The Case for Exchange-Based Credit Futures Contracts

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Abstract
This article examines the growth in the use and application of credit derivatives. It discusses the general advantages to investors that can be gained by using exchange-based futures compared to their OTC counterparts. The iTraxx® index operational framework, composition of the indexes, fixed coupon, and market quotes are explained with the aid of a Bloomberg screen and a numerical example. There is an overview of credit default swap pricing and a presentation of a Bloomberg screen that illustrates the detailed pricing output for Eurex Credit Default Swap Futures in respect of the iTraxx® Europe 5-year contract. The article focuses on the variety of ways in which credit derivatives generally are being used in today's markets. It presents the three Eurex futures contracts in detail and explains how settlement will be affected both in the absence of default and when default(s) occur. The empirical section examines different investment strategies where existing iTraxx® index products could have been used to great advantage. The scenarios examined consider the total return performance of bond indexes, a single bond and an equity index when combined with existing iTraxx® benchmark indexes. The results of the study are positive and implicitly indicate uses to which corresponding exchange-based credit futures could be put.

Acknowledgements

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Disclaimer

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Executive Summary

Credit derivatives have developed during a relatively short space of time into important risk management tools, as well as an investor asset class in their own right. Their use has led to a transformation in the relationship between cash and synthetic (or derivative) assets in the credit markets, in exactly the same way as was observed in an earlier generation of derivatives in the interest rate markets. Credit default swaps and the various other types of credit derivatives are used for a wide range of purposes and by a wide variety of market participants, including banks, asset managers, hedge funds, proprietary traders and insurance companies. Market volume has grown from USD 180 billion notional in 1997 to USD 20.21 trillion in 2006. Indexes supported by the International Index Company Ltd (IIC), namely the iTraxx® Indexes, are now viewed as a market benchmark.

Notwithstanding their flexibility and user-friendly construction, credit derivatives suffer from a number of weaknesses inherent in over-the-counter (OTC) instruments. These include issues in legal definition and the existence of counterparty default risk, common to all bilateral OTC contracts.

Exchange-traded derivative contracts exist in parallel with OTC derivatives in the interest rate markets and were instrumental in generating liquidity and transparency. This has contributed to greater efficiency in both cash and derivative markets. The Eurex Credit Futures Contract written on the iTraxx® is set to perform a similar role in credit markets. Market participants can benefit from the ability to trade in a credit benchmark using an instrument that has the inherent advantage of being an exchange-traded contract. The contract specification features a bond-like construction, making it straightforward for users to see where the index is trading. The price quote itself is transparent, comprising a base of 100 plus credit spread changes in the index, and the accrued premium. At maturity the contract is cash-settled, removing the delivery considerations that currently exist with most CDS trades and which raise cheapest-to-deliver and lack of deliverable asset issues.

As with all exchange-based derivatives, the Eurex iTraxx® Credit Futures offer sound infra-structural advantages when compared to OTC products; for example the absence of counterparty risk for all market participants, because the Eurex clearing system eliminates the risk of counterparty default. Moreover, there is no requirement to execute an additional ISDA® agreement as trading can be undertaken within the existing Exchange Futures Agreement.

Application of Credit Futures Contracts

Banks and fund managers are already making considerable use of credit index products: managing macro risk, Market-Making and structuring credit products, for example. Figures from British Bankers' Association, Credit Derivatives Report 2006 report that full credit trades now have a 30% market share of the take-up of credit products. Following the introduction of the Eurex iTraxx® futures contracts on the Europe, HiVol and Crossover Indexes, existing and new users are able to draw on additional products that can be used as speculative, risk hedging and financial engineering tools. The most straightforward

application is to hedge short-term credit risk exposure in a diversified corporate bond portfolio. The ease of transacting business in exchange-traded futures makes these exchange-based contracts ideal instruments for use in a dynamic hedging context.

There are, however, other interesting possibilities, for instance, exploring the impact of including credit index positions in an index-tracking portfolio. One example examined in the article considers the effect of including the iTraxx® Europe 5-year Index in a Bloomberg/EFFAS Euro Market 3-5 Year bond index-tracking fund. An efficient frontier is established by varying the combinations of the instruments concerned from 0% in the credit index and 100% in the bond index in discrete steps to 100% in the credit index to 0% in the bond index. The findings, based on past data, suggest that the inclusion of credit index positions up to a level of 10% of the portfolio value would have reduced risk and increased return over the period considered. Furthermore the evidence suggests that increasing the credit index holding to 20% would have had a large positive effect on the diversified portfolio's return for a small increase in risk.

This strategy can also be applied to other underlying portfolios: sovereign bond, corporate bond, and equity portfolios and to other credit indexes. A second example in the article considers a short-term speculative exposure to the iTraxx® Crossover Index. A numerical example illustrates how a short position in the iTraxx® Crossover Index linked to a Euro-liquid 3-5 Year Bloomberg/EFFAS bond index-tracking portfolio could have increase returns by 13.6% on an annualised basis.

Other trade strategies present themselves. The iTraxx® future allows an equity fund manager an extra opportunity to generate alpha. For example, the correlation between the Dow Jones EURO STOXX 50® Index and the iTraxx® Europe 5-year Index is generally negative. During a bull run in the equity market a fund manager could, for instance, sell protection in the credit index while simultaneously buying futures in the equity index. Such a position allows the investor to benefit from overall market movements in both asset classes. When compared to each other the returns on credit indexes themselves sometimes exhibit negative correlation. In such cases Eurex futures can be used to mount arbitrage or relative value positions in the different indices. For example, observations during 2006 showed a negative correlation between the CDX Crossover series and the European iTraxx® HiVol Index. To exploit this relationship, an investor could buy or sell the iTraxx® future and put on an opposite position in the CDX.

Conclusion

There are a wide range of trading strategies that can be executed using the Eurex iTraxx® futures contracts. The transparency of these contracts combined with their user-friendly operating characteristics open up possibilities to participants who, for a number of reasons, are not currently engaging with the credit derivative market. Whatever application these instruments are ultimately used for, their availability provides another stepping stone to the more efficient and transparent operation of credit markets.

Section 1: Credit Derivatives

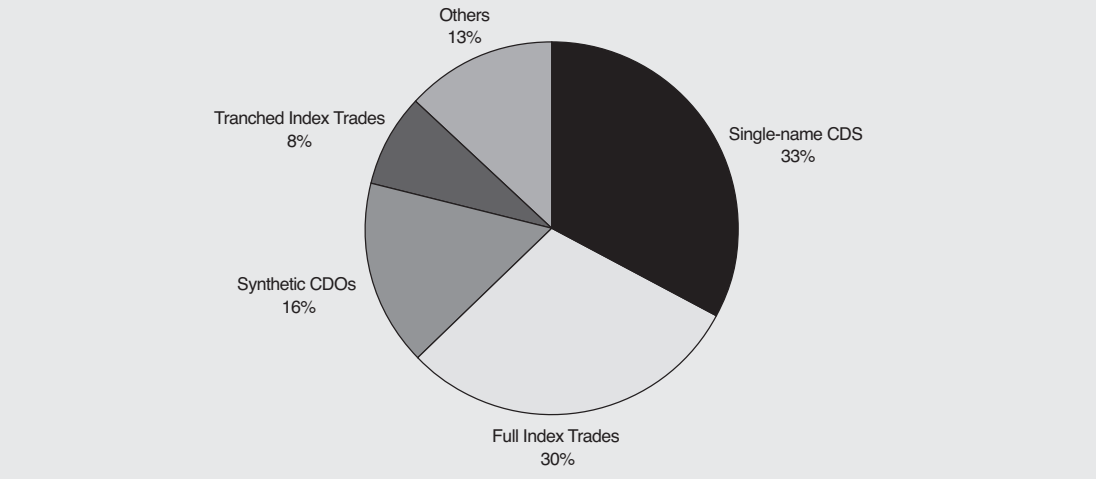
Growth in the use of credit derivatives over the past decade has been phenomenal and widespread. In the 1990s, financial institutions were the prime users of credit derivatives, using them to manage credit risk exposure and to free up credit lines. The primary credit derivative instrument, the credit default swap (CDS), has gained in popularity as an investment tool and asset class in its own right and has attracted substantial market participation from investors such as insurance companies and hedge funds. Such market participants have developed CDS investment strategies that involve both the buying and selling of protection, as their views on the credit market dictate. Alternatively they seek to use CDSs to enhance portfolio returns by using the instruments in a more selective manner.

Table 1.1 provides an illustration of some of the uses to which credit derivatives can be put. Their entry to and increasing participation in the market has led to the rapid evolution of a variety of credit instruments to meet their needs: credit default swaps, credit default options, total return swaps (TRS), portfolios and collateralised debt obligations (CDOs), credit linked notes (CLN), basket products, and importantly, credit indexes and credit index tranches. Many of the newer instruments that have appeared have proved successful, particularly CDS, Portfolio/CDOs, CLNs and credit indexes. Figure 1.1 illustrates the market share of the main credit instruments in 2006 as reported in the British Bankers' Credit Derivatives Report.

Table 1.1: Applications of Credit Derivatives

End Users	Application
Asset managers	Diversify into European credit risk Portfolio balancing tools
Hedge funds	Relative value trading Gaining leveraged exposure Proxy hedge against CDO tranches Circumspect trading strategies
Credit correlation trading desks	Proxy hedge against CDO tranches Gaining leveraged exposure Model trading
Bank proprietary desks	Trading and Market-Making credit books

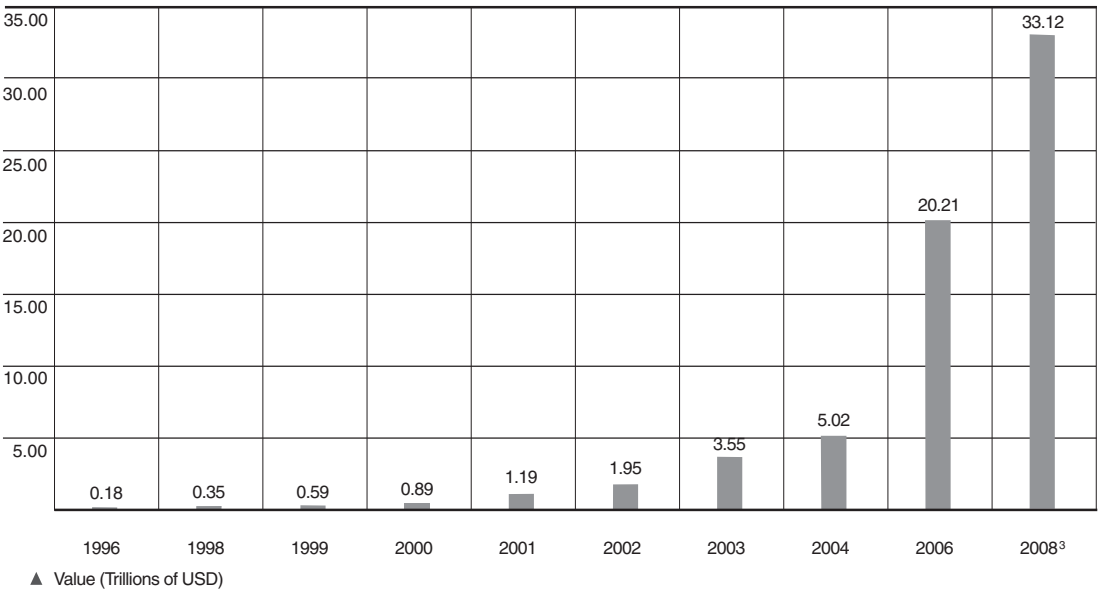
Figure 1.1: Market Share of Credit Derivatives by Type



Source: British Bankers' Association, Credit Derivatives Report 2006

The ability to isolate credit as an asset class, away from funding, interest rate and currency considerations, has been welcomed by all market participants. As a result, the last few years have witnessed an exponential explosion in their usage. Although it is difficult to assess the exact value of early trades the figure estimated for 1997 is in the region of USD 180[1] billion, rising to USD 20.1 trillion in 2006[2]. Official statistics from a BBA publication in 2006 provides an estimate that volume will have reached USD 33.1 trillion by 2008. Figure 1.2 illustrates this tremendous growth. The sums involved are impressive and serve to illustrate the important role that the products are playing in global financial markets.

Figure 1.2: Global Credit Derivatives Growth from 1997 – 2008



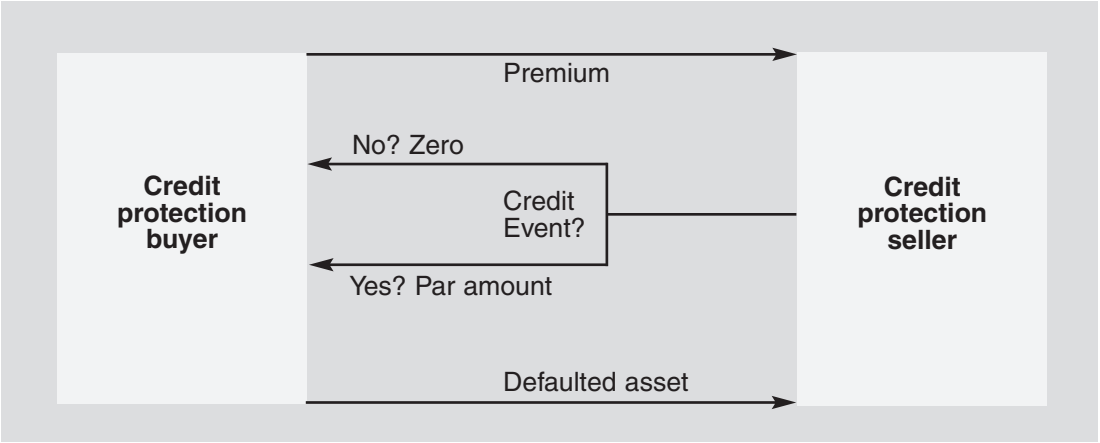
Source: BBA Credit Derivatives Report (2006), British Bankers Association

[1] British Bankers' Association Report 2006
[2] British Bankers' Association Report 2006
[3] Estimated Value

Early users of credit derivatives experienced certain problems associated with the over-the-counter (OTC) nature of the product. Perhaps the most important issues raised were those encountered in the legal domain and which brought with them unexpected risks additional to the identified credit risk, such as definitional and documentation risk. The issues included for example, "What constitutes a credit event?", "What constitutes default?", "What constitutes restructuring?" and "What is deliverable in the event of a contingent claim?". Many of these early problems have been solved by the introduction of standardised ISDA® documentation and the publication in 2003 of the ISDA® Credit Derivatives Definitions Guide, and the instruments are now established on a firm, recognised trading base.

The success of the CDS instrument reflects its inherent simplicity. Financial markets have enjoyed a long era of successfully using interest rate swaps (IRS). The concept underpinning an IRS is well understood, as are the mechanics for valuing, and clearing, and standardised ISDA® documentation is available. The IRS template has spawned many other, perhaps more exotic, swaps, for example, asset swaps, total return swaps, equity swaps, commodity swaps, roller-coaster swaps, currency protected swaps, index principal swaps, etc. It is not surprising that the template should be applied to credit. In fact both asset swaps and total return swaps are categorised as credit management instruments (see Figure 1.1). The structure of a CDS follows the same logic, as shown at Figure 1.3.

Figure 1.3: Credit Default Swap Basic Structure



The transaction is based on a notional principal attached to a defined reference entity. A premium is paid on a periodic basis to the protection seller who, only when a default event is deemed to have occurred, will be obligated to compensate the protection buyer. When no credit event occurs during the life of the swap the protection seller receives the regular premium but delivers nothing. In itself this provides an insight into some reasons for using CDS:

(i) To hedge the isolated credit risk on the defined reference entity by buying protection
(ii) To pick up premium by taking a long position in the credit exposure offered by the reference entity by selling protection

Note that (ii) does present an alternative to the physical purchase of a bond issued by the reference entity; it is, however, not a perfect substitute; buying a bond exposes the investor to the market risk associated to the bond's price in addition to the credit market's perception of the bond's creditworthiness.

Since these transactions are OTC end-users must be aware of the disadvantages as well as the potential opportunities that the instruments offer. First and foremost there is a danger of counterparty default. In the absence of a formally managed and regulated margining system and given the growth that the market has experienced, there is the risk of a counterparty to a transaction failing to honour its contractual obligations. In spite of the standardisation of credit documentation that is available through ISDA®, this risk exposure was recognised by the Federal Reserve Bank of New York. In 2005, it called in representatives from the main global financial institutions and expressed its concern about the length of time being taken to confirm trades, the number of trades remaining unconfirmed for long periods of time, the lack of transparency in assigning positions and the settlement process. These issues have been partially addressed – for instance, reducing the backlog of unconfirmed trades, and more transparency in assignment introduced – although the infrastructural problems have not been fully resolved.

Other well-known features associated with OTC products and transactions can also be problematic: issues such as price determination, price quotes, existing contracts, and transactions costs, for example.

Issues associated with the definition of a "credit event" have, to a great extent, been addressed by the ISDA® standard documentation. There remain, however, a number of questions that need to be considered in a CDS structure. Some examples include:

- On which of the corporates instruments can the default occur in order to be classified as a credit event?

- Over what period is the protection to be in place? Although it should be noted that there is no requirement to hold a CDS until maturity. The market is highly liquid and positions can be opened and closed quite readily.

- What seniority does the reference obligation enjoy? These are categorised, for example, as senior, subordinated, junior or equity, etc.

- In the event of a CDS default, how will settlement be effected, cash or physical delivery? If settlement is in the form of physical which of the corporates bonds are eligible for delivery?

With regard to CDS settlement, physical settlement and delivery can bring with it problems associated with:

(i) The delivery of a cheap bond, and the concept of the cheapest-to-deliver (CTD)
(ii) Whether there are enough bonds outstanding in the market

In the case of an index there is a diversified portfolio of names but the risk of a credit event still remains and in the case of such an occurrence physical settlement – where the reference entity weighting is 0.8 percent and the notional principal is EUR 100,000,000 – proceeds along the following lines:

- The protection seller pays to the protection buying counterparty (0.8% x EUR 100,000,000) = EUR 800,000

- The protection buyer delivers EUR 800,000 nominal of the deliverable obligations of the reference entity

- The original notional principal on which the premium was paid is reduced to (99.2% x EUR 100,000,000) = EUR 99,200,000

- The protection buyer continues to pay premium but now on the revised notional principal until the contract's maturity or until a further credit event or credit events occur.

The iTraxx® futures contracts, which were introduced on Eurex on March 27, 2007, avoid the problem of physical delivery by using cash settlement procedures and will be backed by a fully competent clearing and settlement system. The futures pricing mechanics are introduced in section 4.

Section 2: iTraxx® Credit Indexes

From Figure 1.1 it is clear that single-named CDSs are still the most important instrument in the credit arena, although the credit indexes portion has increased significantly over the last few years. In 2003, CDS accounted for 75 percent of credit products with the percentage usage of index products not recorded. The development through early indexes such as Trac-X and iBoxx to today's CDX and iTraxx® has been rapid as market participants have realised their potential as instruments for credit portfolio engineering.

There are a number of indexes provided by the International Index Company Ltd (IIC) and they have enabled a high degree of transparency, liquidity and diversification to be brought into the credit arena. One of the major indexes is the iTraxx® Europe Index which comprises 125 of the most liquid, equally weighted reference entities drawn from a palette of geographically dispersed industry concentrations, for example, Banking and Finance, Utilities, and Telecommunications from across Europe, and it is this index that is viewed as a market benchmark. The indexes normally trade 5- and 10-year maturities and new series are updated/issued every 6 months. There are 25 Financial names in the iTraxx® Series 6 with representatives from the United Kingdom, Germany, France, Holland, Spain, Italy, Switzerland and Portugal and 100 non-financials with an even broader geographic dispersion.

There are a number of other iTraxx® Indexes. There is a corporate index that has as its constituents 100 non-financial names and a HiVol index constructed using 30 reference entities with the widest CDS spreads and which is a subset of the main Europe index. There is also a Crossover index made up of 45[4] of the most liquid sub-investment grade non-financial reference names. In addition there is a wide spectrum of sub-indexes listing sectors such as financial, consumers, energy, industrial, as well a geographical indexes for Japan, Australia, Europe and Asia ex-Japan, for example. The equivalent index in the North American market is known as CDX.

The iTraxx® Europe exhibits high liquidity and for this reason may be viewed as a credit benchmark. Its bid-offer spread is very narrow at approximately a quarter of a basis point and this contrasts with spreads generally between ten and 20 basis points for most single-name CDS contracts. Because of its liquidity and benchmark status, the iTraxx® Europe is increasingly viewed as a leading indicator of the credit market overall, and the index basis is important in this regard as an indicator of relative value.

The iTraxx® Europe 5-year Index Series is constructed as a basket of reference credits that is reviewed on a regular basis. For example, the index consists of 125 corporate reference names, so that each name represents 0.8 percent of the basket. The Bloomberg screen presented in Figure 2.1 shows the first page of reference names for the December 2011 iTraxx® Europe 5-year Index Series 6.

[4] The Series 7 Crossover index from March 2007 will comprise 50 names.

Figure 2.1: iTraxx® Europe Index Names, February 1, 2007

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CDS INDEX MEMBER LIST Page 1/8

Index:	ITRX EUROPE 12/11	Spread Ticker:	ITRXEB56
RED Code:	2I666VAF2	Deal Spread:	30.000
Effective Date:	09/20/06	Current Spread:	23.190/23.440
Maturity Date:	12/20/11	Contributor:	CMAN

Company Name | Spread Info | Download — Bloomberg CBIN Mid/Last Prices

RED Name	Wgt	RED Ref. Ob.	RED Pair	Corp Tkr	5 Yr CDS Tkr	Spread
1) ABN AMRO Bank N.V.	0.80	XS0180772484	NN02ANAD1	AAB	CAAB1E5	6.103
2) ACCOR	0.80	FR0010026765	0A477BAC1	ACCOR	CACC1E5	34.962
3) Adecco S.A.	0.80	CH0016469279	006DC9AC7	ADO	CADO1E5	34.853
4) Aegon N.V.	0.80	XS0207157743	007GB6AD4	AEGON	CAEGO1E5	9.973
5) Aktiebolaget Electro...	0.80	SE0001376294		ELTLX	CELT1E5	37.875
6) Aktiebolaget Volvo	0.80	XS0157960815	9BAGDBAB8	VLVY	CVLVY1E5	27.286
7) AKZO Nobel N.V.	0.80	XS0170265341	0B11AIAB8	AKZO	CAKZO1E5	27.066
8) ALLIANCE BOOTS PLC	0.80	XS0097335318		ABLN	CBOTP1E5	28.528
9) Allianz Aktiengesell...	0.80	XS0158792381	019G85AE4	ALZ	CALZ1E5	6.476
10) ALTADIS, S.A.	0.80	XS0176838372	EE475EAB6	ALTSM	CALT1E5	34.148
11) ARCELOR FINANCE	0.80	XS0176671732	03CCIGAB6	LORFP	CLFN1E5	34.250
12) ASSICURAZIONI GENERA..	0.80	XS0114161796	0E996BAA9	ASSGE	CASS1E5	6.263
13) AVIVA PLC	0.80	XS0066877258	GG6EBTAD8	AVLN	CAVL1E5	6.135
14) AXA	0.80	XS0130738213	FF667MAA4	AXASA	CAXA1E5	10.107
15) BAE SYSTEMS PLC	0.80	GB0001272664	05A75UAC5	BAPLC	CBAE1E5	17.267
16) BANCA INTESA S.P.A.	0.80	XS0107999707	TU877BAB4	ISPIM	CBCI1E5	7.015

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The index rolls every six months (in March and September), when reference names are reviewed, some names exit the index and are replaced by newcomers, and the premium is set. Hence there is a rolling series of contracts with the “front contract” being the most recent. On the Series 6 European platform there are four maturities listed for the HiVol, 3, 5, 7 and 10 years, and two maturities for the Crossover and sector indexes, namely, 5 and 10 years.

Table 2.1: iTraxx® Index Data

Index	Maturity	Fixed Rate (%)	Date	Series	Observation	Bid	Ask
iTraxx® Europe	5-Year	0.30	February 1, 2007	6	EOD	23.07	23.43
iTraxx® Crossover	5-Year	2.80	February 1, 2007	6	EOD	201.00	203.00
iTraxx® HiVol	5-Year	0.55	February 1, 2007	6	EOD	44.86	45.50

Source: Compiled from IIC Ltd. data

All the existing index series listed in Table 2.1 can be traded although the most liquid index is the current series. The reference names in the iTraxx® Europe Index cover a spectrum of credit ratings and are the highest traded names by CDS volume in the previous six months.

To illustrate trading an iTraxx® index consider the following example. A bank buying protection in EUR 10 million notional of the index has in effect bought protection on EUR 80,000 each of 125 single-name CDS. The premium payable on a CDS written on the index is set at the start of the contract and remains fixed for its entire term; the premium is paid quarterly in arrears in the same way as a single-name CDS. The premium remains fixed for the life of the trade but of course the market value fluctuates on a daily basis. This works as follows:

- The constituents of the index are set about one week before live date, with the fixed premium being set two days before. The premium is calculated as an average of all the premiums payable on the reference names making up the index. In October 2006, the current 5-year index for Europe was the iTraxx® Europe December 2011 contract. The reference names in the index were set on September 13, 2006, with the premium fixed on September 18, 2006. The index went live on September 20, 2006. The index is renewed every six months in the same way.

- After the roll date, a trade in the iTraxx® is entered into at the current market price;

- because this is different to the fixed premium, an up-front payment is made between the protection seller and protection buyer, which is the difference between the present values of the fixed premium and the current market premium.

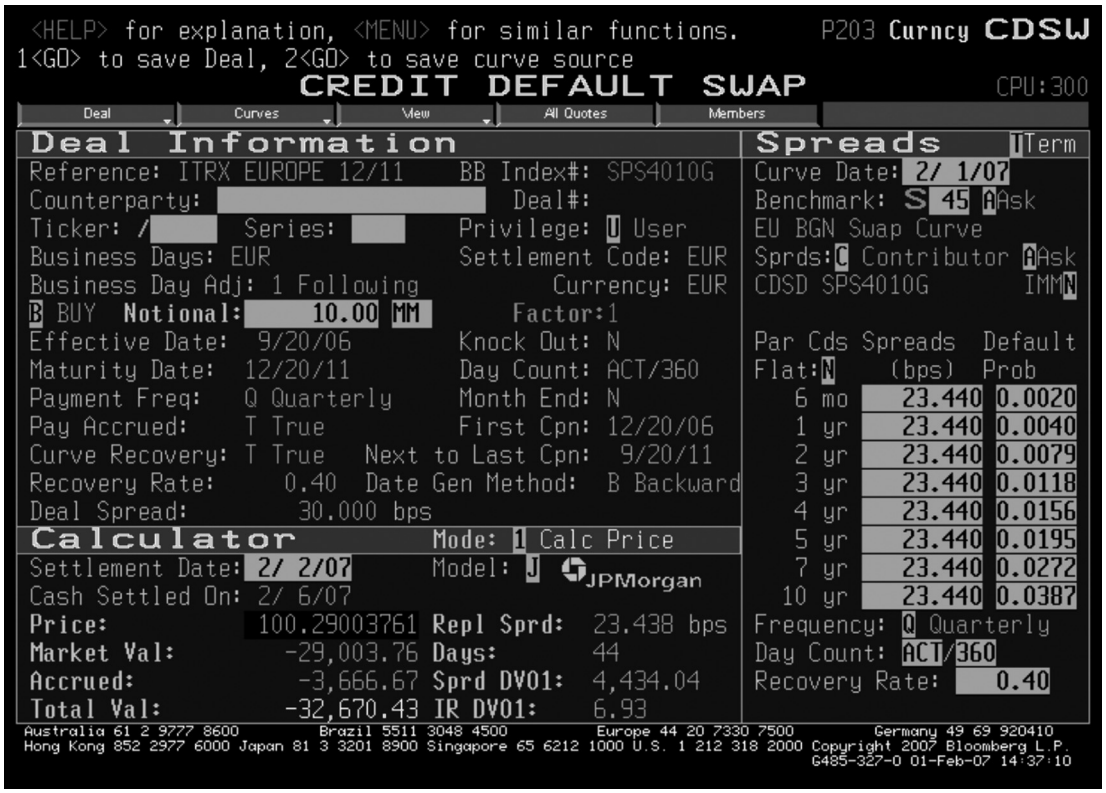
So for example, on February 1, 2007 the market price of the iTraxx® Europe Series 6 was 23.44 basis points. An investor selling protection on this contract would receive 30 basis points quarterly in arrears for the five years until December 2011. The difference between the fixed coupon and the market spread is paid up-front: the investor receives 30 basis points although the market level at time of trade is 23.44 basis points. Therefore the protection seller pays a one-off payment of the difference between the two values, discounted. The present value of the contract is calculated assuming a flat spread curve and a 40 percent recovery rate. The Bloomberg CDSW functionality can be used to calculate the current market value, and Figure 2.2 shows such a calculation using this screen. This is a trade for EUR 10 million notional of the current iTraxx® Europe Index on February 1, 2007. The deal spread (fixed coupon) is 30 basis points; and the current market spread is 23.44 basis points.

From Figure 2.2 it can be seen that the total one-off payment for this deal is EUR 32,670 whereas the market value of the swap for a EUR 10mm notional principal is EUR 29,003, representing the difference between the fixed (30bp) spread and the current spread

(23.44bp) discounted. The EUR 3,667 difference between these values represents the accrued interest that must be paid for at settlement since the full coupon will be received on the next coupon date. The protection seller, who will receive 30 basis points quarterly in arrears for the life of the deal, pays this amount at trade inception to the protection buyer.[5]

If a credit event occurs on one of the reference entities in the iTraxx®, the contract is physically settled, for that name, for 0.8 % of the notional value of the contract. This is similar to the way that a single-name CDS would be settled.

Figure 2.2: Screen CDSW Used to Calculate Up-Front Present Value Payment for Trade in EUR 10 Million Notional iTraxx® Europe Index CDS Contract, February 1, 2007.



Source: Used with permission from Bloomberg L.P.

Unlike a single-name CDS, the contract continues to maturity at a reduced notional amount. Note that European iTraxx® Indexes trade under Modified-Modified restructuring (MMR) terms, which is prevalent in the European market. Under MMR, a debt restructuring is named as a credit event.[6]

[5] The one-off payment reflects the difference between the prevailing market rate and the fixed rate. If the market rate were to be above 30 basis points at the time of this trade, the protection buyer would pay the protection seller the one-off payment reflecting this difference.

[6] This contrasts with the North American market, which includes the CDX family of indexes, where CDSs trade under no restructuring terms; this describes only bankruptcy and liquidation as credit events.

Section 3: CDS Pricing

The pricing of credit default swaps has generated a considerable amount of academic and practitioner literature. In all cases there are a number of general assumptions that need to be made in order to obtain a solution. The assumptions that underpin almost all theoretical pricing models do not necessarily reflect what happens in the market in the real world, for example:

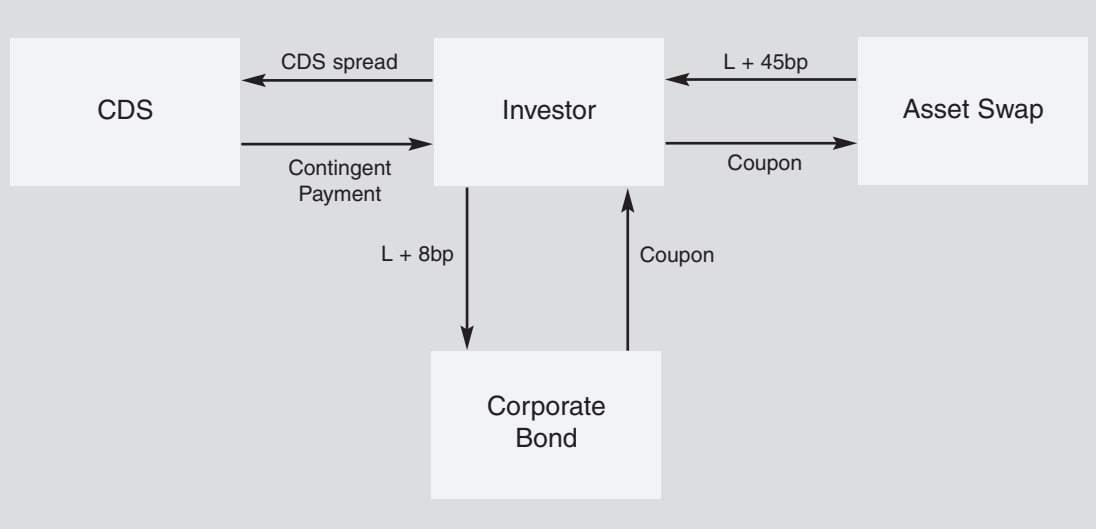
- In the event of a credit event settlement occurs at the time of default
- There are no problems in terms of settlement which requires physical delivery of a reference asset
- Technical defaults are ignored
- Time is taken to be continuous and day count conventions are ignored

One method, which could be described as intuitive, and which appeals to practitioners involves cash-and-carry arbitrage. A popular way of undertaking pricing in this way involves using a par-in/par-out asset swap. To examine this approach a portfolio needs to be constructed containing a corporate, defaultable bond, funded at Libor + $\text{spread}_{\text{repo}}$ this bond delivers a coupon, $C_{\text{Defaultable}}$, which is asset swapped to obtain a benchmark floating rate (Libor + $\text{spread}_{\text{asset swap}}$) and combined with a CDS providing cover in the case of default at a premium of $\text{CDS}_{\text{spread}}$. If a zero basis is to exist then the CDS spread should be equal to:

$$\text{CDS}_{\text{spread}} = \text{Libor} + \text{spread}_{\text{asset swap}} - \text{Libor} + \text{spread}_{\text{repo}}$$
$$\text{CDS}_{\text{spread}} = \text{spread}_{\text{asset swap}} - \text{spread}_{\text{repo}}$$

Figure 3.1 illustrates this approach.

Figure 3.1: CDS No-Arbitrage Pricing Via a Par Asset Swap



In this example it is assumed that the purchase of the bond can be funded at Libor + 8 basis points and that in the par asset swap the investor receives Libor + 45 basis points. In the absence of arbitrage the maximum that the investor should be willing to pay for protection is 37 basis points (45bp – 8bp). This approach is described in Das (2001) and Schoenbucher (2000).

In a more formal setting there are "firm value" or structural models and these have been advanced and discussed by Leland (1994), Longstaff and Schwartz (1995), Leland and Toft (1996), Mella-Barral and Perraudin (1997).

These models adopt the premise that the evolution of a firm's asset value follows a diffusion process and tend to be based on the Black and Scholes/Merton framework. Leland (1994), for example, explains the value of a corporate's assets using geometric Brownian motion:

$$dV = rVdt + \sigma VdW$$

where:

- V represents the value of the company's assets,
- R represents the risk-free rate of interest,
- σ represents the volatility of the company's assets, and
- dW is a Weiner process.

In this framework default is viewed as occurring, or likely to occur when the value of a corporate's assets fall below the level of their debt.

Other researchers have taken a different approach. The methodology adopted in that case is termed a "reduced form" model. Under this approach there is assumed to be no relationship between the value of a company's assets and default. Default is regarded as unpredictable and based on a sudden loss in the firm's market value. Important literature in this area is Jarrow, Lando and Turnbull (1994), Duffie (1999), Duffie and Singleton (1999), and Madan and Unal (1994).

Zhou (1997, 2001) argues that in reality both the structural and reduced forms can, and should, hold and that default can occur through a sudden shock or gradually. He advances an approach where default is modelled in a jump diffusion process that allows for both states. Irrespective of the modelling approach adopted, pricing credit derivatives requires two parameter inputs, namely the probability of a default, and the recovery rate in the event of default.

In practice there are several competing models being used. One is the pricing model developed by Hull and White (2000), another is a "market" method first described by

JPMorgan. Both can be selected on the Bloomberg CDSW screen. Each modelling approach requires information on, at least, the probability of default or its analogue no-default and recovery rate.

The Hull and White model is described as a “reduced form” model. Their model is calibrated using traded bonds of the underlying reference entity on a time series of credit default swap prices. The model assumes that there is no counterparty default risk, that default probabilities, interest rates and recovery rates are all independent, and that, in the event of a default, the claim will be the face value of the reference entity plus accrued interest.

The JPMorgan approach to CDS pricing adopts the no-arbitrage concept as used in the pricing of interest rate swaps (IRS). In the CDS context the present values of the two legs of the transaction can be represented as:

$$\text{PV Premium leg} = \text{Pv Contingent leg} \ldots \quad (1)$$

The present value (PV) of the premium leg is straightforward to calculate, especially if there is no credit event during the life of the CDS. The contingent leg, however, is more problematic and to proceed it is necessary to determine the value of the premium leg at the time of a credit event. This requires the use of default probabilities. Although it is impossible to use observed default probabilities for the reference entity they can be inferred from current bond or CDS market prices. This approach yields implied default probabilities. As a simple example in the case of a zero recovery rate the implied probability of default can be calculated as follows:

$$(1 - p)\, e^{(r + y)\, t} = e^{rt} \ldots \quad (2)$$

The interpretation of this equation is that given a default probability (p) an investor should be indifferent between an expected return on a corporate bond over a time period, t, $(1 - p)\, e^{(r + y)\, t}$ and the risk-free asset ert. Note that ert represents the continuously compounded rate of return on the risk-free asset while $e^{(r + y)\, t}$ represents the continuously compounded rate of return on the risky corporate bond over the same time frame.

The implied default probability that can be found by rearranging equation (2). This will yield an expression for p:

$$p = 1 - e^{-yt} \ldots \quad (3)$$

Choudhry (2006) provides an explanation and numerical examples of how this market data approach can be developed to include the recovery rate.

In respect of the iTraxx® Index series the Bloomberg CDS pricing model adopts a hazard rate approach in its calculations and this is driven by a Poisson process in conjunction with an assumed recovery rate following default. A full description is beyond the scope of this paper but an excellent discussion of the methodology is presented in a technical Eurex iTraxx® futures paper entitled: *Credit Futures Pricing and Final Settlement Price Calculation*.

The results of this methodology are displayed on the Bloomberg FCDS screen reproduced here as Figure 3.2. This functionality allows the Bloomberg user to monitor the CDS "fair" futures price.

Figure 3.2: Credit Default Swap Future

Source: Used with permission from Bloomberg L.P.

The FCDS screen, which can be accessed either from the Futures Contract Description page or by typing directly: **FEAU7 Index FCDS <go>** differs from CDSW in several operational respects:

- Only the Bloomberg Model is available – unlike the CDSW screen which allows the selection of a number of models, for example, JPMorgan, Hull and White or Bloomberg.
- The user can enter an integer Number of Contracts (instead of a Notional Principal Amount)

- The **Future is priced "Dirty"** (whilst the underlying contract is priced **"Clean"**); this means that the Futures Price includes the Accrued Interest of the "Fee Leg".
- Information about the underlying CDS index can be accessed by typing {**2 <go>**}.

The Eurex futures contracts, described in the next section, make use of the Bloomberg CDS pricing approach.

Section 4: Eurex Credit Futures Contracts

An exchange-traded Credit Future offers market participants a number of benefits, many of which reflect the inherent advantage of dealing on an exchange. The Eurex credit futures contracts are standardised with a contract value of EUR 100,000 and, in all other respects, tightly defined: all counterparties to the futures transaction will know exactly what they are dealing in. The contract specifications for the Eurex contracts[7] are presented in Tables 4.1 and 4.2.:

Table 4.1: Eurex iTraxx® Europe Futures Contract Specification

Underlying	The current iTraxx® Europe 5-year Index Series at the introduction of the respective futures contract month
Contract Value	EUR 100,000
Minimum Price Change	The Minimum Price Change is 0.005 percent, equivalent to a value of EUR 5
Price Quotation	In percent, with three decimal places, expressed as the sum of: • 100 (nominal value figure representing the number of names in the underlying index series) • present value change of the underlying index series • accrued constant premium (premium accrues until Last Trading/Expiration Day)
Contract Months	The nearest semi-annual month of the March and September cycle will be available for trading; trading in the back month contract starts on the 20th if this is an exchange trading day; otherwise on the next trading day
Deal Spread Initiation of Contract	Coupon fixed for respective iTraxx® Series
Last Trading Day/Expiration Day	The 5th exchange day following the 20th of the respective contract month
Final Settlement Price	Formula based cash settlement, determined with four decimal places and rounded to the next possible interval (0.0005; 0.001 or a multiple thereof) expressed as the sum of • 100 (nominal value figure representing the number of names in the underlying index series) • present value change of the underlying index series to deal spread • accrued constant premium (premium accrues until Last Trading/Expiration Day)

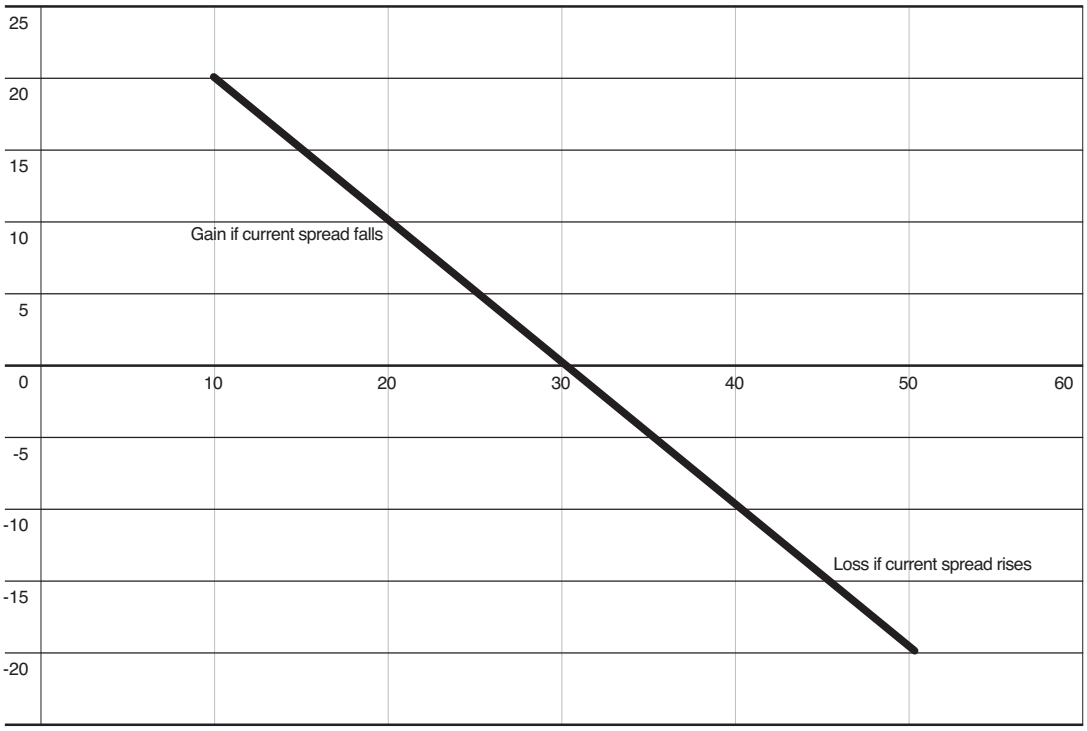
[7] A contract description can also be found on the Bloomberg by typing: FEAU7 Index DES <go>

Table 4.2: Eurex iTraxx® Europe HiVol and Crossover Futures Contract Specification

Underlying	The current iTraxx® Europe HiVol/Crossover 5-year Index Series at the introduction of the respective futures contract month
Contract Value	EUR 100,000
Minimum Price Change	The Minimum Price Change is 0.01 percent, equivalent to a value of EUR 10
Price Quotation	In percent, with two decimal places, expressed as the sum of: • 100 (nominal value figure representing the number of names in the underlying index series) • present value change of the underlying index series • accrued constant premium (premium accrues until Last Trading/Expiration Day)
Contract Months	The nearest semi-annual month of the March and September cycle will be available for trading; trading in the back month contract starts on the 20th if this is an exchange trading day; otherwise on the next trading day
Deal Spread Initiation of Contract	Coupon fixed for respective iTraxx® Series
Last Trading Day/Expiration Day	The 5th exchange day following the 20th of the respective contract month
Final Settlement Price	Formula based cash settlement, determined with four decimal places and rounded to the next possible interval (0.0005; 0.001 or a multiple thereof) expressed as the sum of • 100 (nominal value figure representing the number of names in the underlying index series) • present value change of the underlying index series to deal spread • accrued constant premium (premium accrues until Last Trading/Expiration Day)

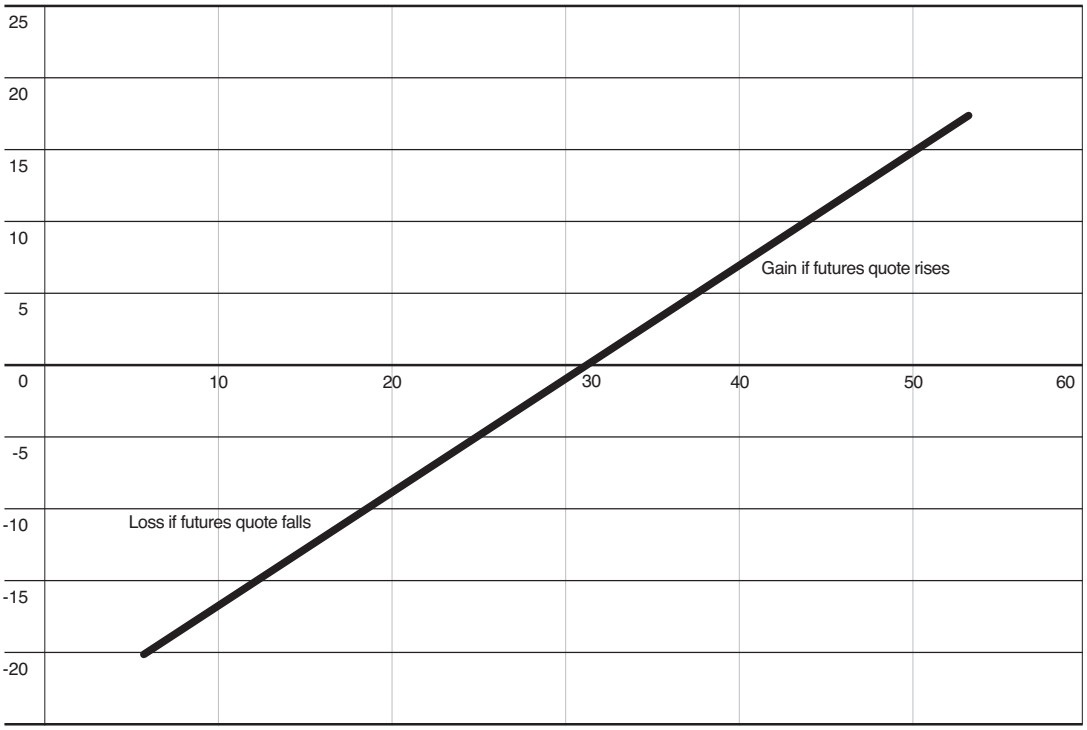
The quotation will be familiar to fixed income market practitioners thanks to its bond-like construction. The quote comprises: a base of 100, plus the present value (pv) change resulting from credit spread changes in the underlying iTraxx®, plus a coupon based on the accrued premium calculated on a daily basis. In this contract structure a short position in the iTraxx® CDS future is the equivalent of buying protection through a CDS in the OTC market. So buying or going long a futures contract is identical to selling protection in a CDS. To participants in the money markets an analogy can be drawn between entering a long forward rate agreement (FRA) and shortening a short-term interest rate (STIR) futures contract to hedge an underlying interest rate liability exposure. Under these strategies a long FRA will generate a positive payout in a rising interest rate regime whilst a rise in interest rates will result in a fall in the value of the STIR futures quote and hence a profit to the seller of the futures. Figures 4.1 and 4.2 illustrate the payout profiles for the OTC and exchange-based markets, respectively.

Figure 4.1: OTC Index Pay-out Profile: Long Credit Risk



▲ Profit/Loss
► Current Spread Quote (Basis Points)

Figure 4.2: Exchange-based Futures Pay-out Profile: Long Credit Risk



▲ Profit/Loss
► Futures Quote

Eurex Credit Futures Contract Features

The Eurex Credit futures contracts, based on the iTraxx® Index Series, and the adopted quotation methodology have been designed to reflect states where no credit events have occurred during the life of the contract as well as states where credit events are deemed to have occurred.

Potential contract users come from many motivational backgrounds: hedgers/risk managers, speculators, arbitrageurs and financial engineers and, as with government bond futures previously, the contract fills a market need. Bid/ask spreads are likely to be tight and the existence of an OTC product will ensure competition and fair market pricing. Importantly, Eurex's back office support through Eurex Clearing AG provides a well-tested infrastructure that will guarantee that all aspects of clearing and settlement are dealt with accurately and without delay. This contrasts favourably to the recent experiences in the OTC market.

The market as a whole may derive considerable benefit from the advantages of using the iTraxx® future which include:

- Enlarged client base: Market participants such as certain fund managers that have previously shied away from using credit derivatives, because they are formally disallowed from so doing or otherwise uncomfortable with dealing in OTC instruments, can now access the synthetic credit market using a standardised and liquid product.

- Low initial margin when opening positions:
  - EUR 290 in respect of the iTraxx® Europe 5-year Index Futures,
  - EUR 550 in respect of the HiVol contract, and
  - EUR 2,000 for the Crossover

- Absence of counterparty risk: The Eurex clearing system eliminates the risk of counterparty default by holding cash or collateral deposited against open positions and securing daily mark-to-market variation margin as market price movements dictate. It also ensures that the required legal documentation is in place and duly accepted by all counterparties from the outset of the transaction.

- Pricing transparency: As an exchange-traded product the contract value will be apparent to all users at all times.

- Independent daily valuation: This feature presents an advantage over OTC products and should draw in fund managers and other users that have hitherto avoided OTC credit derivatives for just this reason.

- Trading flexibility: The Eurex iTraxx® contracts provide investors with an ability to put on or hedge credit exposures with a liquid, easy-to-trade instrument that closely correlates with cash market exposures. It also provides the ability to trade in benchmark credit

risk along the term structure. The range of applications for the iTraxx® futures is potentially very extensive, from straightforward speculation or hedging in credit to spread trades across tenors or versus other asset classes.

- Low transaction costs and low administrative burden (typical of exchange-traded contracts) compared to other products used to hedge credit exposure.

- No requirement to execute an ISDA® agreement as trading can be undertaken within the existing Exchange Futures Agreement.

- Cash-settlement: the removal of delivery considerations that currently exist with most CDS trades and which raise cheapest-to-deliver and lack of deliverable asset issues.

Additional benefits to the market overall will arise as the product becomes established and as more financial institutions become aware of the rise in market liquidity, trading and hedging efficiency.

Two types of credit event situations are allowed for in the quotation and settlement procedures:

(a) Futures contract expires after an actual credit event and after recovery rate determination.

After the announcement of a CDS protocol by ISDA® a reduced name futures contract will be available for trading. The new futures contract will be introduced one day after the announcement and will be quoted on a 99.2 nominal value (for 124 names) rather than 100.[8] The premium component of the reduced name contract will accrue from the effective date of the underlying series.

The original 125-name contract will have a final settlement price determined by the 124-name credit spread plus a recovery rate based on the auction price for the defaulted reference entity as announced in ISDA®'s CDS protocol. This recovery rate will be calculated using the following formula:

```
RR * w/100
```

where: RR is the recovery rate and w is the original weight in the underlying series of the credit event affected reference entity. Note that, driven by market forces, the recovery rate will fluctuate until it has been fixed in accordance with the ISDA® CDS

[8] Should a further CDS protocol be announced by ISDA® the nominal value would be reduced to 98.4, etc.

protocol. Until this rate is finally determined the difference between the 125-name contract quote and the 124-name contract quote will provide a market view on the implied recovery rate.

Final settlement for the 125-name contract will be the International Index Company's index level for the 124-name index plus the final price for the reference entity that experienced a credit event.

Final settlement for the 124-name contract will be International Index Company's index level for the 124-name index.

(b) Futures contract expires after an actual credit event but before the recovery rate has been determined.

On the Last Trading Day, the original (125-name) futures contract will be settled based on the index level for the 124-name contract. Simultaneously, a new single-name recovery futures contract will be created. The single name recovery future which, for the iTraxx® Europe will have a contract size of EUR 800 with a minimum price change of 1/10th of a point, equates to a tick value of EUR 0.80. This new single name futures contract will be available for trading until the final recovery value is determined according to the ISDA® CDS protocol. Once the recovery rate is determined it remains constant until the contract matures which will be the 5th exchange trading day following the scheduled final price determination date announced in the ISDA® CDS protocol.

In the absence of other credit events the 124-name index will have a final settlement price determined by the 124-name index.

Section 5: CDS Applications

The previous sections have suggested some of the ways in which single name CDS and index products could be used by market participants. The paragraphs that follow will elaborate on these and advance other trading and investment possibilities.

Traditionally financial institutions such as banks and insurance companies have been the main participants in the credit derivatives market but in recent years they have been joined by hedge funds whose involvement in the credit arena continues to rise. Whilst transactions in single name credit default swaps still represent the largest share of the market the introduction of the iTraxx® indexes has stimulated interest and usage by both banks and hedge funds.

As indicated earlier both CDS and iTraxx® instruments are extremely efficient instruments in the context of targeted credit-based investment strategies. In the fixed income/credit portfolio management domain these instruments enable the implementation of efficient strategies that would otherwise be difficult or even impossible.

Since the indexes are tradable instruments they provide the banking community with tools with which to hedge the credit risk of loan portfolios and investment portfolios, and undertake credit arbitrage. They can also be used to manage the risks involved in more exotic activities, for example, correlation or volatility trades.

Macro Risks

Using iTraxx® indexes a bank is able to reduce its credit exposure by choosing those relevant for this purpose from a number of possible instruments. Apart from the liquid iTraxx® Europe main Index, which itself can be broken down into financial, senior and subordinated, and non-financial indexes, there are two other diversified, highly liquid indexes: HiVol, Crossover.

In a diversified investment portfolio credit spread changes among the issuers named in an index are likely to be highly correlated. Buying protection through, say, the iTraxx® Europe Main Index could avoid the need to identify and sell individual names that might be affected by negative, short-term considerations.

On another occasion, on that same portfolio, a bank may sell protection through an index as a means of enhancing income.

Market-Making

A financial entity may wish to set itself up as a market maker in credit derivatives. In this case, it may or may not hold the reference assets directly, and depending on its appetite for risk and the liquidity of the market, it can offset its long/short credit exposure by shorting or going long either single name CDSs or credit indexes.

Structuring Credit Products

The introduction of the iTraxx® Europe and the CDX indexes stimulated a new generation of liquid credit derivatives: credit index tranches. Each of the indexes is divided into five tranches each with a defined subordination level. As an indicative example the Series 6 iTraxx® Europe 5-year Index has the following tranche structure:

Table 5.1: iTraxx® Europe Tranches and Spreads

Series 6 iTraxx® Europe 5-year	Bid (bp)	Offer (bp)
3 – 6 %	43.14	43.89
6 – 9%	11.65	12.47
9 – 12%	5.12	5.86
12 – 22%	1.75	2.33
22 – 100%	N/A	N/A

Source: Compiled from data obtained from Bloomberg.

Each tranche has a defined attachment point and detachment point which identify boundaries. For example, the 3-6% tranche in Table 5.1 has an attachment point of 3% and a detachment point of 6%.

A buyer of protection for this tranche will pay premium to the seller on a quarterly basis until the maturity of the contract or until credit events result in the tranche being totally written down. In the event of defaults the protection seller will pay the buyer as long as the losses lie between the tranche's boundaries.

One way in which the protection seller of, say, a 6-9% could hedge the short exposure would be to take a long, leveraged position in the iTraxx® Europe index. Since the tranche width is 3% this would mean taking EUR 30bln long index position for an underlying notional iTraxx® of EUR 1,000bln. Alternatively the position could be delta[9] hedged at the same time that the transaction is effected. The resulting hedge will not be perfect but is effective, convenient and highly liquid.

Collateralised Debt Obligations (CDOs): Yield Enhancement

Financial markets have over the last few years enjoyed a low interest rate regime. Although good from the perspective of economic stability, and providing a sound, reliable trading environment, commercial banks, insurance companies and pension funds have needed to identify ways in which the yield on their funds could be enhanced. Collateralised debt obligations provide one investment vehicle that they can use to achieve higher yields.

[9] The tranche delta is the credit risk of the note to each of the names in the portfolio, that is, the change in value of the note for a change in the credit spread of each reference credit.

CDOs can be constructed to give investors yields that are higher than those available on credit card or auto-loan asset-backed securities (ABS) of similar credit rating, and enable exposure to sectors in the market that would otherwise be inaccessible. One advantage that CDOs enjoy is that financial institutions such as higher-rated banks typically issue them. This provides comfort to investors on the credit side, but also on the administration and servicing side with regard to underlying assets employed in the collateralisation when compared to, say, consumer receivables securitisations. A hypothetical CDO portfolio is presented in Table 5.2:

Table 5.2: CDO Portfolio

Equity note	0.5% – 2.50%
Mezzanine note Baa3	2.50% – 5.50%
"B" note A3	5.50% – 7.50%
"A" note Aaa	7.50% – 10.00%

Source: Choudhry, M., Structured Credit Products: Credit Derivatives and Synthetic Securitisation, Wiley (2004).

Each note in the structure will be priced according to its correlation sensitivity. This correlation measures how each of the reference credits perform with respect to each other. Positive correlation indicates a pool of credits whose credit spreads will generally move in the same direction whether widening or narrowing. Negative correlation, as its name suggests, indicates a pool of credits whose spreads move in opposite directions.

Each note in the liability structure of a CDO exhibits different correlation sensitivity. The equity (first-loss) tranche is long correlation, as its value increases with higher correlation. This reflects the fact that higher correlation indicates a higher probability of fewer defaults as well as, paradoxically, more defaults. Equity investors are sensitive to just a single default, so it is logical that they would prefer a high probability of less defaults; in practice, higher correlation. Mezzanine notes share patterns of behaviour with both equity and senior tranches, and are least sensitive to changes in correlation.

On the sell side one correlation strategy open to traders is to sell protection on a single name CDS or one of the notes in the structure, say the mezzanine note and delta hedge this with an appropriate member of the iTraxx® index family. If this strategy has a positive carry and is long implied volatility then, when the market correlation increases or the spreads in the underlying tranche move in a positively correlated way, the value of the position rises. The risk to this strategy is that correlation between the reference entities decreases, spreads move in an uncorrelated way or one of the names defaults. In managing the risks of this relatively new market for tranche products the potential default linkage between reference entities is crucial. In this market correlation plays a role similar to that of volatility in the more traditional financial markets.

On the investor side of the market hedge funds have come up with a substantial number of market strategies involving both single name CDS and iTraxx® instruments. In the fixed income/credit portfolio management domain these instruments enable the implementation of strategies that would otherwise be difficult or even impossible, and this in a transparent, fast and economical way.

Basis Trading

A recent, and successful, strategy in the relative value category that has been employed entails the identification of a cash bond coupled with a CDS trade that facilitates the profitable exploitation of a basis anomaly. Good examples of this have manifested themselves in the market for some time in particular the opportunity to undertake negative basis trades. Under this scenario investors identify corporate bonds whose risk premium is higher than the cost of buying protection through a CDS. The investor then takes a long position in the bond and simultaneously buys protection. This strategy ensures that credit risk has been reduced to virtually zero but still achieves a spread above risk-free rates.

The availability of indexes makes possible a wider spectrum of possible trading strategies. Buying protection through an index has the effect of reducing or neutralising the average credit duration of a portfolio while selling protection increases the portfolio's exposure to credit risk. Consider the case where a fund manager is invested in a portfolio of government bonds. If this position is combined with a short position in the iTraxx® Crossover Index a synthetic corporate bond has been created. In theory, substantial selling of protection through an index could lead to a narrowing of the basis whilst substantial buying of protection could lead to a widening of basis.

Relative Value

In the case of the iTraxx® still more trading possibilities present themselves. Not least the existence of these indexes facilitates relative value trades across diversified credit portfolios.

As with alpha strategies in other markets the approach would require research into exploitable trading opportunities. In the equity markets this could involve portfolio managers running a Dow Jones EURO STOXX 50® Index tracking portfolio identifying that the Media sector is likely to outperform the index as a whole while the Chemical sector is likely to under-perform. In this case an appropriate long position in futures contracts on the Dow Jones EURO STOXX® Media sector index versus an appropriate short position in futures on the Dow Jones EURO STOXX® Chemicals sector index futures would enable the fund manager to capitalise on his/her view in a very efficient manner. In the credit arena the introduction of the iTraxx® Europe Index and the sub indices has opened up similar possibilities.

An investor with a portfolio exposed to bonds of different maturities and credit rating, credit instruments such as single name CDS or CDS tranches as well as credit indexes is able to analyse the portfolio constituents identify potential under or out performers and adjust either the beta and/or alpha structure of the portfolio. Thanks to the existence of CDS indexes a portfolio manager is able to neutralise the effect of the portfolio's beta by buying protection and simultaneously create alpha by buying protection on another index, say, HiVol and selling protection on the Crossover index.

CPDOs

More structured, and complex, uses of CDS and the iTraxx® (CDX) indexes are to be found in constant proportion debt obligations (CPDOs). These instruments are designed to provide leveraged exposure to credit risky portfolios and aim to provide investors with high returns. In their construction CPDOs reference either CDX, iTraxx® indexes or single name CDS but the risk is, nevertheless, high since typically CPDOs do not offer principal protection.

CPPIs

A new generation of credit-linked products has recently been introduced that does offer principal protection, namely, constant proportion portfolio insurance (CPPI). In the credit market these instruments offer a coupon return and in addition a return linked to the performance of a portfolio of CDS or an iTraxx®/CDX index. To CDO or CPDO investors who receive a known coupon but, potentially, face total loss of principal, this type of product offers a means to diversify into a guaranteed principal but unknown return.

A CPPI is structured by defining a "riskless" floor. This can be achieved by either buying a zero coupon bond that will deliver par at maturity from the initial investment principal or by depositing cash on an interest bearing account that is monitored on a daily basis. The risky credit exposure is engineered synthetically and the combined value of the components never falls below the riskless floor. In this way, the return of principal at maturity is guaranteed. As with other types of principal protected instruments the difference between the zero coupon price and the initial investment fund provides a cash pool that can be used to leverage returns on an underlying index or portfolio. In the case of a credit-linked CPPI the exposures to credit references can be managed to either increase or decrease leverage in light of the performance of the risky, synthetic portfolio.

Figure 5.1: CPPI Structure

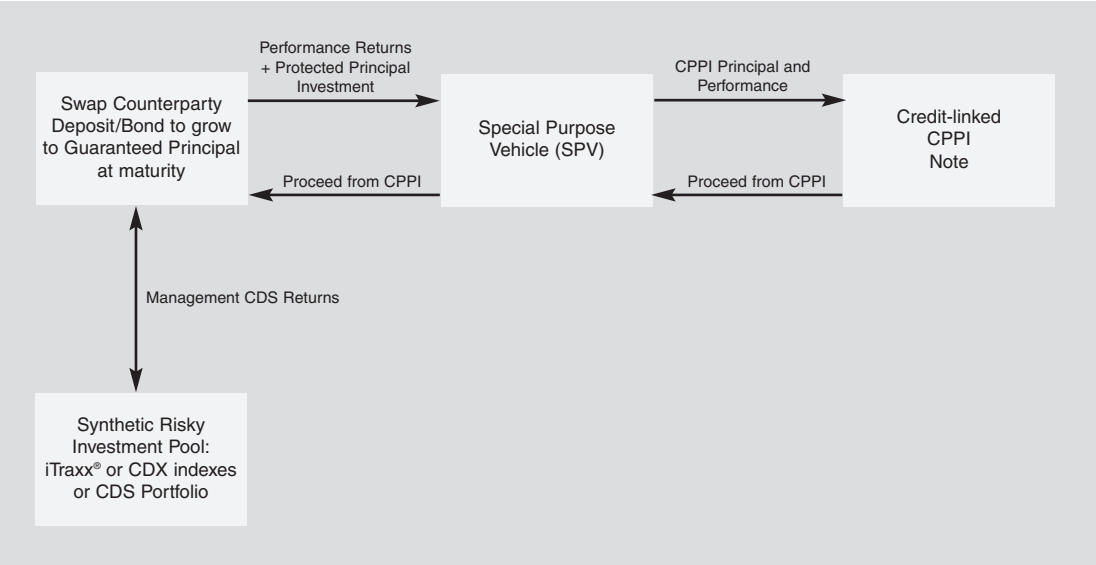


Figure 5.1 illustrates a total return swap structure (TRS) that pays the risky returns from a credit reference portfolio combined with a cash deposit or bond into a SPV and receives the proceeds from the credit-linked CPPI.

Bid/Ask Spreads

To whatever end uses the family of iTraxx® indexes are put, an important consideration for rational investors in all categories is not only the cost of trading but also the cost involved in opening and closing positions, namely the bid/ask spread. A comparison of the bid/ask spreads across a spectrum of instruments from investment grade cash market bonds to the iTraxx® HiVol index is presented in Table 5.3, and reveals the average bid/ask cost advantage of the Series 6 indexes compared to cash bond trades.

Table 5.3: Bid/Ask Spreads

Instrument	Bid/ask spread
iTraxx® Europe (main)	0.25bp
iTraxx® HiVol	0.70bp
iTraxx® Crossover	2.00bp
Investment grade corporate bond	6.82bp
High yield corporate bond	30.00bp (Average)

Compiled from data obtained from Bloomberg.

The iTraxx® indexes facilitate the entry into or exit from a well-diversified credit portfolio. Not only that, they enable hedge or speculative positions to be taken in sectors at a relatively cheap cost as Table 5.3 evidences – with the usual caveat concerning instrument basis risk.

CDS instruments are not without risk. There is no guarantee in the credit domain that spreads will behave as expected. This is particularly true in the case of the "roll" as the CDS or index goes off-the-run. Buying protection just a few weeks before the quarterly CDS or semi-annual index roll could, on the basis of historical performance, be a poor strategy. As an illustration of this point consider Table 5.4 below. Clearly the transition from one series to the next is not smooth.

Table 5.4: iTraxx® Europe 5-year Index Bid-Offer Spreads Series 3 to 6

Roll Date	Series	Bid	Offer
September 20, 2006	6	29.75	30.01
September 20, 2006	5	27.75	28.01
March 20, 2006	5	35.75	36.25
March 20, 2006	4	33.50	34.00
September 20, 2005	4	38.56	39.02
September 20, 2005	3	34.55	35.00

Source: Compiled from IIC Ltd. data

One reason for this spread change is that every six months a new 5-year on-the-run index is created and this index will now enjoy the highest liquidity. As a general rule this new series will be cheaper to trade than its predecessor. Another important reason is that the new series will be created from a new set of names. There were, for example, 16 changes that took place in the construction of the iTraxx® Crossover 5-year Index Series 6.

Whilst opening up a whole range of investment possibilities there are problems associated with these OTC credit products. Perhaps the most important of which relate to the infra-structure in which they operate: price determination, counterparty default risk, and trade confirmations, as discussed in detail in section 1. The introduction of an exchange-based product should go a long way towards making the market more efficient, transparent and user friendly.

Section 6: Empirical Examples

The following scenarios provide an insight in different ways in which the iTraxx® indexes could be used by a cross-section of potential end users.

Scenario 1: Bond Index Tracking Portfolio Plus Credit Index Efficient Frontier
Over the last few years the market price return on European government bond portfolios has tended to be low or negative. Even in the case of an index tracking portfolio containing only high quality, investment grade bonds the performance has not been good. For example, the Euro Market Tracker 3-5 Year Bloomberg/EFFA index comprising 41 unequally weighted issues over the period January 1, 2005 to December 31, 2005 generated a negative 1.126% return[10], the period January 1, 2006 to December 31, 2006 returned negative 3.491%. On a total return basis the returns are positive but still relatively low at 2.745% and 0.564%, respectively.

On the same measurement basis some comparators, for example, the Euro Market Tracker 5-7 Year Bloomberg/EFFA index faired worse. Over the same periods the price returns were –0.597% and –4.854%, respectively, while the total return came in at 4.089% and –0.25%, respectively. This index, has 32 components, all Sovereign debt issues, ranging from Germany, France, Spain, Austria, Ireland, Finland and the Netherlands rated Aaa to Greece rated A1[11]. Clearly there is scope here for improving the return profile of these low risk portfolios the question is: can higher levels of returns be achieved without increasing risk?

One way of offsetting the effect of the falling market price of a single government bond or a portfolio of government bonds is to use futures contracts. A portfolio comprising a diversified holding of bonds in the 5-year maturity range could be hedged by using Eurex Euro-Bobl Futures contracts appropriately adjusted by some measure of relative volatility. It is straightforward, in a technical sense, to neutralise a bond portfolio's beta by selling futures contracts or even engineering a beta that takes advantage of falling bond prices. These strategies, if held too long, could result in the underlying cash bonds being delivered into the futures contract to meet the settlement obligation.

It would, of course, be possible to engineer a neutral portfolio beta and, simultaneously, generate alpha strategies. One such way within a European sovereign issuer, maturity diversified bond portfolio would be to neutralise beta by selling the appropriate number of futures contracts across the different maturities: Euro-Schatz Futures contracts for the 2-year, Euro-Bobl Futures for 5-year, Euro-Bund for 10-year for the German market and combine this with short positions in, say, the UK Gilt and the American 10-year Bond. Uncorrelated asset classes could then be included in a satellite portfolio.

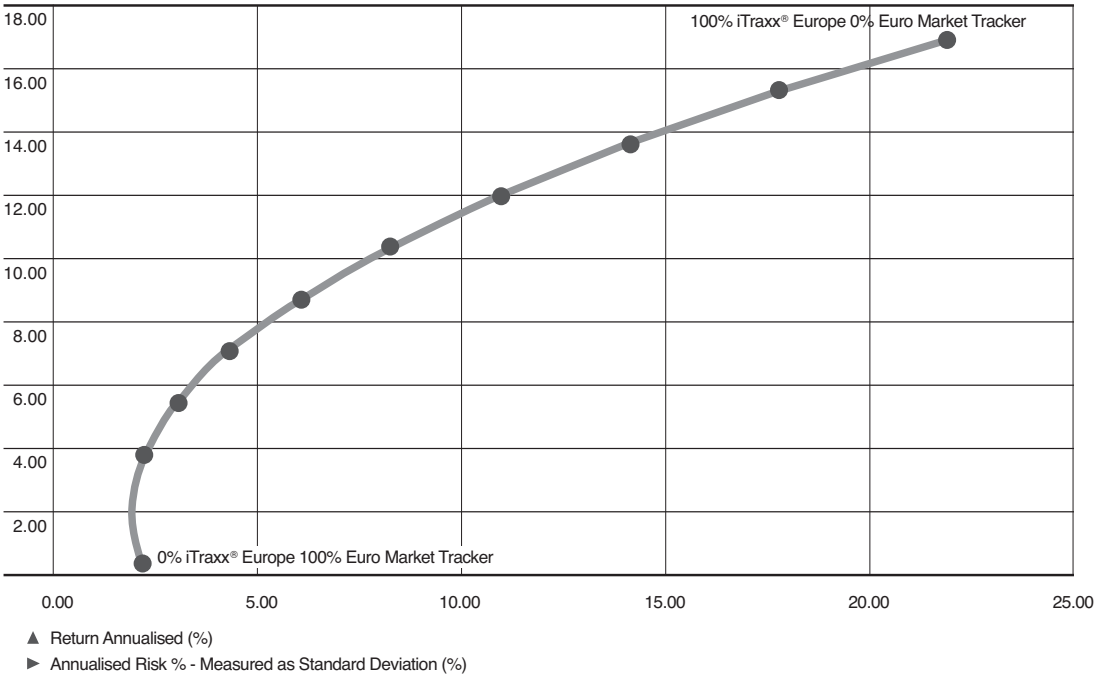
With tradable iTraxx® indexes other possibilities present themselves. Combining, say, a portfolio of bonds designed to track the Bloomberg/EFFAs Euro Market 3-5 Year Tracker

[10] Source: Bloomberg
[11] Moody's ratings, Source: Bloomberg.

index with a long credit risk position in the iTraxx® Europe 5-year Index a fund manager is creating a synthetic corporate bond portfolio. Evidence drawn from recent data reveals that this type of strategy could have improved underlying portfolio performance.

An efficient frontier can be calculated to examine different diversified holdings ranging from a weight of 0% in the iTraxx® Europe 5-Year Index and 100% in the bond portfolio through to 100% holding iTraxx® Europe 5-year Index and 0% in the bond portfolio. Past data is used to estimate the volatility of each instrument; for the bond index this is found to be approximately 2.17% on an annualised basis while for the iTraxx® Europe 5-year Index it is approximately 22% p.a. Figure 6.1 depicts the efficient frontier calculated using this approach.

Figure 6.1: Efficient Frontier

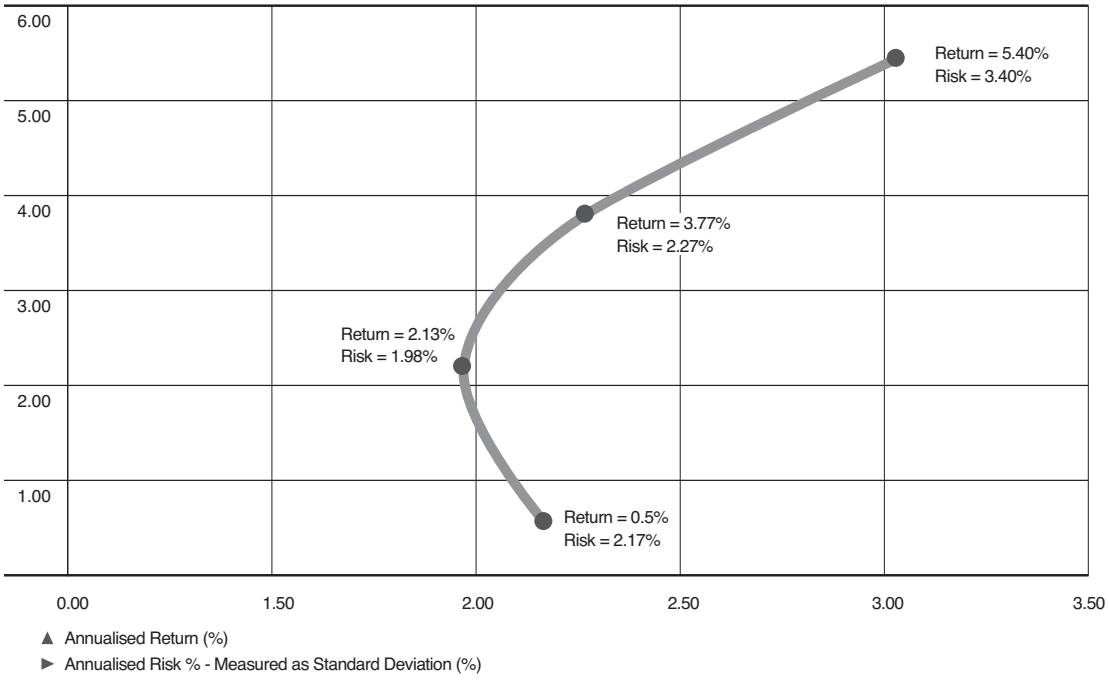


Source: Compiled data drawn from Bloomberg and IIC Ltd.

As the diagram shows the evidence points to the fact that investing a proportion of the portfolio funds would lead to more efficient diversification. For example, investing only in bonds will result in a low risk, low return situation even when accrued interest is included. The inclusion of the credit index position up to a level of 10% of the portfolio results in a reduction of risk and an increase in return. As the diagram also shows, a movement along the frontier to the point where 20% is invested in the credit index return increases rapidly for only a small increase in risk. Specifically, the inclusion of a 10% holding in the iTraxx® Europe 5-year Index reduces risk from 2.17% p.a. for a return of 0.50% p.a.

(annualised figures), to risk of 1.98% p.a. for a return of 2.13%. A 20% holding increases risk marginally to 2.27% p.a. but offers a return potential of 3.77% p.a.; this can be seen in Figure 6.2.

Figure 6.2: Efficient Frontier Close-up of Low-Risk Portfolio



Source: Compiled from data drawn from Bloomberg and IIC Ltd.

Scenario 2

This strategy of including a credit index into a highly diversified sovereign issuer index-tracking portfolio can be extended to the case of a less diversified bond index-tracking portfolio. As an example, take the Bloomberg/EFFAS Euro Liquid 3-5 Year Bond Index, which, at the time of writing, comprised:

- DBR 5.00% of July 4, 2011,
- DBR 5.25% of January 4, 2011, and
- BTPS 5.5% of November 1, 2010.

The annualised price return on this index over the last twelve months has been poor, showing a market price loss of approximately 3.886% p.a. On a total return basis the index has also performed poorly but at least shows a positive annualised return. Table 6.1 reports an annualised total return on this index over the period January 2, 2006 to December 31, 2006, of 0.697%.

Table 6.1: Bloomberg/EFFAS Euro-liquid 3-5 Year Bond Index

Index EUL2TR	Total Return
Start date	January 2, 2006
End date	December 31, 2006
Days	365
Index start value	137.699
Index end value	138.648
Period return	0.689%%
Annualise return	0.697%

Source: Compiled from data drawn from Bloomberg.

A possible strategy in conjunction with this bond index portfolio would have been to sell protection on the iTraxx® Europe Crossover 5-year Index to obtain a short-term speculative exposure. For example, the end-of-day quote for the Crossover Index on September 22, was 287.5bp. If a short position on the index had been entered into on that day and unwound on December 19 when an index quote of 225.6bp prevailed, a gain of around 62bp would have been achieved.

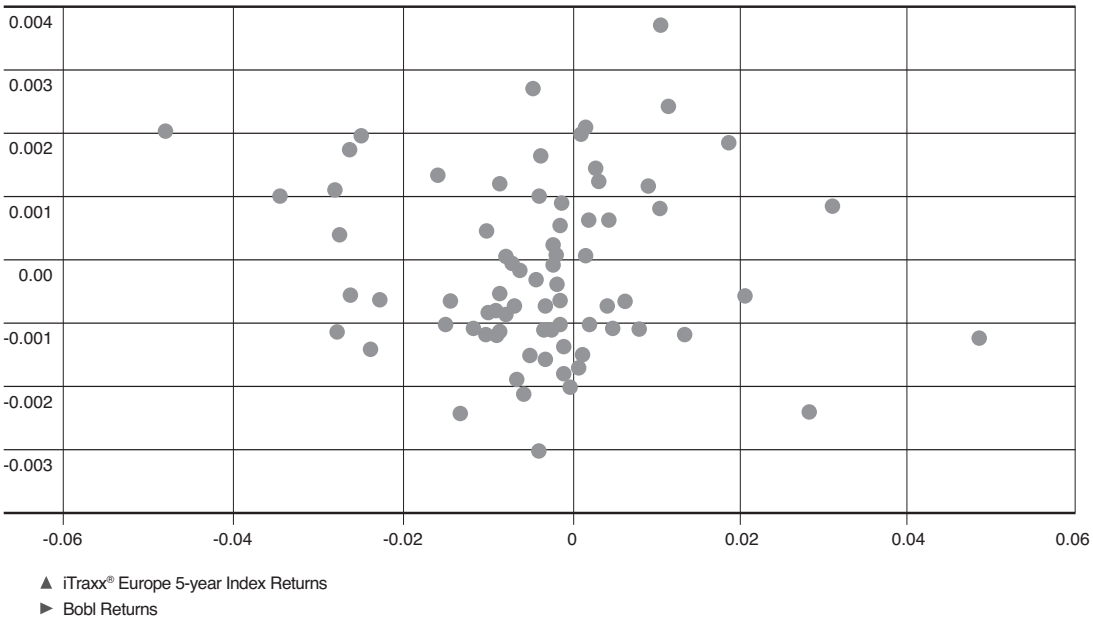
To analyse what this means in money terms consider a notional principal of EUR 1,000,000. When the transaction is carried out in the market the spread is 287-289bp. The fixed rate is 280bp, hence the seller of the iTraxx® Crossover 5-year Index receives an up front payment from the buyer of EUR 3,123 less EUR 155 accrued interest. The seller will also receive the fixed premium on a quarterly basis calculated on an actual/360 basis for as long as the position is held. On December 19, the buy quote is 225.6 and the position is cleared at 225.6 by buying protection. Since the fixed rate of 280bp is greater than the market quote, the protection buyer receives a one-off payment of EUR 22,835. The total gain on this strategy over the 88 days, ignoring accrued interest, is EUR 25,958. On a notional principal of EUR 1,000,000 this represents a holding period return of 2.6% and an annualised return of 10.77%. When accrued interest is taken into account the profit on the transaction rises to EUR 32,802 or 13.6% on an annualised basis. This would have provided some compensation for the continued poor showing of the Bloomberg/EFFAS Euro-liquid 3-5 Year Bond Index. Which, over the same September to December period, recorded a price decline of 0.682%.

The results would have been similar had either the Europe Main or the HiVol indexes been used albeit less dramatic due to the smaller movement in the spreads. The profit, respectively, would have been EUR 1,656 on a 5bp fall in the spread and EUR 5,668 on 9.5bp fall in the spread.

Scenario 3: Single Bond Portfolio: Bundesobligation Deliverable Into the Eurex Futures Contract.

Past data seems to suggest that there is little or no correlation between a portfolio that consists of the German government bond that pays a coupon of 5 percent annually on an act/act basis and reaches maturity on July 4, 2012 and the iTraxx® Europe 5-year Index. Figure 6.3 illustrates this in the form of a scatter diagram. Over long, medium time periods the correlation is consistently low and often close to zero.

Figure 6.3: Scatter Diagram of the Relationship Between a Bobl and the iTraxx® Europe Index



Source: Bloomberg and IIC.

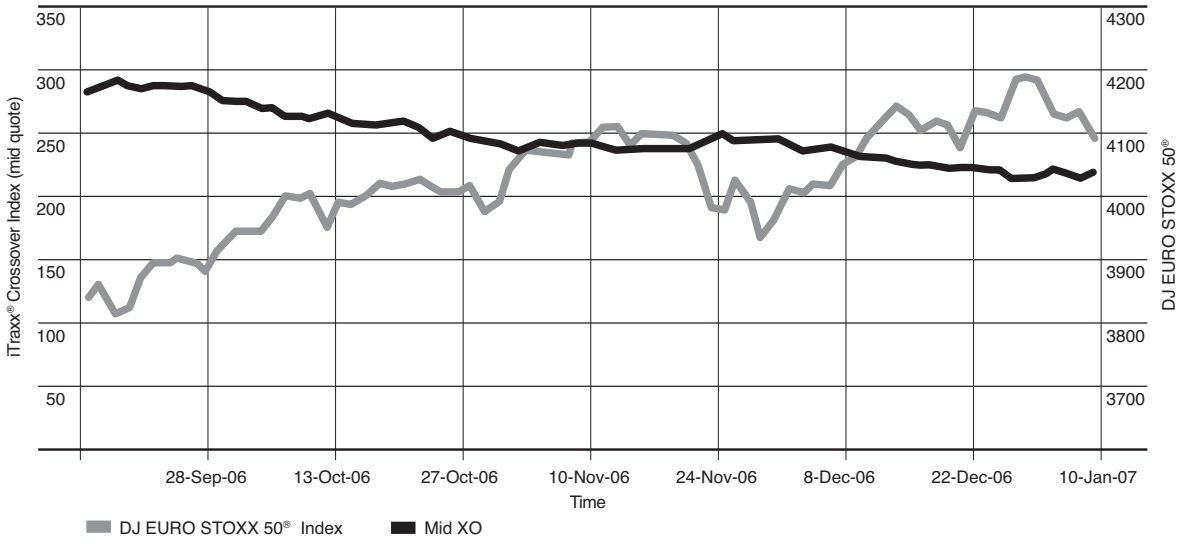
A short-term alpha strategy would be to sell protection through an iTraxx® index, say, the iTraxx® Europe 5-year Index, with the intention of closing the position if and when spreads tighten but in any case before the iTraxx® contract roll. Any view concerning the cash market bond itself could be engineered cheaply by taking appropriate positions in Eurex Euro-Bobl Futures contracts.

Scenario 4: Credit Indexes Combined with Equity Index-Tracking Portfolios

The introduction iTraxx® index contracts offer equity fund managers even more opportunities to create alpha exposures. The relationship between the returns on the Dow Jones EURO STOXX 50® Index, the iTraxx® Europe 5-year, HiVol and Crossover indexes is, generally, negative. In respect of the Series 6 indexes returns over the period September 21, 2006 to January 10, 2007 display correlations of approximately –20%, –22% and –44%, respectively. The correlation between observed end-of-day market price quotes of the pairwise indexes is higher at –85% for the Europe main index, –92% and –81% for the Crossover

and HiVol indexes, respectively. Figure 6.4 illustrates the quote behaviour of the Dow Jones EURO STOXX 50® and iTraxx® Crossover indexes over this period. The negative relationship manifests itself particularly clearly during the earlier part of this period.

Figure 6.4: Dow Jones EURO STOXX 50® Versus iTraxx® Crossover Index



Source: Eurex and IIC Ltd.

During a bullish equity market one strategy would be to go long credit risk by selling one of the iTraxx® indexes, say, the iTraxx® Crossover Index. If a long position is taken in the iTraxx® Crossover Index this would be the equivalent of selling protection on the 45[12] individual CDS names that comprise that index. Simultaneously in the equity market a long position could be opened using Dow Jones EURO STOXX 50® Index futures contracts. To illustrate how this strategy could work assume that a fund manager is running a core portfolio that tracks the Dow Jones EURO STOXX 50® Index and that it is currently valued at EUR 100,000,000. Assume, in addition, that a total of EUR 10,000,000 is available in a satellite fund 80% of which can be invested at any time in derivatives while a 20% reserve is to be held to cover margin calls and other administrative costs.

If a nominal EUR 4,000,000 position in the iTraxx® Crossover tradable index is opened on September 9, 2006 by selling protection when the fixed series spread is 287.5bp and bought back on December 19, 2006 at a spread of 225.6bp this would have generated a total return of approximately EUR 131,190.

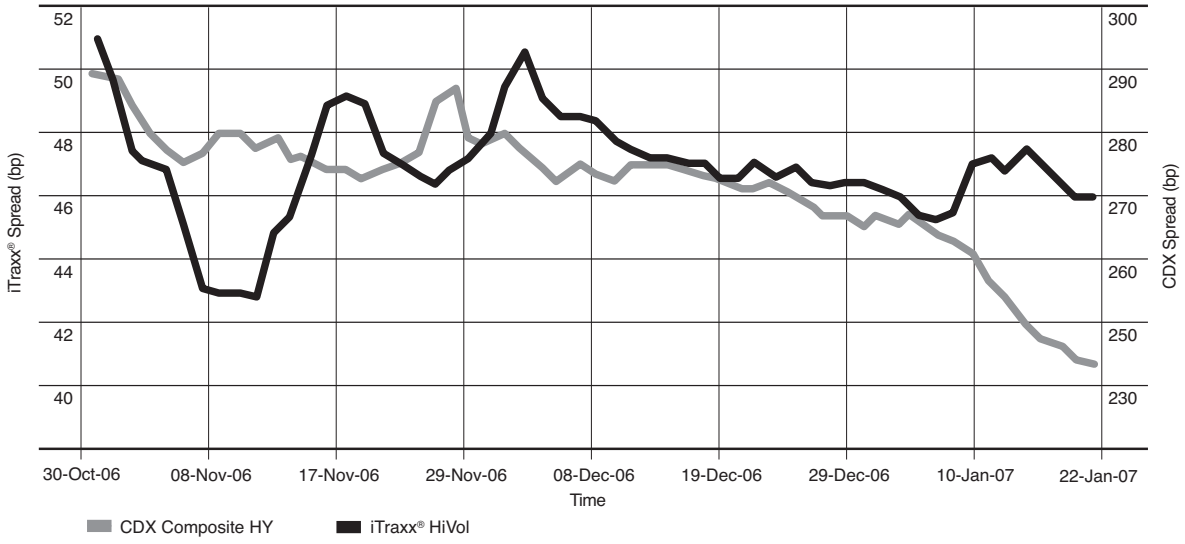
[12] For a deep and broad survey of the bootstrap, we refer to Shao and Tu (1995).

By December 19, the equity index has risen by nearly 300 points generating a mark-to-market value, ignoring dividend payments, of EUR 107,555,000. In percentage terms this modest use of the iTraxx® Crossover Index strategy yields a holding period core plus satellite portfolio return of 7.39% compared to 7.26% when no active investment strategy is used in conjunction with the equity index-tracking benchmark portfolio. It should be noted that although this strategy ignores the implication of margining cost it also does not reflect the interest that could, and would, have been earned by depositing excess funds at the risk-free rate.

Scenario 5: European Versus American Credit Indexes

Research into the credit spreads for the CDX Crossover series reveal that on occasions they are negatively correlated to their iTraxx® index counterparts but at other times they are positively correlated. This phenomenon is illustrated in Figure 6.5 which captures the co-movement of the CDX Composite High Yield Index and the iTraxx® HiVol Index over the period October 30, 2006 and January 22, 2007.

Figure 6.5: CDX Composite HY Index Spreads vs iTraxx® HiVol Index Spread



Source: IIC Ltd.

This negative relationship would, at that time, have presented a good trading opportunity. Over a short time frame an investor could have bought protection on the CDX Composite through an OTC contract and bought (go short credit risk) the iTraxx® HiVol Index. From Figure 6.5 it can be seen that the timing of this strategy would have optimum pay out if implemented in early October and unwound towards the end of November.

Conclusion

The scenarios outlined above give an insight into how the iTraxx® indexes could be used to advantage by a cross-section of investors. The list of examples is by no means exhaustive. There are, for example, applications for managers of large diversified credit portfolios where particular tranches will need to be hedged or engineered as market forces require. Managers of CDOs with CDS links may also find the new exchange-based instruments useful. The Eurex futures contracts, based on these indexes, with their transparent, user-friendly operating characteristics will open up possibilities to participants who, for whatever reason, are not engaging with the credit market instruments. However these instruments are eventually used, their availability provides another stepping stone to the more efficient and transparent operation of credit markets.

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