

Information Bulletin: The Risks of Derivative Exposures

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1 Introduction

- 1.1 Organisations can use derivatives such as futures, forwards, options and swaps (or similar instruments or securities which have derivative characteristics) to manage their risk exposures in ways that often cannot be achieved (or cannot be achieved as efficiently) by more traditional means. But their use also makes it possible for risk exposures to be mismanaged, with potentially serious consequences.
- 1.2 The possible mismanagement of risk exposures is not a problem unique to derivatives. However, some forms of derivatives may be more difficult to control or analyse than other financial instruments and they can be highly geared to underlying market movements in the referenced securities. Also, by using derivatives it is often possible to make large shifts in market exposures more quickly than by more traditional means. The underlying assets and liabilities may have characteristics which are hard to follow and contracts may be complex in nature and involve market and counterparty risks of sorts not usually experienced with other investments.
- 1.3 There are other sorts of instruments (e.g. Collateralised Debt Obligations) which may legally be structured in the form of more traditional investment instruments but which embed risks akin to those arising with more complex derivative instruments. Agreements for stock lending or sale and repurchase ("repo") may also have some of the characteristics of derivative instruments. Other forms of investment, particularly collective instruments such as pooled funds, may also contain derivative instruments and the extent of the risks involved in the use of derivative instruments by the pooled fund managers concerned may be unclear.
- 1.4 This resource material is intended to highlight some of the key risks of derivatives and the processes or techniques by which they can be managed.

2 Control Procedures

- 2.1 Organisations wishing to control the risks associated with derivatives may do so by the use of internal guidelines and monitoring systems developed for this purpose. For example, a system of derivative guidelines on the use of derivatives may:
 - a) define the instruments that may be dealt in by the organisation, and the margining arrangements required for the various instruments;
 - b) identify limits on exposures or volumes (encompassing both credit risk and risks from market movements), where appropriate aggregating such exposures with those incurred through non-derivatives activities and taking into account arrangements with counterparties such as netting

agreements;

- c) delineate the type of counterparties with which the organisation can deal (e.g. the organisation's own views of counterparty strength, which might for example be informed by external credit ratings);
- d) set counterparty exposure limits;
- e) specify acceptable collateral arrangements that should be applied to mitigate counterparty exposures, including the frequency with which collateral is posted and acceptable instruments;
- f) specify that contracts are the subject of legal advice, particularly where there may be mutual obligation between parties;
- g) ensure that the organisation's use of derivatives and interpretation of such terms as 'reduction in risk' and 'efficient portfolio management' satisfy statutory rules, prudential guidance or codes of practice published by relevant statutory authorities;
- h) ensure that senior management with responsibility for control of derivative instruments is sufficiently independent of those concerned with trading and day-to-day management of derivatives, has sufficient understanding of the derivatives contracts being used and is provided with sufficient statistics and information (suitably summarised) to be able to exercise effective management control;
- i) require a schedule to be prepared on a regular basis (commonly daily) showing the number and type of derivative transactions undertaken, the gross and net market exposures involved, counterparty exposures and the sensitivity of the portfolio to large market movements;
- j) include monitoring arrangements under which identified persons who have an ongoing responsibility to comment on exposures or assess whether exposures are being satisfactorily monitored receive suitable summaries and exception reports, and have access to the full schedules on demand; and
- k) ensure that material breaches of investment restrictions in relation to derivatives are immediately reported.

2.2 Derivative guidelines and monitoring systems might also recognise that:

- a) the management of some types of derivative positions may need to be dynamic, which requires a management team which is sufficiently large, and sufficiently skilled, to undertake this work and to understand its limitations. A range of skills is needed, both within the derivatives team and within more senior management. Even derivative hedges that were intended to be static may need to be rearranged rapidly in the event of a downgrade in credit quality of a counterparty;
- b) the tax treatment of some derivatives is complex;
- c) derivatives or equivalent instruments may be bought solely to match some underlying liabilities. Even in these circumstances, however, risk exposures still arise (e.g. counterparty risk or the possible purchase of too much or too little exposure) which need proper management. Roll-over risks should be considered if the liabilities extend over a longer period than the derivative

instruments being acquired; liquidity risks should be considered if the derivative hedges may need to be sold or rebalanced if, for example, the underlying liabilities change;

- d) for some types of derivatives, standardised forms of legal agreement exist, and a decision not to use these standard forms would be unusual;
- e) the value of derivatives can change very rapidly as markets move. This can mean that whilst the initial value of a derivative may be small in relation to all of the investments held, gains or losses could become significant. Therefore, when determining whether a derivative holding is material, the potential change in the value of the derivative should be considered rather than just its current market value; and
- f) Collateral arrangements can mitigate but do not eliminate counterparty exposures. Collateral assets may themselves be subject to investment risks. Also, there can be significant market movements between the last day on which collateral was posted and the close out of the trade, and it may prove difficult to value derivative positions, and costly to replace them with other counterparties. Further, these factors may be particularly acute in conditions that might be associated with a counterparty failure, for example bid-offer spreads often widen during such periods of market stress.

3 Quantifying the Financial Impact of Derivatives

3.1 Organisations may wish to quantify the financial impact of derivatives for a number of different purposes including:

- a) the effectiveness of derivatives for hedging or risk reduction, and
- b) the assessment as to whether sufficient capital, funding reserves, or provisions exist in respect of derivative contracts entered into by an organisation.

3.2 The following points may be relevant when such quantifications are required:

- a) it may require significant expertise to fully assess the value of the derivatives within the context of the assets and liabilities and the risk involved. It may be inappropriate to rely for such expertise on the party that has sold the derivative without the organisation being able to form its own view that the process for producing the value of the derivative is appropriate/objective/sound;
- b) depending on the purpose of the quantification, it may be appropriate to be prudent. For example, in assessing the level of risk capital required for an organisation like an insurance company or a bank, an appropriately prudent assessment may be required, which would need to take account of how the risks were being hedged or otherwise controlled (and the limitations of such techniques);
- c) For over-the-counter (OTC) derivatives (or other derivatives dealt in relatively infrequently), obtaining a reasonable estimate of realisable value may be difficult. An estimate may need to reflect what the derivative might actually realise on closing out of the derivative position, including reflecting the further adverse market movements which may occur in the time

between the decision to close out and the completion of the transaction. In this context, the size of the contract relative to the market is a major consideration;

- d) models are commonly used to value OTC derivatives (or other derivatives that are traded relatively infrequently). Both the choice of model, and the parameters entered into the model, involve an element of judgement. There is always 'model risk', i.e. the risk that the model being used proves inaccurate or does not capture some fundamental characteristic of the market in question which is relevant to the price movements of the investment underlying the derivative or to the contingency being covered. If the estimates are prepared in-house using computer programs then the accuracy of the quantification may depend on how well these programs are controlled, validated and documented;
- e) the realisable value of or liability arising from some derivatives can change rapidly as markets move and daily (or even more frequent) pricing may be appropriate;
- f) allowance may need to be made for the aggregation of counterparty risk and market exposures for all investments including both assets and liabilities, especially as counterparty exposures can be substantially changed by large market price movements. Such aggregations may impact on rules about maximum exposures; e.g. for an insurance company there can be an effect on the amount of inadmissible assets.

3.3 Due to the above quantification difficulties, some organisations may wish to hold additional capital or reserves in respect of derivative exposures.

4 Difficulties Arising from the Use of Derivatives for Hedging

4.1 The use of derivatives as a hedge of an asset or liability position of the organisation is subject to the following difficulties (in addition to assessment):

- a) there can be basis risk between the asset or liability position being hedged and the closest available matching derivative. This basis risk can be particularly acute in terms of the market values of derivative hedges versus hedged provisions in stressed market conditions;
- b) organisations sometimes seek to replicate or hedge the effects of derivative exposures using 'dynamic hedging' or other portfolio insurance techniques. There are limitations to such techniques, e.g. it may be difficult or impossible to replicate the effects of derivative exposures if markets jump suddenly or if the underlying behaviour of the market changes significantly;
- c) problems can arise if the liability or asset being hedged (e.g. relevant insurance policies or liability to pay pension benefits) does not remain in force until maturity, when it may become necessary to close out the derivative transaction prior to its maturity; and
- d) derivative positions can have a substantial impact on an organisation's investment portfolio if extreme movements in markets occur (e.g. the potential impact of meeting margin requirements, having positions involuntarily closed if such margin payments cannot be met, and the effects of market movements can themselves be potentially exacerbated by the use of derivatives). Moreover, the pricing of a derivative after a sharp market movement may not be consistent with its pricing immediately before the movement.

5. Further Reading

The following books may be helpful in learning more about derivatives and how they can be valued:

- Baxter, M. and Rennie, A. (1996), A Financial Calculus: An Introduction to Derivative Pricing
- Fulcher, P., Baid, S., Chambers, A., Catchpole, S., Rogers, M. and Tatham, C. (2007), "Practical implementation of liability driven investment", downloadable from ["http://www.actuaries.org.uk/research-and-resources/documents/practical-implementation-liability-driven-investment"](http://www.actuaries.org.uk/research-and-resources/documents/practical-implementation-liability-driven-investment)
- NAPF (2005), Swaps Made Simple, downloadable from ["http://www.actuaries.org.uk/research-and-resources/documents/swaps-made-simple-what-trustee-needs-know"](http://www.actuaries.org.uk/research-and-resources/documents/swaps-made-simple-what-trustee-needs-know)
- NAPF (2007) Liability Driven Investment Made Simple
- Hull, J. (2005), Options, Futures and Other Derivatives
- Wilmott, P. (2007), Paul Wilmott Introduces Quantitative Finance

6. Any queries?

If you have any queries regarding the content of this material please contact the Finance and Investment Communities Manager Kirstin Lambert (Kirstin.lambert@actuaries.org.uk).