in the index, and has also launched an array of new alternatives, including indexes of various sectors. Recently iBoxx has launched a high volatility CDS index, as well as a 100-name tradable index on US non-investment grade companies. It is important to note that indices such as the TRAC-X and iBoxx not only improve market transpar-

ency and liquidity, but also provide a new and important tool for risk hedging. By the end of 2004, some USD 150 billion worth of trades have been linked to the TRAC-X alone and an increasing number of derivatives based on the indexes are being continuously introduced.

The market for CDS indices is by no means limited to the US, and similar markets exist in Europe and Asia. In Japan, for example, the indexation of CDS prices began in 2002 when Morgan Stanley Securities developed the MSJ-CDS index of 25 constituents. As of December 2004, MSJ-CDS and TRAC-X Japan combined to form the Dow Jones iTraxx CJ which boasts thirteen major dealers in the domestic credit derivatives market. The merger between iBoxx and TRAC-X, the competing indices that have made way for iTraxx, has led to a dramatic increase in trading volumes. The rival groups agreed in April 2004 to bury their differences and also launched a combined set of European indices: volume has risen three to four-fold in Europe since iTraxx was launched. A merging of the two groups has not yet been achieved in the United States, however. Nevertheless, a common ground has at least been found in forming a merged high yield CDS index.

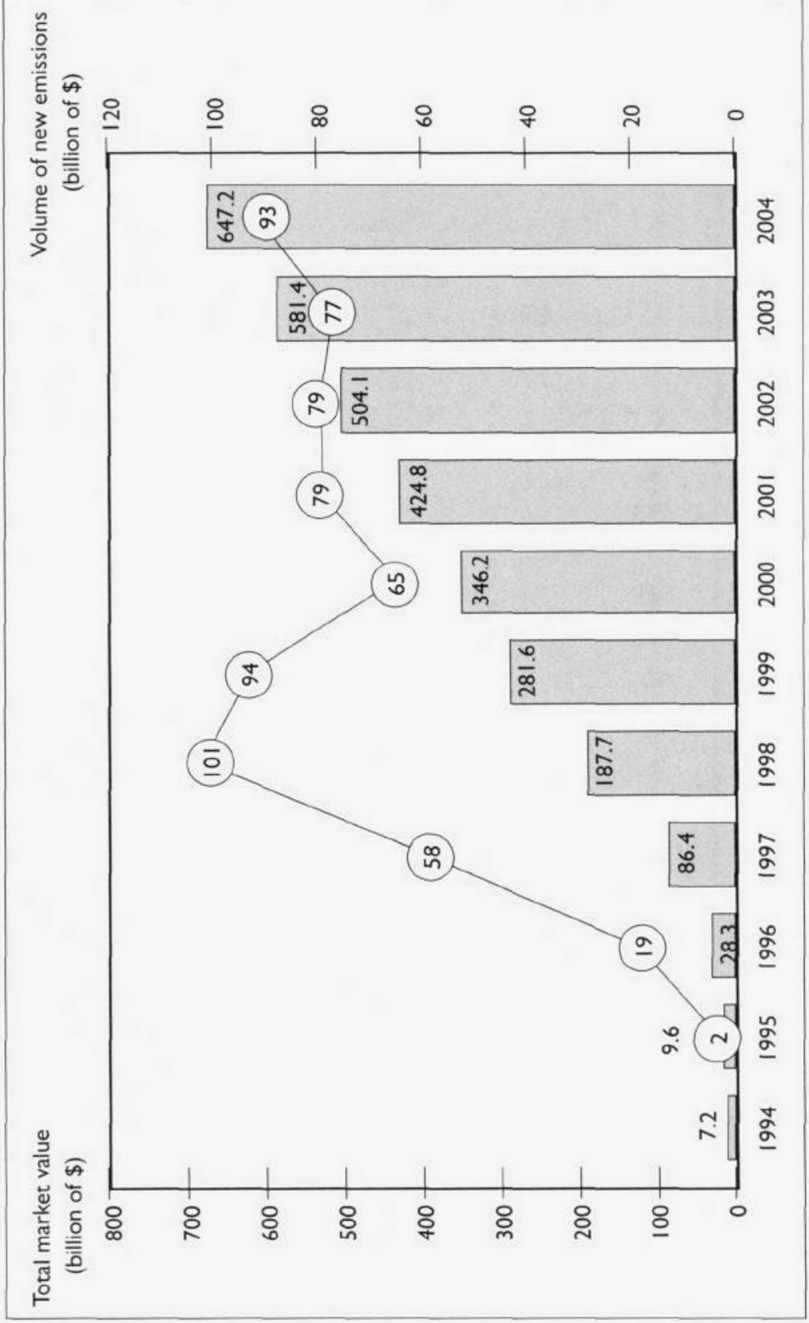
J.P. Morgan Securities has also launched an index tracking the performance of emerging market credit in the booming credit derivatives market. The index, called the EMDI (Emerging Market Derivative Index), follows the credit default swap spreads on 19 of the 31 countries in J.P. Morgan's widely followed index of emerging market sovereign bond spreads over benchmark U.S. Treasuries. The countries in the EMDI include most of the biggest emerging market bond issuers, with the biggest index weighting going to Mexico, Russia, Brazil, Malaysia and South Korea respectively.

3.2 Multi-name derivatives

The market for basket derivatives is considerably less evolved; however its size is growing impressively. For instance, the market for CDO grew from an estimated $4 billion in 1996 to $137 billion in 2001. Recent estimates claim the market for CDO has doubled again since 2001 (see Figure 3).

Products such as basket default swaps are much less standardized and therefore harder to price than their single name counterparts. The difficulty arises mainly due to the variety of issuers included in the pool, as well the financial health dependence between the different constituent firms. Nonetheless, the Dow Jones North American CDX credit derivatives indexes began including standardized versions of first-to-default (FTD) basket in the New York market, allowing parties

FIGURE 3
GROWTH OF CDO MARKET



to trade in a standardised FTD basket. While basket trades have been traded over-the-counter for awhile, the standardised basket option will allow parties to trade with reference to a uniform and standard basket.

Presently, there are standardized FTD baskets for each of five sectors, and two diversified versions. The sectors include basic industries, energy, technology-media-telecom, financials, as well as more diversified baskets. For instance, the basic industry basket has the following names: Ford Motor Co., Bombardier, Delphi Corp., Dow Chemical Co. and International Paper. Index trades on standardised terms are becoming increasingly popular in credit derivatives markets, signalling potential for explosive growth.

The CDO market is fast coming out of its banker-dominated mould, and today, there a variety of participants including the hedge funds and pension funds. Essentially, the CDO technology has enabled institutional investors and asset managers to increasingly participate into the credit derivatives arena without having to expose themselves to stand-alone derivatives. A recent report by Nomura Research[7] claims that hedge funds are believed to be driving the rapid growth of the market, as evidenced by the emergence of new types of funds that are focused on credit and credit derivatives. Not only hedge funds, but corporations as well are investing in CDO.

Corporate Canada and Corporate America are flush with funds that increasingly find their way into investment opportunities in the CDO market. Even more welcome news for the CDO market is the entry of more conservative investors such as pension funds and life and health insurance corporations. With huge funding deficits, pension funds in search of yield enhancing alternative investments are heading towards the credit market to find appealing products. While credit products such as high-yield and structured finance CDO are gaining popularity among pension funds, not to mention CDS index trades and single-tranche CDO, some funds are even moving into more complex multi-name structures. For example, General Motor's pension fund manager was reported to have directed over $10 billion of funds to the structured credit market to boost investment returns.

4. THE FUTURE FOR CREDIT DERIVATIVES

4.1. Credit derivatives: friend or foe?

As with the introduction of any new product or technology, there has been a heated ongoing debate in the financial markets as

to the added value of credit derivatives and the risks that are associated with these products. Market participants, regulators and Central Bankers have all weighed in with their respective opinions. Warren Buffet sent chock waves through financial markets in the late 1990s when he unforgettably labelled credit derivatives as «weapons of mass destruction».

Notwithstanding Warren Buffet's statement, Alan Greenspan, chairman of the Federal Reserve Bank of the United States and an ardent supporter of credit risk transfer tools, was quick to come to the defence of credit derivatives. According to Greenspan, the greatly extended use of credit derivatives doesn't threaten the stability of the global financial system; on the contrary, credit derivatives have helped to defuse financial crises. For example, he noted that during the collapse of the dot.com bubble in 2000, the global telecommunications industry had more than $1 trillion worth of debt outstanding and much of that debt went into default. Fortunately, since much of the risk had been transferred to holders of financial derivatives, the use of those instruments prevented a total collapse in the banking industry. Derivatives allowed the risk to be transferred and assumed by the financial market as a whole, hence lightening the credit risk burden placed on banks and other first line providers of debt capital.

More recently, in May, 2005, while addressing the Federal Reserve Bank of Chicago's Forty-First Annual Conference on Bank Structure, Greenspan still maintained his overall positive tone on the use of credit derivatives, however he expressed certain reservations about the market for credit transfer. Specifically, he cited at length the report of the Joint Forum under the aegis of banking and insurance regulators as well as the UK FSA report that concluded that the information about risk transferred outside the banking sector by credit derivatives was extremely opaque and in particular, data about the notional values of credit default swaps, particularly CDO, was not reliable to understand the exact element of risk.

Greenspan's remarks could not have come at a more opportune time since the credit market is presently struggling to cope with the impact of downgrades to junk-rating of two corporate giants: General Motors and Ford. While spreads for both the car makers had been widening for quite some time, the arguably justified junk rating attributed to the two car makers meant that several institutional investors constrained to hold only investment grade securities, were mandated to hedge or clear their credit risk positions in these firms. Both GM and Ford are regularly traded names in the credit derivatives market and GM bonds are referenced in several CDO. The impact of the downgrades on the CDS markets was readily apparent:

The 125-name 5-year Dow Jones index widened from 59.08 bps to 63.49 bps, breaking the 60-bp mark for the first time.

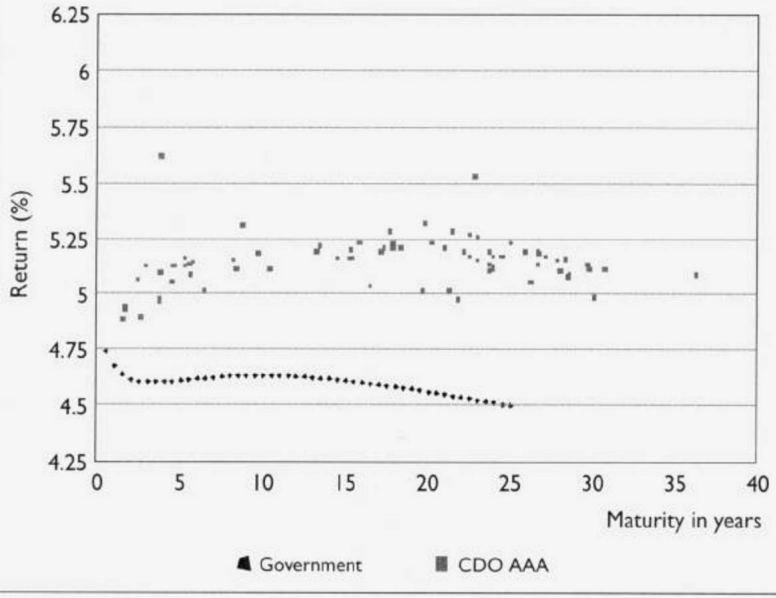
4.2. Investment Valuation and Model Risk

The increasing popularity of the credit derivative market in general, and the CDO market in particular raises interesting question for regulators and investors alike, not to mention accountants, financial analysts and academics. One important question one is bound to ask is how to value multi-name credit derivative products?

When we look at the current spread on CDO in the British market (Figure 4), we realize that, even for extremely good credit quality tranches (AAA to be precise), the spread with returns on government security is quite high. One must wonder why these spreads, in the magnitude of 50 bps to 75 bps on average over the entire term structure, are so large.

These spreads can have many sources: Lack of liquidity, difficulty in attributing an appropriate rating, a supply surplus associated with the Basel II Accord, accounting problems, lack of transparency,

FIGURE 4
TERM STRUCTURE OF INTEREST RATES AND OF RETURNS ON CDO IN BRITAIN (31 MARCH 2005)



adverse selection in the choice of the names to be part of the CDO, moral hazard in the management of the CDO, a demand shortage associated with a lack of education and information, etc. These are all noteworthy problems, but together we do not think they justify such huge spreads when looking at the spreads of closed-end funds and other debt-like financial assets. One explanation that appears more appealing is that investors have a problem in finding the correct way to value these assets. In other words, the CDO market is faced with an important model risk in valuing the credit worthiness of a given structure.

In essence, there is a model risk when it is difficult to assess to fair market value of a derivative product. Using the fair market value is important when one needs to asses the contribution of a given trader to the profitability of the firm or when accountants need to report the financial health of a firm. For some assets, the fair market value is easily observable when the asset is traded regularly. When the asset is not traded regularly, one must then rely on models that give some quasi fair market value. The problem resides in that not every model is robust, and not every robust model gives the correct value. Model risk basically means that one cannot be sure which model is the correct one so that one is faced with some uncertainty related to the value of the credit derivative instrument.

In the case of CDO, there are no reference models similar to the Black-Scholes model for options. This means that each investor must use his own model for valuing portfolios of debt instruments that may themselves be debt instruments such as the so-called CDO of CDO, or CDO^2. This means that valuing a CDO remains a very risky process in that each analyst uses his own model to come up, presumably, with radically different assessments of its market value. Another important model risk associated with CDO is that there does not seem to be a clean historical record of CDO transactions – or more precisely, none that are long enough – that would allow a researcher to back-test any model. Add to this the fact that some CDO include non-traded assets and we have the perfect recipe for facing an important risk associated with the model that should be used.

How must we value a CDO then? Although the task is complex, it is nonetheless essential if one is to become a major trader on the CDO market. Without a proper model with which to compare the investment and/or arbitrage opportunity on the CDO market, investors are bound to sail blindly in rough waters. Many firms offer computer programmes that aid in the valuation of CDO, but none appear to generate a wide consensus on the financial market. This lack of consensus exists both amongst practitioners and academics alike.

Although no model has been widely accepted by the financial community yet, we can divide the different approaches used in the different model into two categories: A simulation (Monte-Carlo) approach and a closed-form solution approach. These two approaches to the problem are radically different and may yield radically different solutions. Nevertheless, just like diversification minimizes the risk specific to a financial asset, model risk is minimized when we use more than one model to assess the value of a given CDO.

The *Centre interuniversitaire de recherche en analyse des organisations (CIRANO)* developed in the past year an interface designed to minimize the model risk associated with this credit derivative product.[8] This module designed as a *VisualBasic* interface allows the trader (or any user) to access the two types of approaches common in the valuation of CDO: the Monte-Carlo simulation approach and the Close-form approach. Part of this interface is presented in Figure 5a and Figure 5b.

FIGURE 5A
THE CIRANO CDO MONTE-CARLO INTERFACE

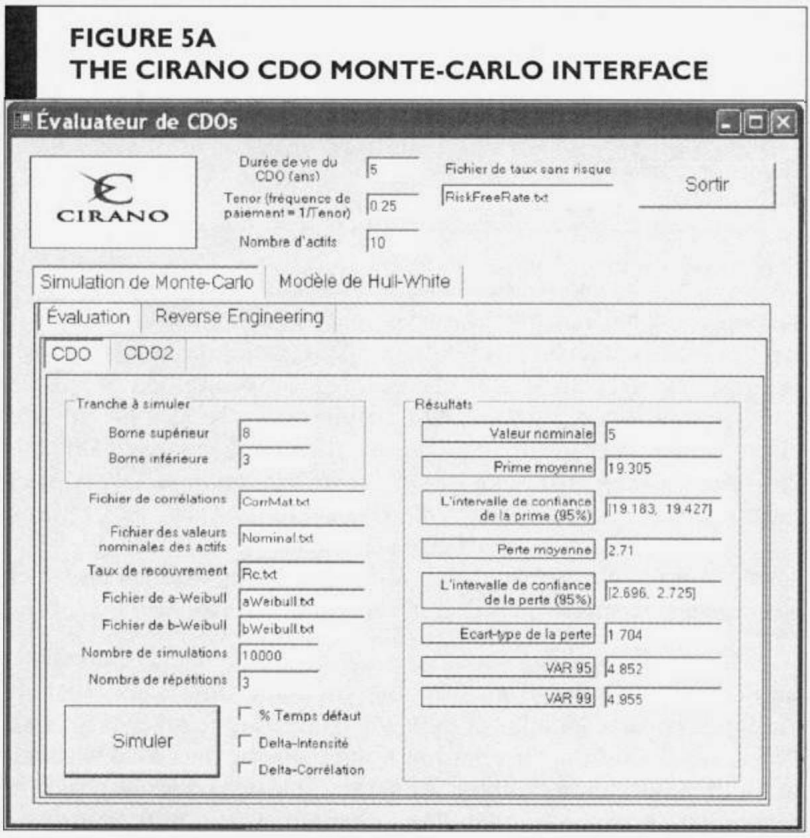
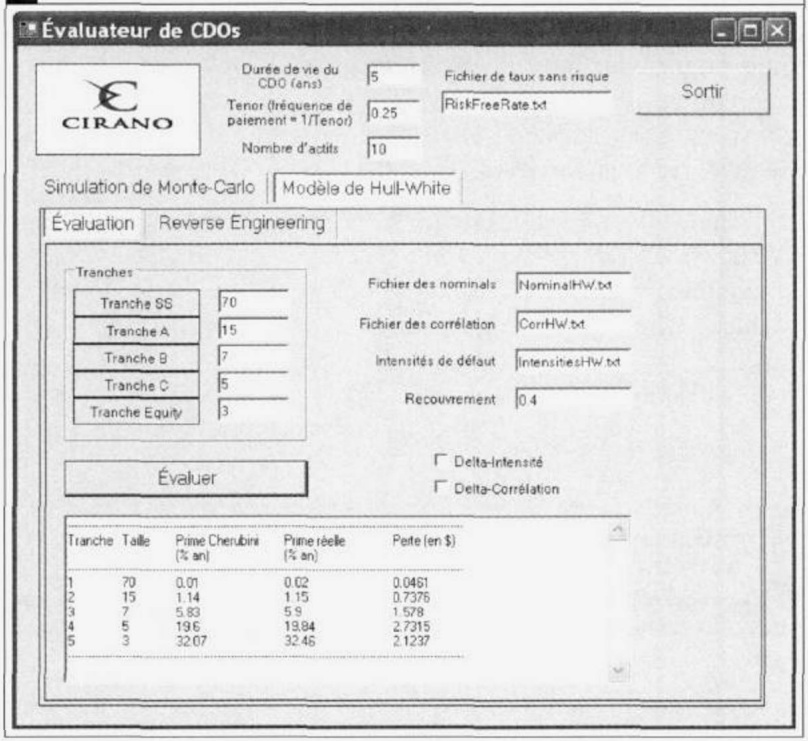


FIGURE 5B
THE CIRANO CDO CLOSED-FORM INTERFACE



Both the Monte-Carlo and the Close-form approaches have their advantages as well as their drawbacks. The Monte-Carlo simulation approach to valuing a CDO is the most flexible, but it necessitates the input of a correlation matrix between the returns on the different assets included in the CDO portfolio and a model for the loss given default. In many off-the-wall programmes available from large investment banks or trading groups, this correlation matrix is often assumed to be the same are the one that exists between stock returns. This necessarily lacks robustness since CDO may be composed of debt securities of companies whose stock is thinly traded and even non-traded; a correlation is therefore impossible to calculate.

Although these drawbacks are not insurmountable, the Monte-Carlo approach still has another drawback that trumps all others in that simulations take a lot of time when there are many assets in the CDO. Moreover, tranches must be valued one by one. This is necessarily time consuming if there are 40 tranches for which one million simulations are run. Since it takes approximately two hour to run a

million simulations when there are 150 assets in the CDO, we see that it is not reasonable to expect traders to wait 80 hours to get a clear picture of the value of a CDO.

Another interesting characteristic of the CIRANO CDO module is that it allows the trader to calculate an implicit correlation coefficient between the names in the CDO. Similarly to the case of options where an implicit volatility can be calculated if we know the market price of the option, we should theoretically be able to calculate an implicit correlation coefficient for CDO is we know the price of a given CDO tranche. The Reverse Engineering option of the CIRANO CDO Module calculates any CDO's implicit correlation for both the Monte-Carlo and the Close-form approaches. This aspect of the product will benefit any trader who, with the calculation of an implied correlation on a high-liquidity tranche for which pricing information is reliable and informative, is then able to calculate the value of a low-liquidity CDO tranche.

The Close-form approach of the CIRANO CDO Module currently only calculates a close form solution in the case of a Gaussian copula. Recent research[9] has shown, however, that student copulas are better at following the return of highly liquid CDO. A future development for the CIRANO CDO Module should therefore be allowing users to define many other types of copulas that may be better at modeling the correlation in the credit risk of the different CDO components.

5. CONCLUSION

The goal of this article was to describe the main credit derivatives and structured products available to manage and hedge credit risk in the financial markets, as well as to provide some insights into the latest trends in credit risk.

Credit risk behaves a lot like traditional insurance products in that a default on a debt can be seen as a catastrophe just like any accident that would reduce the value of an asset in traditional insurance markets such as sickness, death, theft, accident and fire. Although traditional insurance markets have been around for a long time and the process by which premiums on individual risks and on baskets of risks (i.e., reinsurance products) is relatively well understood, the end of the 20th century has seen the development of similar products

in the bond market. This development was fuelled by two significant financial developments: securitization and derivatives.

Just as the market for single insurable risk is more developed in the insurance market, the market for single issuer credit default products is more mature than its multi-name counterpart. One reason is that there is more liquidity on the single name product market than on the multi-name product market, which has helped standardize numerous types of credit derivatives, which has in turn attracted more players that do not have enough sophistication to invest in the multi-name market. As a consequence, the multi-name credit derivatives market, and in particular the collateralized debt obligation (CDO) market is still in its infancy and much research is still being done in finance, economics and statistics to properly understand and model the risks of these credit linked products.

Concentrating on the collateralized debt obligation market, we presented in this column current research and tools that are being developed to help finance practitioners interested in the structured debt finance market, but who, at the moment, lack the needed experience and/or sophistication.

Credit derivative products are developing rapidly for many reasons that were presented in our previous column.[10] In particular the new Basle Accords increase the value for banks to get rid off loans that unduly drain much needed equity capital via low-cost single-name and/or multi-name credit derivatives. We can then be relatively certain that the new Basle Accord is fuelling much of the growth on the demand side of the credit derivative market. Who will then be supplying this demand? Possible players include hedge funds and financial institutions that are not bound by the equity capital requirement outlined in the new Basle Accord.

Although hedge funds may have the expertise in assessing the value of credit derivative as well as banks, their backbone is arguably not strong enough to assume all the weight of the credit market. Non-banking financial institutions (pension funds, mutual funds, insurance companies) on the other hand have the necessary backbone, but they lack the sophistication of banks in this type of market. This means that there are potentially large rewards available to institutions that could enter this market and gather enough momentum and expertise to become a major player. Whether we will see a major influx of non-banking financial institutions into the realm of credit derivatives is still unknown. Nevertheless, the world credit market, and especially the Canadian credit derivative market is ripe for new

capital. We must only wait to see if there are Canadian institutions that will profit from this new investment opportunity.

Notes

1. British Bankers Association, Credit Derivatives Survey, 2002.

2. See T. Bowler and J.F. Tierney. Credit Derivatives and Structured Credit: A Survey of Products, Application and Market Issues. London Deutsche Bank (1999).

3. See the paper by John Hull and Alan White: «Valuation of a CDO and an n^{th} to Default CDS without Monte Carlo Simulation», *Journal of Derivatives*, 12:1-20.

4. Source: The ABC of CDO, Credit Magazine, 2004.

5. Boyer, M. and Papageorgiou, N. (2004). Passing the buck! Le risque de crédit et le risque réglementaire, *Assurances et gestion des risques*, vol. 72, no. 3, octobre 2004.

6. From Goodman & Fabozzi, Collateralized Debt Obligations - Structures and Analysis, 2002.

7. Nomura bank report, *Mid-year Fixed Income Outlook*, 2004.

8. See www.cirano.qc.ca.

9. Burtschell, X., Gregory, J. and Laurent, J.-P., (2005). A Comparative Analysis of CDO Pricing Models, Mimeo, ISFA Actuarial School, Université de Lyon, April 2005.

10. Boyer, M. and Papageorgiou, N., op. cit.