NAPF

Securing the future of pensions

Derivatives and Risk Management Made Simple

December **2013**

Acknowledgements

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J.P.Morgan

Note: This guide is for information only. It is not investment or legal advice. In particular, this outline does not address in detail developing regulatory requirements with respect to derivatives: readers should seek their own professional advice on these matters.

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Contents

1. Derivatives and Risk Management

Introduction

Over the last 10 years, UK pension funds have increased their usage of derivatives, either directly or through fund managers, as they focus on managing the risks associated with their liabilities. The 2012 NAPF Annual Survey results showed that 57% of members' schemes are using derivatives.

As derivative strategies have become more commonplace, risk regulation has tightened. A number of EU and OECD directives and guidelines have been issued requiring all counterparties with derivative contracts to report the details of them to a trade repository. The regulatory trend towards greater data transparency and governance is also growing.

After the financial crisis, the European Commission proposed a Financial Transaction Tax (FTT), which would be set at a minimum of 0.01% for derivatives transactions. NAPF member pension schemes estimate their potential cost at around EUR 35 million.[1]

However, the responsibility still remains with pension trustees to adopt appropriate derivative risk management processes for their pension schemes. This makes it even more important that pension trustees understand the risks inherent in their scheme's investments.

This guide has been designed for UK pension funds to introduce:

- **Exchange-traded and over-the-counter derivative instruments –** their uses and relative benefits
- **Market and counterparty credit risks**
- **Risk methodologies –** how to calculate, interpret and apply them

The risk methodologies include ESMA's guidelines for UCITS funds in Europe, which could be used to supplement the high level guidance provided by Article 14(1) of the European Directive on the Activities and Supervision of Institutions for Occupational Retirement Provision 2003/41/EC and The Pensions Act 2004 in the UK.

This guide does not address in any detail the implications of the evolving regulatory landscape and pension fund trustees should ensure they obtain detailed independent legal advice to ensure their continuing compliance with these requirements.

[1] www.napf.co.uk/PolicyandResearch/Europe-and-International/Financial-transaction-tax.aspx

Controlling uncertainty

A UK defined benefit pension fund is subject to variations in the value of its assets due to market movement. At the same time, the present value of its future liabilities is subject to change caused by fluctuation in the discount rate used in the liability valuation process (changes in GBP yield rates required at each time horizon).

A fund can manage part or all of its interest rate risk by matching assets to liabilities using practices that:

- Match liability cash flows using zero coupon bonds
- Match the average duration of assets and liabilities
- Use derivatives to create an immunisation overlay (hedge)

Full immunisation requires the future value of assets to equal the future value of liabilities at the time the payment is required. The use of zero coupon bonds, where the bond maturity matches the payment date, theoretically provides a good process. However, the supply and credit rating diversification of suitable bond maturity dates is unlikely to perfectly match the required payment dates. These concerns are compounded by corporate sponsors' desire to minimise their funding payments through the use of investment price growth, whereby a pound of future liability is funded with less than a pound invested today, and the subsequent need to take investment risk, to achieve value growth.

Using a derivatives overlay is one way of managing risk exposures arising between assets and liabilities. Derivatives are often used to hedge 'unrewarded' risks in the pension scheme (such as interest rates) providing schemes with greater flexibility around asset allocation. For example, a pension scheme could hedge the interest rate risk associated with its liabilities with a derivative allowing it to allocate its cash into assets which have limited interest rate sensitivity such as equities or alternative assets; however, this introduces other risks such as liquidity and counterparty risk (see Counterparty Risk Methodologies on page 14).

2. Derivatives

Definition

Derivatives are specific types of instruments that derive their value over time from the performance of an underlying asset: eg equities, bonds, commodities.

A derivative is traded between two parties – who are referred to as the counterparties. These counterparties are subject to a pre-agreed set of terms and conditions that determine their rights and obligations.

Derivatives can be traded on or off an exchange and are known as:

- **Exchange-Traded Derivatives (ETDs):** Standardised contracts traded on a recognised exchange, with the counterparties being the holder and the exchange. The contract terms are non-negotiable and their prices are publicly available.

or

- **Over-the-Counter Derivatives (OTCs):** Bespoke contracts traded off-exchange with specific terms and conditions determined and agreed by the buyer and seller (counterparties). As a result OTC derivatives are more illiquid, eg forward contracts and swaps.

Pension schemes were freed by the Finance Act of 1990 to use derivatives without concern about the tax implications. The Act clarified the tax for derivative use. At the time of writing this guide, OTC assets are not explicitly included as valid assets for Local Government Pension Schemes and relevant pension fund trustees should consider obtaining legal advice as to their admissibility.

Commonly used derivatives and their uses

The most common types of derivatives are **options, futures, forwards, swaps and swaptions**.

Options:
Exchange-traded options are standardised contracts whereby one party has a right to purchase something at a pre-agreed strike price at some point in the future. The right, however, is not an obligation as the buyer can allow the contract to expire and walk away. The cost of buying an option is the seller's premium which the buyer must pay to obtain the option right. There are two types of option contracts that can be either bought or sold:

- **Call** – A buyer of a call option has the right but not the obligation to buy the asset at the strike price (price paid) at a future date. A seller has the obligation to sell the asset at the strike price if the buyer exercises the option.
- **Put** – A buyer of a put option has the right, but not the obligation, to sell the asset at the strike price at a future date. A seller has the obligation to repurchase the asset at the strike price if the buyer exercises the option.

Futures:
Futures are exchange-traded standard contracts for a pre-determined asset to be delivered at a pre-agreed point in the future at a price agreed today. The buyer makes margin payments reflecting the value of the transaction. The buyer is said to have gone long and the seller to have gone short. Counterparties can exit a commitment by taking an equal but offsetting position with the exchange, so that the net position is nil and the only delivery will be a cash flow for profit or loss. Futures coverage includes currencies, bonds, agricultural and other commodities such as gold. An example would be to buy 10 EUR/USD December contracts each with a nominal of EUR 125,000 to gain future delivery of EUR 1.25 million at a pre-agreed exchange rate.

Forwards:

Forwards are non-standardised contracts between two parties to buy or sell an asset at a specified future time at a price agreed today. For example, pension funds commonly use foreign exchange forwards to reduce FX risk when overseas currency positions are required at known future dates. As the contracts are bespoke they can be for non-standardised amounts and dates, eg delivery of EUR 23,967 against payment of USD 32,372 on 16 January 2014.

Swaps:

Swaps are agreements to exchange one series of future cash flows for another. Although the underlying reference assets can be different, eg equity or interest rate, the value of the underlying asset will characteristically be taken from a publicly available price source. For example, under an equity swap the amount that is paid or received will be the difference between the equity price at the start and end date of the contract.

Swaptions:

These are non-standard contracts giving the owner the right but not the obligation to enter into an underlying swap. The most common swaptions traded are those dependent on interest rates which allow funds to create bespoke protection. Contracts can be preconfigured to provide both upside and downside protection if an event occurs. For example, a party can purchase a swaption to protect itself from the 10-year interest rate swap rate going below 1% in 3 months' time.

3. Market risk

Market risk refers to the sensitivity of an asset or portfolio to overall market price movements such as interest rates, inflation, equities, currency and property. Pension funds are heavily exposed to interest and inflation rate risks as these determine the present value of the scheme's liabilities; typically these risks are referred to as 'unrewarded' risks as these are intrinsic to the liabilities. While market risk cannot be completely removed by diversification, it can be reduced by hedging. The use of interest and inflation rate swaps can produce offsetting positions whereby the risks are hedged.

Pension funds can access interest rate and inflation hedges through liability-driven investment funds (LDI) or by using derivatives directly. Typically derivatives contracts also carry collateral requirements to manage counterparty exposure (see Counterparty Risk on page 13).

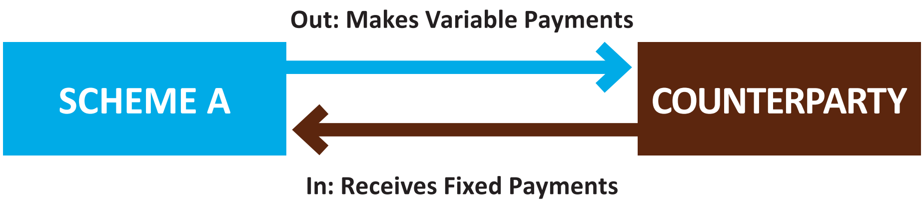
Example – Interest rate swap

Ordinarily when interest rates rise, the discount rate used in calculating the net present value (NPV) of liabilities rises, so the NPV of those liabilities is reduced and the fund's funding ratio is improved. However, the opposite is also true of a decrease in rates, whereby the NPV of liabilities increases and the pension scheme's funding deteriorates.

Swaps can involve a scheme swapping either a fixed or variable rate payment.

In the following example, Scheme A wishes to reduce its exposure to interest rate sensitivity and has entered into an interest rate swap contract whereby it has agreed to pay a variable rate of interest on a nominal amount in exchange for a fixed rate of interest on the same nominal. With such a position, the value of both scheme assets and liabilities is either positively or negatively affected. The net position is that the funding status remains unmoved and thereby the position is hedged.

Scheme A swaps a variable rate payment in exchange for a fixed one. There are two 'legs' to the contract, one fixed and one floating (see diagram below).



Under normal circumstances the present value of the future payments under each leg of the swap would be a similar amount on initiation; but over time market movement is likely to vary from expectation. However, if set up correctly the net position of the funding status will remain unmoved and thereby the position is hedged.

Scenario	Effect on payments	Effect on assets (value of position)	Effect on liabilities	Net position (Assets: Liabilities)	Collateral requirements
Rates up	Scheme A still receives the same fixed amount, but now pays more as variable payment	Swap value decreases	NPV liabilities are reduced	Lose: Win Funding ratio is the same	Scheme A posts collateral
Rates down	Scheme A still receives the same fixed amount, but now pays less as variable payment.	Swap value increases	NPV liabilities are increased	Win: Lose Funding ratio is the same	Scheme A receives collateral

Example – Inflation rate swap

Inflation is one of the main risks that pension schemes are exposed to as typically schemes' liabilities may be linked to inflation. Therefore, high inflation has a negative impact on the NPV of a scheme as liability values are higher and may create additional funding requests for the corporate sponsor. Inflation rate swaps can be used to reduce inflation risk. Similar to an interest rate swap there are two flows and payments are made between the two counterparties.

In this example, Scheme A swaps a variable rate payment for a fixed one, with changes in the variable payment dependent upon changes in an inflation rate calculated on a nominal amount. In this example, the scheme funding status (net ratio of assets to liabilities) will remain unaffected and thereby the position is hedged.

Scenario	Effect on payments	Effect on assets (value of position)	Effect on liabilities	Net position (Assets: Liabilities)	Collateral requirements
Inflation up	Scheme A still pays the same fixed amount, but now receives more as variable payment	Swap value increases	NPV liabilities are increased	Win: Lose Funding ratio is the same	Scheme A receives collateral
Inflation down	Scheme A still pays the same fixed amount, but now receives less as variable payment.	Swap value decreases	NPV liabilities are decreased	Lose: Win Funding ratio is the same	Scheme A posts collateral

Currently, the deepest market for inflation swaps references the Retail Price Index (RPI). Certain pension schemes' liabilities may reference the Consumer Price Index (CPI). Schemes should consider the trade-off between liquidity and basis risk (the difference between RPI and CPI) when looking to hedge inflation risk.

4. Market risk methodologies

When establishing a derivatives overlay, it is essential for pension schemes to measure their exposure to market risk and leverage. In this section, we review some of the main market risk and leverage methodologies, their application, interpretation and benefits.

Commitment approach

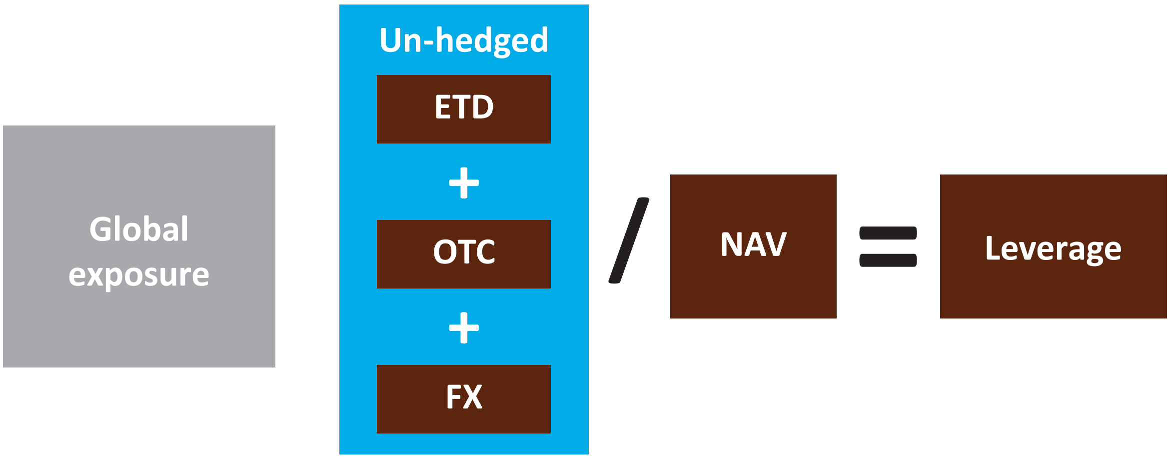
The commitment approach is a standard methodology used to calculate the **gross notional exposure** and **global exposure (net leverage/gearing)** arising from a portfolio's derivatives. The commitment approach is referenced in detail in the guidelines issued by the European Securities and Markets Authority (ESMA) for UCITS funds on 28 July 2010. These guidelines build on standard market methodologies and practices to calculate the underlying exposure of derivative instruments and a measurement of global exposure. They are a valuable reference source for UCITS and non-UCITS practitioners.

The commitment approach is a measure of leverage and does not fully reflect the market risk arising from derivatives. Other measures including qualitative assessment should also be performed to ensure the scheme's market risk is adequately identified.

Gross notional exposure:
This metric represents the absolute value of the sum of the values of individual derivative instruments. Gross notional exposure reports usually show the split between long and short derivative values as well as the gross absolute value. The calculation of exposure is based on an exact conversion of the financial derivative into the market value of an equivalent position in the underlying asset of that derivative. For example, for an Equity Futures contract the notional exposure is equal to the following:

Number of contracts * notional contract size * market price of underlying equity share.

Global exposure:
The global exposure is the absolute value of the notional exposure of each individual derivative after applying any hedging and netting benefits of longs and shorts. It is a metric reflecting the net leverage and provides a better understanding of the net derivative exposure arising from derivatives in the portfolio compared to the gross notional exposure metric.



Leverage = <u>Absolute exposure value of un-hedged* derivative positions</u>
Net Asset Value (NAV) of portfolio

* Based on pre-defined hedging/netting logic

Global exposure can be calculated by carrying out the following seven steps:

Step 1
Select all derivative instruments within the fund.
Step 2
Calculate the commitment of each derivative instrument.
Step 3
Apply netting and/or hedging logic to reduce commitment value.
Step 4
Absolute the value of any derivative instrument not used in the netting/hedging.
Step 5
For any derivative used within the netting/hedging; absolute any uncovered values that remain.
Step 6
Add the values from steps 4 and 5.
Step 7
Divide the results from step 6 by the total portfolio value to represent the global exposure as a percentage.

The above global exposure calculation is based on a harmonised definition agreed by ESMA across the EU member states and published within circular CESR/10-788 (Guidelines on Risk Measurement and the Calculation of Global Exposure and Counterparty Risk for UCITS) issued in July 2010.

When calculating global exposure using the commitment approach, netting and hedging arrangements can be taken into account to reduce global exposure. Under CESR 10-788 netting and hedging arrangements are defined as follows:

- **Netting:**
  Netting is the combinations of trades on financial derivative instruments and/or security positions which refer to the same underlying asset, irrespective of the contract's due date. Trades on financial derivative instruments and/or security positions are concluded with the sole aim of eliminating the risks linked to positions taken through the other financial derivative instruments and/or security.

- **Hedging:**
  Hedging refers to combinations of trades on financial derivative instruments and/or security positions which do not necessarily refer to the same underlying asset. Trades on these instruments/positions are concluded with the sole aim of offsetting risks linked to positions taken through other instruments/positions.

Value-at-Risk

Value-at-Risk (VaR) is a commonly used measure of risk. As a single metric, it provides a single consolidated view which incorporates the scheme's exposure to risk sensitivities. ESMA recommends that UCITS funds with more complex investment strategies use the Value-at-Risk approach as a complement to the commitment approach.

Definition: VaR calculates an expected loss amount that may not be exceeded at a specified confidence interval over a given holding period, assuming normal market conditions.
Interpretation: The higher the portfolio's VaR, the greater its expected loss and exposure to market risks.
Benefit: VaR is a composite risk measure that incorporates interest rate, FX, credit, inflation, equity risks etc. into one figure. VaR gives a consolidated view of different risks in a portfolio.

Pension schemes' VaR typically considers both assets and liabilities. VaR can be calculated using either historical or market-implied data.

VaR methodologies – common approaches
There are three commonly used methodologies to calculate VaR – each is valid in its own right but not all measures are appropriate for a given portfolio. Validity depends on where the assets are held, processing power and price. Whilst common assets such as equities and bonds tend to be linear in their outcomes, this is not necessarily the case for all derivatives; eg an option may give protection if the underlying asset price goes down but not up (or vice versa), so the payoff profile is skewed one way or another. A normal distribution of outcomes is therefore not always valid where derivatives are held.

Parametric:
- This approach calculates VaR typically assuming returns are normally distributed
- Estimates VaR direct from the standard deviation of the portfolio returns
- Easy to calculate and understand

Historical simulation:
- This approach calculates VaR from a distribution of historical returns
- Can only reflect asset sensitivities to events captured in the time horizon used
- Easy to calculate and understand

Monte Carlo simulation:
- This approach calculates VaR from a distribution constructed from random outcomes
- Can be difficult to explain as it uses sensitivities to re-price assets via a model
- Computer-intensive as normally thousands of scenarios are run with each constituent asset requiring repricing per each scenario
- Accommodates assets with non-linear pay-offs.

Complementary metrics

There's also a combination of complementary VaR and non-VaR metrics which can give a more indepth understanding of a situation.

- **Active VaR:**
  Definition: For a pension scheme this is the difference between the assets and liabilities. If a scheme is perfectly immunised active VaR will be nil.
  Interpretation: The higher the active VaR of a portfolio, the greater the scheme's exposure to market risks.
  Benefit: Active VaR on a discrete time horizon basis indicates where changes are required to the investment policy or the assets held.

- **Conditional VaR (CVaR):**
  Definition: This averages all the expected losses greater than VaR, also known as 'expected shortfall' or 'tail loss'.
  Interpretation: If VaR is calculated at a 99% confidence level, CVaR averages the worst 1% expected losses.
  Benefit: In one comparable metric, this indicates the wider exposure not contained in VaR. This is very useful where there is a high exposure to derivatives as the distribution may be highly skewed.

- **Marginal VaR (MVaR):**
  Definition: This is a measure of the change in VaR at the aggregation level when an instrument's position is increased by one percent or unit.
  Interpretation: It helps optimise the risk/return profile of a portfolio.
  Benefit: An indicator of which assets or sectors provide the most or least level of exposure. As such it can assist in identifying any possible corrective changes required.

- **Partial VaR (PVaR):**
  Definition: A measure of the change in VaR at the aggregation level when an instrument's position is completely removed.
  Interpretation: This helps clients understand the contribution to aggregated VaR.
  Benefit: Since assets influence each other (covariance), removing an individual asset can have a disproportionate change in the level of risk. This identifies key contributors.

Other metrics that can be used to complement VaR metrics include sensitivity or scenario-based analysis:

- **PV01:**
  Definition: A measure of sensitivity to a 1bp (basis point) change in interest rates. This can be shown for scheme assets, liabilities, and also the difference between the two which is known as active PV01. The outcomes may be positive or negative reflecting the percentage change in scheme value for say a 1bp or a 50bp rise or fall in interest rates.
  Interpretation: The higher the PV01, the greater the sensitivity to a change in interest rates. An immunisation policy would attempt to have a zero active PV01.
  Benefit: This metric is used by strategists to indicate immunisation completeness. It can also help in detailing at which point rebalancing of assets and hedges may be required.

- **IE01:**
  Definition: A measure of sensitivity to a 1bp change in inflation. This can be shown for scheme assets, liabilities, and also the difference between the two which is known as active IE01. The outcomes may be positive or negative reflecting the percentage change in the scheme's value for say a 1bp or a 50bp rise or fall in inflation.
  Interpretation: The higher the IE01, the greater is the sensitivity to a change in inflation. An immunisation policy would attempt to have a zero active IE01.
  Benefit: This metric indicates immunisation completeness and can assist in detailing at which time rebalancing of assets and hedges may be required.

Reporting example 1 – Active summary (assets less liabilities):
Scheme immunisation targeting compares assets to liabilities. Perfect immunisation is where future asset value is the same as future liability at each pensioner payment point. An active position occurs when the values don't perfectly match, thereby the closer any active metric is to zero, the more effective the immunisation policy.

The following example shows an imperfectly immunised scheme, with an active VaR at 4.52% and a confidence level of 99%.

Scheme immunisation summary			
Number of positions	253	Asset duration	14.25
NAV assets	719,253,123	Active duration	1.75
NAV liabilities	756,456,915	Active PV01%	0.16%
Active VaR 99% (MC monthly)	4.52%	Active IE01%	0.09%

This means:

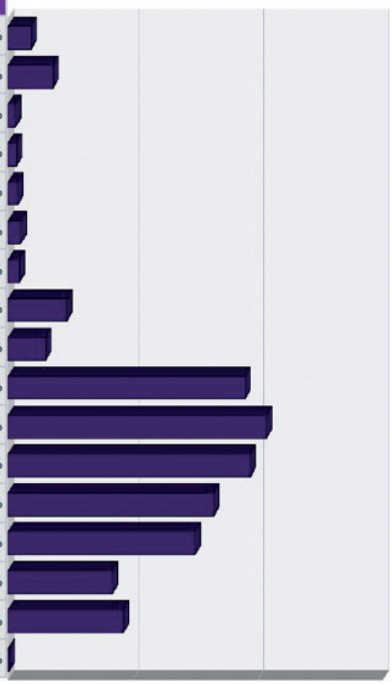
- There is a one percent chance that the scheme's assets could lose more than 4.52% value greater than the liabilities over a 1 month period
- Active PV01 is positive, so the scheme's asset value would change 0.16% greater than that of liabilities for a 1bp change in interest rates, thereby assets are more sensitive to interest rate changes than liabilities
- As active IE01 is positive, for a 1bp point change in inflation the asset value would change 0.09% more than the liabilities. Therefore, the assets are more sensitive to changes in inflation than the liabilities

Reporting example 2 – Immunisation effectiveness:

A common immunisation policy is to match the durations of assets and liabilities at each time period when liability payment is expected. The following chart shows active duration over the scheme's time horizon. If the scheme is perfectly immunised, the assets would fund the liabilities in each time period. However in this example imperfect immunisation exists. This chart shows the risk points and exactly where rebalancing action is required. A duration mismatch will also be reflected in PV01 (interest rate sensitivity) and IE01 (inflation rate sensitivity) active positions at each time point. Similar tables can be constructed for larger shifts (eg 10bp, 50bp and 100bp).

Sensitivity Analysis

	Asset Weight %	Active Weight %	Active Dur	Abs Active Dur Contr
0 - 2 yr	52.29%	43.33%	-0.75%	1.46%
2 - 3 yr	20.36%	15.87%	-0.27%	2.86%
3 - 4 yr	6.84%	2.39%	-0.40%	0.45%
4 - 5 yr	6.60%	2.19%	-0.51%	0.52%
5 - 6 yr	5.99%	1.65%	-0.20%	0.61%
6 - 7 yr	2.67%	-1.56%	-0.26%	0.80%
7 - 8 yr	2.99%	-1.11%	-0.52%	0.72%
8 - 9 yr	-1.99%	-5.97%	0.23%	3.75%
9 - 10 yr	0.40%	-3.44%	-0.63%	2.39%
10 - 15yr	0.22%	-17.00%	0.36%	15.16%
15 - 20yr	0.00%	-13.40%	-17.27%	16.53%
20 - 25yr	0.00%	-9.82%	-22.10%	15.50%
25 - 30yr	0.00%	-6.84%	-26.93%	13.17%
30 - 35yr	0.00%	-5.20%	-32.20%	11.96%
35 - 40yr	0.00%	-2.49%	-37.65%	6.68%
40+ years	0.00%	-2.27%	-45.58%	7.39%
Other	3.64%	3.64%	0.22%	0.06%



5. Counterparty risk

In addition to market risk, derivatives carry counterparty credit risk. Counterparty risk arises when one of the parties defaults, resulting in a replacement risk for the non-defaulting party. Replacement risk can be broken down into:

- **Mark-to-market exposure:** The close out process may result in realised mark-to-market exposure on the underlying contract
- **Liquidity risk:** Sourcing sufficient liquidity in the market (notional/maturity) to replace the required position that has been closed out following the counterparty's default
- **Operational risk:** Managing the close-out of a portfolio of positions, notifying the counterparty that an event of default has occurred, replacing the transactions in the market, accurately margining transactions, managing any on-going valuation disputes, meeting required intra-day settlements
- **Legal risk:** Enforceability of netting/collateral enforcement arrangements
- **Collateral risk:** Collateral posted may be ten-year government bonds. However, on default there may be a requirement to reinvest cash into new assets. There's also the risk that the haircuts on the collateral are insufficient or that the collateral is too closely correlated with the risk of the counterparty (eg systemically important bank posting its government's bond)
- **Settlement risk:** The intra-day exposure to a counterparty, arising from transfers of cash flows under a derivative transaction or returns of collateral amounts following payments under a derivative contract (eg cross-currency swaps, option purchases, etc.)

As the use of derivatives has grown, systems and methodologies to monitor and mitigate counterparty risk have become more sophisticated. Regulators have also been enhancing the accounting standards (eg IFRS 13) and capital frameworks to capture counterparty risk (Basel II, Basel III, Solvency II).

6. Counterparty risk methodologies

Quantifying the exposure

In this section, we explore the current approaches that market counterparties are using to monitor and manage derivatives exposure. These approaches primarily focus on the mark-to-market component of replacement risk.

Derivative contracts are dynamic in nature and can therefore give rise to either an asset or a liability for a counterparty (depending on market movements). The following metrics can be used to monitor and measure counterparty exposure:

- Notional of contracts
- Current mark-to-market
- Expected exposure
- Stressed future potential exposure

Notional of contracts: As a metric, this provides information around the total size of a product with a counterparty. Unlike bonds and loans, the notional of a derivative does not reflect the actual risk. Furthermore, it is not straightforward as to how best to net positions where long and short positions are entered into with different maturities, coupon details, options, etc.

Summary Notional Exposure by OTC Counterparty			
Counterparty	**Short Notional**	**Long Notional**	**Gross Notional**
Total GREEN BANK	-111,968,268	213,148,942	325,117,210
Total ABC BANK	-244,312,076	1,457,268,850	1,701,580,926
Total CBA GROUP	-310,069,150	317,609,192	627,678,342
Total XYZ BANK	-465,745,229	431,674,745	897,419,974
Grand Total	**-1,132,094,724**	**2,419,701,728**	**3,551,796,452**

Current mark-to-market: This is a snapshot of the current exposure to a counterparty typically adjusted to reflect any netting (eg ISDA agreements) and collateral arrangements. This provides more information than the notional amount of derivatives in question. However, it is still limited in its information, particularly when the forward mark-to-market is expected to change (eg based on the shape of the interest rate yield curve). This metric can be enhanced by incorporating a sense of the potential future exposure using a specific percentage of the notional of each transaction ('add-on factor') based on a grid for each underlying asset class and maturity. An example of this can be found in the Basel II banking capital rules.[2]

[2] Please refer to paragraph 92(i) of Annex 4 of the document International Convergence of Capital Measurement and Capital Standards June 2006 (www.bis.org/publ/bcbs128.pdf)

Counterparty credit risk	Step 1		Step 2		Step 3
	Method 1 Positive mark-to-market value of contracts **Method 2** Positive mark-to-market value of contracts + potential future exposure	–	Less negative mark-to-market value of contracts *Subject to confirmation of netting agreements*	–	Less collateral held *(Initial and variation margin)*

Note: Steps 2 and 3 are optional and subject to the conditions being met with regards to enforceable netting arrangements being in place and eligibility of collateral.

Counterparty credit risk = (Current net exposure + Potential future exposure) - collateral

Current Mark-to-Market OTC Counterparty Exposure					
Counterparty	**Negative Market Value**	**Positive Market Value**	**Positive Net Market Value (After Netting)**	**Collateral Held**	**Net of Collateral OTC Counterparty Exposure**
Total GREEN BANK	-7,336,722	2,794,328			
Total ABC BANK	-40,688,354	11,061,145			
Total CBA GROUP	-21,918,952	13,195,710			
Total XYZ BANK	-7,031,893	11,374,144	4,342,251	3,540,000	802,251
Grand Total	**-76,975,920**	**38,425,326**	**4,342,251**	**3,540,000**	**802,251**

Potential Future Exposure (PFE) is calculated by multiplying the notional values of the contracts with a fixed percentage which is based on the PFE Add-on Factor.

PFE Add-on Factor is based on the asset class and on the remaining maturity of the contract.

	Interest Rates	FX and Gold	Equities	Precious Metals Except Gold	Other Commodities
One year or less	0.0%	1.0%	6.0%	7.0%	10.0%
Over one year to five years	0.5%	5.0%	8.0%	7.0%	12.0%
Over five years	1.5%	7.5%	10.0%	8.0%	15.0%

Future Credit Risk Table based on PFE Add-on Factor outlined in the Basel Accord.

www.bis.org/publ/bcbsca.htm

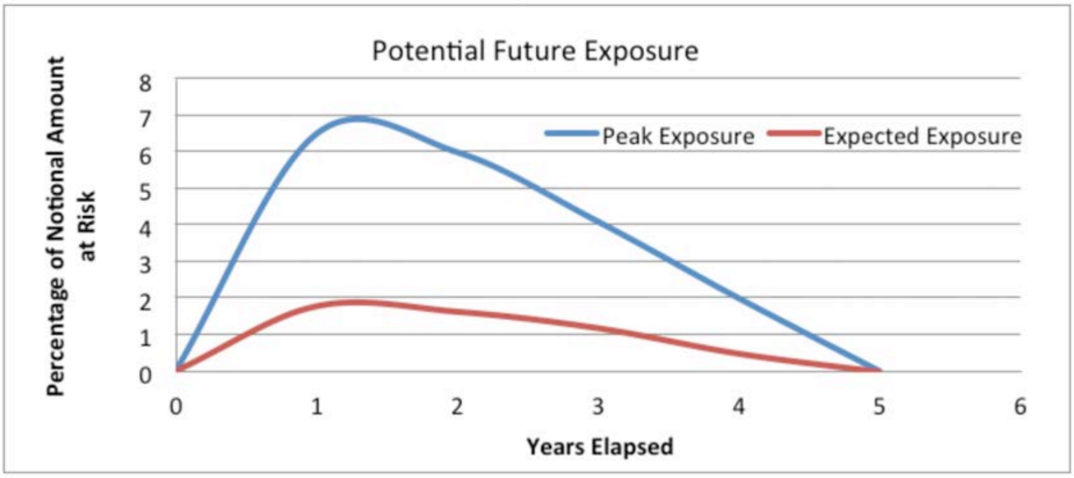
Current Mark-to-Market OTC Counterparty Exposure						
Counterparty	**Negative Market Value**	**Positive Market Value**	**Potential Future Exposure (Notional Add-on)**	**Positive Net Market Value (After Netting + Potential Future Exposure)**	**Collateral Held**	**Net of Collateral OTC Counterparty Exposure (With Potential Future Exposure Add-on)**
Total GREEN BANK	-7,336,722	2,794,328	6,500,250	1,957,856		1,957,856
Total ABC BANK	-40,688,354	11,061,145	20,600,202			
Total CBA GROUP	-21,918,952	13,195,710	10,010,240	1,286,998		1,286,998
Total XYZ BANK	-7,031,893	11,374,144	19,540,305	23,882,556	3,540,000	20,342,556
Grand Total	**-76,975,920**	**38,425,326**	**56,650,997**	**27,127,410**	**3,540,000**	**23,587,410**

Expected exposure: This represents the expected positive mark-to-market profile of a swap or portfolio of transactions reflecting any netting and collateral arrangements at different points in the future. Expected exposure is typically calculated as the average of potential mark-to-market paths which are in-the-money (out-of-the-money paths are set at 0 for the purposes of computing the average). The paths can be generated using a Monte-Carlo simulation using implied market volatilities and correlation parameters.

The chart below illustrates the exposure on a 5 year Swap as a % of Notional.

As an example, if interest rates were to reduce by 0.5% at the end of year 1, then in the event of a default the replacement cost for the counterparty receiving the fixed rate will be equal to the following:

0.5% (rate change) * 4 (years) = 2% of Notional



Stressed future potential exposure: This is typically a high percentile of the distribution of potential in-the-money paths for the portfolio of derivatives. This metric is sometimes referred to as a peak exposure measure. The paths used in this calculation can be generated using a Monte Carlo simulation in a similar way to the expected exposure and then further enhanced by using stressed parameters (eg worst case historic volatilities/correlation parameters). Examples of high percentiles used for measuring the exposure include 95%, 97.5%, 99% or 99.5%.

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7. Managing the exposure

Risk limits

Counterparty risk can be managed by constructing risk limits for each counterparty based on:

- **Counterparty rating, market capitalisation, country of incorporation**
- **Maturity bucket** (1 day, 1 week, 30 days, 1 year out to 50 years)
- **Exposure metrics** outlined above (including and excluding the benefit of collateral and risk mitigation techniques)
- **Product type** (equities, FX, interest rate, inflation, etc.)

Gross Notional Not to Exceed 30%			
	Gross Notional	**% Gross Notional**	**Message**
Total GREEN BANK	25,000,000	10%	
Total ABC BANK	60,000,000	24%	
Total CBA GROUP	107,500,000	43%	POTENTIAL VIOLATION
Total XYZ BANK	57,500,000	23%	
Grand Total	**250,000,000**	**100%**	
Counterparty Not Less Than A+			
	Moody Rating	**S&P Rating**	**Message**
Total GREEN BANK	Baa1	A	POTENTIAL VIOLATION
Total ABC BANK	Aa3	A+	
Total CBA GROUP	Aa1	A+	
Total XYZ BANK	A3	A-	POTENTIAL VIOLATION

Collateral arrangements and collateral management:

Collateral has historically been used to facilitate trade between two parties by providing security against the possibility of default of a counterparty. The main intention of using collateral has been to manage counterparty credit exposure created by bilateral trading. Over the last decade, OTC derivative exposure has been more formally managed via Credit Support Annexes (CSAs) under International Swap and Derivatives Association Master Agreements (ISDAs) setting out collateral arrangements. Active management of counterparty risk by market participants, particularly buy-side firms, has resulted in larger amounts of collateral being demanded and more frequent movements between counterparties.

Credit support agreements (CSAs) are typically used for derivative transactions as a way of reducing the mark-to-market exposure to a counterparty. Under a CSA the counterparties agree to collateralise the net mark-to-market exposure of the portfolio with a defined pool of eligible assets (eg cash, government bonds). The collateral is transferred to the other party when the portfolio of transactions under the respective CSA is a net negative amount for the transferring party.

Collateral arrangements mitigate credit risk by transforming it into legal and operational risk, subject to:

- Legal enforceability of collateral arrangements
- Operational capabilities to margin derivative portfolios daily, subject to minimum transfer amounts, thresholds, etc.
- Liquidity risk arising on ability to meet daily margin calls
- Collateral replacement risk following a close out event

Regulations such as Dodd-Frank, EMIR, IOSCO, MiFID /MIFIR and Basel III are designed to create (amongst other things) greater transparency and appropriate capitalisation of derivative instruments. They will also bring greater complexity in collateral processes as OTC clearing brokers are introduced, collateral eligibility becomes more granular and segregation of collateral is considered across both cleared and non-cleared instruments. Even where mandatory clearing is not applicable, reporting and risk mitigation requirements may apply. For many participants, increased costs are also a key concern, which in turn is placing greater focus on the collateral management process. A key focus across all organisations is to employ efficient processes that identify and deploy the cheapest assets to deliver as collateral.

Active management

OTC derivatives can move dynamically within volatile markets, creating the potential for pre-defined risk limits to be breached following sizeable market movements. To address this, active management of counterparty risk may be necessary by:

- Re-couponing/resetting the mark-to-market of the derivative
- Unwinding positions based on certain market movements
- Transfer of positions from over-threshold names to third parties (‘novation’) where risk limits are being under-utilised
- Hedging the exposure using credit derivatives with a third party
- Incorporating a credit support annex (CSA) with daily settlements, thresholds, minimum transfer amounts, independent amounts

Given the bilateral nature of derivatives contracts in many of the cases above, consent from the over-threshold counterparty may be required to effect these actions.

Further areas of risk analysis around derivatives

Additional considerations for counterparty risk management include:

- **Liquidity implications** on portfolio allocations of using derivative transactions and different eligible assets in collateral agreements
- **Transfer pricing** of the cost of credit and liquidity risk in derivative contracts into strategic asset allocations
- **Hedging tools** for derivative exposure
- **Valuation implications** of derivatives of collateral arrangements, clearing, credit and capital

8. Summary

In summary, pension trustees continue to have considerable scope regarding how they monitor and manage their pension schemes' risk. At the same time, derivative and portfolio structuring are becoming increasingly complex – which in turn requires more sophisticated risk management and reporting. This makes it even more important for pension schemes to properly understand, monitor and manage their risk exposures.

Whilst VaR remains an important metric for measuring market risk exposure, there are limitations with this measure. Regulators are increasingly recommending a broader range of risk metrics to evaluate risk exposure. Ultimately, each pension scheme needs to adopt the best combination of risk metrics for its unique asset/liability, funding and risk profile.

Key considerations associated with applying derivatives

1) **Identifying the right overlay strategy**
   Derivatives can be used for risk reduction and efficient portfolio management. The key starting point is to establish an appropriate overlay strategy defining its objectives, the associated cost and benefits as well as key risks.

2) **Establishing robust operational procedures for managing an overlay strategy**
   Pension schemes need to ensure appropriate and robust processes are in place when using derivatives overlays, which should include amongst other aspects:

   (i) Creating an appropriate governance and internal risk reporting framework
   (ii) Pricing, executing and booking the transactions
   (iii) Measuring and reporting risk arising from the derivatives overlay and its effect on the pension scheme's strategic asset and liability portfolios and liquidity profile
   (iv) Managing the operational aspects of the derivatives (eg collateral transfers)
   (v) Monitoring of additional risks (eg counterparty risk limits)
   (vi) Complying with regulatory requirements (eg potential future EMIR clearing implications)

3) **Identifying risk limitations**
   There is a wide range of trade-offs involved in risk-managing a pension scheme as in practice it is not possible to perfectly manage a risk. Derivatives provide a tool for managing risks and achieving certain financial objectives; however, as with any risk management decision, they may convert a first order risk (eg interest rate risk) into other second order risks (eg liquidity risk, rebalancing risk, counterparty risk etc). When using derivatives, appropriate analysis of these limitations needs to be carried out.

Notes

Important Information

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