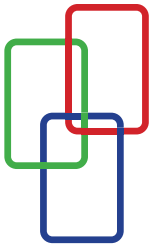

A Core Curriculum for Insurance Supervisors

ICP 22B: The Use of Derivatives by Insurers

Basic-level Module

THE WORLD BANK

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About the Core Curriculum

A financially sound insurance sector contributes to economic growth and well-being by supporting the management of risk, allocation of resources, and mobilization of long-term savings. The insurance core principles (ICPs), developed by the International Association of Insurance Supervisors (IAIS), are key international standards relevant for sound financial systems.

Effective implementation of the ICPs requires skilled and knowledgeable insurance supervisors. Recognizing this need, the World Bank and the IAIS partnered in 2002 to develop a "core curriculum" for insurance supervisors. The Core Curriculum Project, funded and supported by various sources, accelerates the learning process of both new and experienced supervisors. The ICPs provide the structure for the core curriculum, which consists of a set of modules that summarize the most relevant aspects of each topic, focus on the practical application of supervisory concepts, and cross-reference existing literature.

The core curriculum is designed to help those studying it to:

- Recognize the risks that arise from insurance operations
- Know the techniques and tools used by private and public sector professionals
- Identify, measure, and manage these risks
- Operate effectively within a supervisory organization
- Understand the ICPs and other IAIS principles, standards, and guidance
- Recommend techniques and tools to help a particular jurisdiction observe the ICPs and other IAIS principles, standards, and guidance
- Identify the constraints and identify and prioritize supervisory techniques and tools to best manage the existing risks in light of these constraints.

Note to learner

Welcome to module 22B on the use of derivatives by insurers. This module on the uses of derivatives by insurers and related risk management practices presupposes some familiarity with derivative contracts, the market context in which derivative transactions occur, and the risks they entail. A basic module, 22A, introducing derivatives is available for study that provides the necessary background on derivatives. It is also assumed that students have a basic understanding of insurance markets, products, investments, risks, and prudent risk management practices. The module should be useful to either new insurance supervisors or experienced supervisors who have not dealt extensively with the topic or are simply seeking to refresh and update their knowledge.

Start by reviewing the objectives, which will give you an idea of what a person will learn as a result of studying the module. Then proceed to study the module either on an independent, self-study basis or in the context of a seminar or workshop. The amount of time required to study the module on a self-study basis will vary, but it is best addressed over a short period of time, broken into sessions on sections if desired.

To help you engage and involve yourself in the topic, we have interspersed the module with a number of hands-on activities for you to complete. These exercises are intended to provide a checkpoint from time to time so that you can absorb and understand the material more readily and can apply the material to your local circumstances. You are encouraged to complete each of these activities before proceeding with the next section of the module. If you are working with others on this module, develop the answers through discussion and cooperative work methods. An answer key in appendix III sets out some of the points that you might consider when tackling the exercises and suggests where you might look for the answers.

As a result of studying the material in this module, you will be able to do the following:

- Explain the capital market utility of derivatives
- Explain the objectives of each of the following participants in the market for derivatives: (a) hedgers, (b) speculators, and (c) arbitragers
- Explain how insurers use derivatives to manage risk and achieve their business objectives
- Enumerate the concerns of insurance supervisors regarding insurers' use of derivatives
- Assess the appropriateness of a particular insurer's policy on the use of derivatives
- Describe the systems that insurers use to manage the risks of derivatives
- Describe techniques for measuring and controlling counterparty risk
- Outline the issues in accounting for derivatives
- Describe the disclosures that an insurance supervisor might require regarding an insurer's use of derivatives
- Summarize the requirements of ICP 22.

ICP 22B:
The Use of Derivatives by Insurers

Basic-level Module

A. Uses of derivatives by insurers

The exponential growth of derivatives results from many factors. These include the globalization of capital markets; the perception of increased volatility in currency, interest rates, and commodity markets; the desire to leverage capital; the growing emphasis on asset-liability management; the exponential growth in retirement savings to which interest rate guarantees are attached; the technological advances in computers and telecommunications; and pressure on banks and dealers to find new sources of profit as developments in the capital markets erode their traditional activities. Fundamentally, however, the use of derivatives has exploded because a large and diverse group of users recognizes that derivatives make good financial sense.

By promoting the modification and repackaging of cash flows and the disaggregation of risks into their component parts, derivatives promote the sale of cash flows by those not in a position to give them their highest value to those who are. Derivatives promote the raising of capital and the sale of risk exposures at the cheapest price. Derivatives bring about a fundamental improvement in the availability of capital, the liquidity and pricing of assets, and the diversification of risk, all of which enhances the efficiency of capital markets and the soundness of financial institutions.

Derivatives are used to take advantage of price differences that exist in capital markets due to differences among participants, differences in their perceptions of credit or other risks, and differences in regulatory, legal, tax, or other constraints. They enable borrowers to borrow in the market—national or international—that provides the cheapest source of funds and investors to invest in the markets that provide the highest return for any given level of risk. Borrowers and investors then use derivatives to

achieve the asset and liability structures and risk exposures desired. Derivatives reduce the impediments to free-market access that traditionally produce opportunities for price arbitrage.

Derivatives have proven themselves to be of fundamental value to financial institutions, capital markets, investors, and borrowers. For this reason, the financial market regulator has a role to play in ensuring that derivative transactions take place in an orderly, legal, and regulated framework, have adequate capital support, and are fully disclosed to internal management, stockholders, and the marketplace.

Understanding the capital market utility of derivatives

It is important for insurance supervisors to understand the positive effects that derivatives produce in capital markets, since this will help them to appreciate both the popularity of derivatives and the benefits they can bring to insurance companies.

Lower cost of risk transfer

The use of derivatives to transfer risk might be expected to involve material and potentially prohibitive costs. Financial intermediaries, who have excess risk, pay to transfer this risk to those who have the capital resources to assume it. If the price to sellers for laying off the risk is commensurate with the price charged to clients of the financial intermediary for taking on the risk, then the price may well be prohibitive, and the use of derivatives is a zero-sum game.

In reality, derivatives are often an efficient mechanism for relieving unwanted concentrations of risk in financial intermediaries, in much the same way as reinsurance and syndication. A financial intermediary takes on risks in a retail market at retail prices, nets many of these risks against offsetting risks, absorbs the level of risk commensurate with its level of capital and risk tolerance, and sells any excess risk in the wholesale market at wholesale prices. The cost-effectiveness arises because there are differences in the retail and wholesale pricing of risk and because costs are incurred only at the margin and only after the netting of offsetting risks.

Derivatives may exchange the costs, regulatory environment, burdens, and constraints in one jurisdiction for those in another. For example, a securities firm may set up off-shore affiliates to trade in over-the-counter derivatives in order to book transactions in foreign jurisdictions where regulation is more favorable to the transaction. To the extent that this leads to the regulatory lowest common denominator, it may be harmful, and regulators must be vigilant to prevent abuses. To the extent that this brings the market discipline of the international community to bear on unnecessary and costly legal and regulatory burdens and constraints, it may be beneficial.

Diversification of risks across institutions and markets

In the case of reinsurance and syndication, risks are transferred from one financial intermediary to another without any mitigation of the risk itself. The real efficacy of derivatives arises from the fact that they facilitate the netting of risks across financial institutions and financial markets. Investors may have reciprocal risk positions that they can exchange. The costs of a derivative transaction may be relatively modest if the risk can ultimately be transferred to a party that is well positioned to absorb it without having to put up any capital.

Insurance company A might need to reduce asset duration, while insurance company B might need to increase asset duration. The two insurers could transact in the cash markets, with company A selling its excess assets to company B. However, company A may wish to retain all of its assets for portfolio, tax, or other reasons, while company B may not have the cash needed to make the purchase. What the two companies really want to do is to buy and sell interest rate exposure.

The buying and selling of interest rate exposures is precisely what the derivatives market is designed to facilitate. Company A could enter into a $10 million interest rate swap with company B, whereby it agrees to pay an appropriate fixed rate for 10 years in exchange for a three-month LIBOR rate, which changes every three months. Effectively, company A sells an exposure to 0-year interest rates to company B and purchases an exposure to short-term rates from company B. And there is no need to presume that a speculator is lurking in the process, seeking to charge an exorbitant rate for putting the speculator's limited and valuable capital at risk.

In practice, companies A and B are unlikely to identify each other and thus be able to transact directly. Derivative market makers facilitate the process by buying an exposure from one party and selling it to another. The market maker charges a relatively small transaction fee for facilitating the transaction. The size of the fee depends on how readily the market maker can lay off the exposure, since the market maker does not plan on retaining the exposure (unless it happens to fit with a desired trading position). The exposure will be broken into its component parts and netted against all other exposures. Only then will the market maker need to consider laying off the risk externally.

The market maker enters into a huge volume of derivative transactions across the full spectrum of end users: individuals, corporations, financial institutions, pension funds, mutual funds, governments, and central banks. And global market makers deal with end users crossing international, regulatory, accounting, and tax jurisdictions. This means that most exposures can be netted without putting capital at risk or incurring costs by laying off the risk to other market makers.

With complex, innovative derivative transactions, the transaction costs can be substantial, since the market maker will charge for its innovation, for the complexity of monitoring, measuring, and netting the risk on a dynamic and continuous basis, and for the likelihood that some of its capital will be put at risk for some period of time.

With simple, high-volume transactions, however, these factors do not apply, and the transaction costs will be minimal.

Derivatives can be used to create the same or similar market exposures as direct investments, but more effectively. Some jurisdictions impose percentage limits on foreign investments in pension plans. Futures on a foreign stock index can be combined with a domestic money-market position. Alternatively, an equity swap to pay a domestic stock index total return and to receive a foreign stock index total return can be combined with direct local stock investments selected to match closely the domestic stock index returns that must be paid. In either way, foreign stock exposure is increased without increasing the level of foreign investments. Similar strategies can be effective in reducing withholding taxes or constraints imposed by foreign jurisdictions on foreign investors.

Enhanced market liquidity

Securitization serves to bring new investors into the market for the asset securitized. Consider the situation where borrowers' preference for mortgages with five-year terms creates excess exposure to five-year interest rates across the entire insurance or banking industry. The risk caused by excess five-year mortgages can be transferred to a new player by securitizing the mortgages in a mortgage-backed security (MBS). The MBS investor is not able to lend directly to mortgage borrowers but finds the thin MBS spread over government bonds attractive and happily absorbs the excess of five-year mortgages. The new investor relieves financial intermediaries of the term mismatch at little cost to them.

The investor has no interest in, and no capability of, sourcing and evaluating the assets securitized (auto loans, card receivables, residential mortgages, and so forth) and no interest in, and no capability of, servicing and administering these assets. The illiquidity of the securitized asset may be unacceptable to the investor. Securitization removes these incidental obstacles to ownership, creating liquidity, investment opportunities, and risk management opportunities.

The simplicity and liquidity of interest rate swaps make them an extremely cost-effective tool for risk transfer. Cross-currency swaps mean that the entire financial world can participate in the swap market of any country. This means that the supply-demand forces affecting swap rates are not entirely a matter for domestic market makers. For more on derivative markets, see Ritchken (1996).

Uses of derivatives

According to ICP 22, explanatory note 5, "In monitoring the activities of insurers involved in derivatives, the supervisory authority must satisfy itself that insurers have

the ability to recognize, measure, and prudently manage the risks associated with their use."

To appreciate this principle, insurance supervisors must understand that derivatives do not themselves create financial risk. Rather, the fundamental concern is with the way in which insurers use derivatives. Thus supervisors must understand the distinct ways in which derivatives can be used in order to recognize when insurers are using them to manage risk "in the context of a prudent overall asset-liability management strategy" (ICP 22, explanatory note 2) rather than as part of a risky speculative strategy. Derivatives can be useful tools, but they can be abused.

Insurance supervisors must ensure that derivatives are used in accordance with prudent asset-liability and risk management policies and practices. Specifically, ICP 22, explanatory note 1, states that insurers using derivatives should clearly define their objectives and that both insurers and supervisors need to ensure that these objectives and the uses of derivatives are consistent with legislative restrictions. ICP 22, explanatory note 2, states that derivatives should be used to mitigate risk and to undertake portfolio management. ICP 22, explanatory note 3, advises supervisors to consider prohibiting the use of derivatives by insurers where the conditions for effective supervision are not fully in place.

Derivatives generally are used to address one of the following: to reduce risk (hedging), to manage risk (portfolio management), or to assume "naked" risk (speculation). In hedging and portfolio management, derivatives are used to solve problems or achieve objectives created by an existing portfolio of assets and liabilities. These uses can be contrasted with stand-alone, speculative uses of derivatives that have no context in the broader portfolio.

Use of derivatives to hedge

To hedge is to reduce risk by taking a position that offsets an existing or anticipated risk exposure arising from either side of the balance sheet or from the relationship between the two sides. For example, insurers can hedge risk exposures faced by their businesses as a result of price fluctuations that are incidental to their operations by using derivatives to fix the price of future purchases and sales and future exchange rates.

Perhaps the greatest risk to a financial institution or sector is to underutilize derivatives as risk and portfolio management tools in the face of persistent risks that cannot be managed cost-effectively in any other way. To the extent that derivatives are used prudently and cost-effectively, the failure to use them may ultimately lead to declining market share and shareholder value.

Use of derivatives to achieve risk and portfolio management objectives

Using derivatives to achieve risk and portfolio management objectives goes beyond hedging in that it seeks to manage risk-return trade-offs within a prudent risk management framework. The same framework and portfolio management objectives should be applied to both cash-market investments and derivatives alike.

Derivatives can also be used to (a) allocate assets efficiently, (b) manage balance sheets and income statements, (c) improve access to capital, (d) enhance treasury functions, (e) manage debt, and (f) transfer price. For more on the use of derivatives to manage portfolio risk, see Brown (1993).

Use of derivatives to speculate

Derivative instruments are used speculatively when they are bought and sold on a stand-alone basis—that is, their purchase or sale is not related to, or justified by, other asset holdings or liabilities. Speculators can play an important positive role in financial markets by absorbing risk, providing liquidity, facilitating capital flows, and reducing the price of risk. The role of the financial market regulator should be to ensure that such speculation takes place in an orderly framework, is supported by adequate capital, and is fully disclosed to internal management, stockholders, and the marketplace.

Use of derivatives to facilitate arbitrage

Price arbitrage arises when it is possible to buy and sell the same or a similar position in different markets or jurisdictions at a profit. The arbitrageur takes on offsetting risk exposures and so has little or no net risk. By facilitating arbitrage, derivatives help to ensure that all market exposures have the same market price in different markets and jurisdictions.

Uses of futures and forward contracts

Futures and forwards contracts can be used to meet a wide range of risk and portfolio management objectives. A future can be sold to hedge excess assets or bought to hedge excess liabilities or to gain market exposure until an outstanding premium is received or excess cash can be invested. Futures are useful where it is desirable to increase or decrease financial exposure to an asset, but there are cash-flow, liquidity, tax, market, or other reasons to defer the actual purchase or sale of the asset. Futures are useful as a substitute for asset transactions where regulatory, contractual, or other constraints

prevent an actual purchase or sale or where lack of expertise, lack of resources, or high transaction costs makes an actual transaction difficult.

Futures on bonds or money-market instruments can be bought and sold to increase or decrease portfolio duration. The shift in duration may reduce a duration gap between assets and liabilities or may achieve a shift in the gap consistent with the portfolio manager's views regarding interest rates. Futures can be used to support asset overlay and replication strategies and to hedge specific debt issues, liabilities, and assets. Futures provide a fast, efficient way for portfolio managers to implement investment strategies without affecting their portfolio. They can be used to rebalance relatively illiquid portfolios.

Use of bond futures to manage fixed-income portfolio duration

Consider a situation in which an insurer wishes to reduce interest rate exposure by selling a $10 million par value Canadian government bond (CGB) and holding cash. The bond meets the delivery requirements for the 10-year CGB futures contract. The Montreal Exchange has set a 1.04 conversion factor for this bond, which means that $100,000 par of this bond can be delivered to meet $104,000 of contract requirements or 1.04 contracts (contracts are in $100,000 units). Thus the $10 million of par value can be delivered to satisfy (10 million / 100,000) x 1.04 = 104 CGB futures contracts. The impact of the sale of 104 CGB futures on the company's interest rate sensitivity is identical to the impact of the sale of the $10 million of bonds, since no matter how interest rates change, the bonds can be delivered for a price fixed at the time of the sale of CGB futures.

The direct sale of a Canadian government bond is likely to be preferred to the sale of CGB futures. However, consider the situation where the unwanted interest rate exposure arises from an illiquid private placement that provides an attractive spread over government bonds. It may not be possible to sell the private placement, or the insurer may wish to keep the private placement because of the attractive spread over government bonds. Assuming that the private placement and government bond have similar terms to maturity, the undesired interest rate exposure created by the private placement can be eliminated by selling the same 104 CGB futures contracts.

Suppose the duration of a block of liabilities is seven years and the duration of the supporting asset portfolio is 6.5 years. The market value of both assets and liabilities is $1 billion. The insurer wishes to eliminate the duration gap and decides to do so by using the CGB bond futures contract. The duration and market value of one contract are six years and $105,000, respectively. The number of futures contracts that must be purchased in order to increase the duration of the combined asset portfolio and futures position to seven years, the same as that of the liabilities, equals (the required duration change divided by the duration of the futures contract) times (the market value of the portfolio divided by the market value of one futures contract) = (0.5 / 6) x (1 billion

/ 105,000) = 794 futures contracts. The increase (decrease) in value from a uniform decrease (increase) in interest rates on the 794 futures contracts when added to the increase (decrease) in value on the $1 billion of duration 6.5 assets equals the increase (decrease) in the value of the duration-seven liabilities.

Use of bond futures to hedge outstanding premiums and future debt issues against interest rate changes

Bond futures may be bought to hedge the interest rate risk associated with future premiums that will be received in an interest rate environment different from that in which the liability was priced and sold. If rates drop between the time the liability was priced or sold and the time the premium is received and invested in cash-market investments, the gains on the future position purchased at the time the liability was priced and sold will offset the lower rate earned on the cash-market investments purchased when the premium is received. If rates increase, then a loss will be incurred on the bond futures, representing an opportunity cost. The opportunity that has been forgone is the opportunity to benefit from investing the premium in the higher interest rate environment prevailing when the premium is received rather than the lower interest rate environment prevailing when the liability was priced and sold. This opportunity is forgone in order to avoid the risk of loss should interest rates decline, not rise.

Exercises

1. **Review the example in the previous section that explains how to calculate the number of CGB futures contracts to eliminate a duration gap. A liability with duration five today has been priced today at $50 million. The CGB that can be delivered to meet the requirements of one CGB futures contract has a duration today of six and a market value today of $105,000. Determine how many CGB contracts must be purchased to hedge the liability, until the outstanding premium is received.**

2. **An insurer wishes to issue $300 million of duration-eight debt at today's interest rates. However, the legal paperwork has not been executed, and so the debt cannot be issued for a few weeks. The insurer is concerned that market conditions will become much less favorable between today and when the debt is actually issued. Futures may be sold to hedge future debt issues against rises in interest rates. If rates rise, then the bond futures contracts sold will result in gains that offset the extra cost of issuing debt at the higher rates. If rates drop, a loss will be incurred on the bond futures, representing an opportunity cost—that is, the opportunity to benefit from issuing debt at lower rates is forgone. The CGB bond that can be delivered to meet the requirements of one CGB futures contract has a duration today of six and a market value today of $105,000. Determine how many CGB futures contracts must be sold to hedge the debt issue.**

Use of equity index futures to manage equity exposures

An insurer has a $10 million equity portfolio with a Beta of 1.1 relative to the equity index underlying an equity futures contract. The insurer feels that this portfolio is vulnerable to losses at present market levels. However, the insurer does not wish to sell the equity portfolio because it is an exceptionally good portfolio and the insurer intends to reinstate it once market levels have dropped to less "frothy" levels. In addition, selling the equity portfolio would realize gains or losses that have adverse tax or financial statement consequences. Moreover, the insurer finds futures more attractive than cash-market transactions, because the transaction costs of futures are lower (commissions on futures are lower than those in the cash market), and the futures strategy can be implemented and administered easily and rapidly and reversed easily and rapidly, whereas cash-market transactions are difficult and have to be implemented and reversed over an extended period of time.

The insurer can "hedge" the exposure of the equity portfolio against market declines by selling $11 million of equity index futures contracts. If equity markets decline as expected, the losses on the equity portfolio will be offset by the gains on the equity index futures contracts. The hedge has been established on the assumption that the equity portfolio will experience 110 percent (Beta 1.1) of the market value return on the equity index underlying the equity futures contract. The gains on the equity futures contracts will exceed (be less than) the losses on the equity portfolio if the equity portfolio experiences less than (more than) 110 percent of the decline in value of the equity index. Thus the effectiveness of the hedge depends on the correlation of returns between the equity portfolio of the insurer and the equity index underlying the equity futures contract sold to hedge the equity exposure.

If equity markets increase in value, then the insurer will experience gains on the equity portfolio and losses on the equity futures it sold. The hedge has been established on the assumption that the equity portfolio will experience 110 percent of the market value return that the equity index will experience. The losses on the equity futures contracts will exceed (be less than) the gains on the equity portfolio if the equity portfolio experiences less than (more than) 110 percent of the gain in the value of the equity index. Thus, once again, the effectiveness of the hedge depends on the correlation of returns between the equity portfolio of the insurer and the equity index underlying the equity futures contract sold to hedge the equity exposure.

Use of equity index futures to diversify equity exposures

An insurer is concerned about having all its $1 billion of equity investments in domestic stocks. The domestic stock market is relatively illiquid and constrains the company's exposure to a relatively small number of relatively small companies in a relatively small number of sectors. However, the insurer has no expertise in foreign equity investments. Moreover, developing the expertise to invest in individual foreign stocks or hiring an

external fund manager is prohibitively expensive. The insurer can more easily acquire the expertise needed to purchase exposure to foreign equities by indirect means through the use of a variety of foreign equity futures exchanges.

The insurer may wish its exposure to domestic equities to be 60 percent of the total equity exposure, with the balance of foreign equity exposure split 20 percent, 10 percent, and 10 percent among the U.S., U.K., and Japanese equity markets, respectively. To achieve this equity exposure without selling any of the existing domestic equities, the insurer could use futures exchanges to sell $400 million of equity futures contracts on a domestic equity index and purchase $200, $100, and $100 million of equity futures contracts on a U.S., U.K., and Japanese index, respectively.

Often a range of underlying equity indexes and a range of future maturity terms are available in each major country. The insurer can select between these different futures contracts based on the insurer's specific objectives as to type of equity exposure and length of equity exposure.

This particular use of futures contracts is likely to make sense only as a short-term strategy, since futures contracts have to be replaced on a regular basis as they mature, and this could prove both costly and difficult to administer over time. Equity swaps are likely to provide more effective longer-term strategies.

Use of futures to manage portfolio exposures to different asset classes

The asset mix of an insurer's $1 billion portfolio is 20 percent stock, 60 percent bonds, and 20 percent mortgages. The insurer wants to increase equity exposure to 25 percent and decrease bond exposure to 55 percent without disturbing the existing portfolio. The insurer may wish to leave the portfolio intact because the selection of bonds and stocks is particularly attractive, because the sale of assets would realize gains or losses that have adverse tax or financial statement consequences, because the costs of futures transactions are lower (commissions are lower on futures than on transactions in the cash market), or because the futures strategy can be implemented easily and rapidly, while a cash market strategy cannot.

In the cash market, $50 million of stocks would be purchased and $50 million of bonds sold. Equivalently, the insurer could purchase $50 million of stock index futures and sell $50 million of bond futures. The desired market exposure objectives are now met.

Uses of options to manage market risks

The use of options requires close monitoring of the impact of the passage of time and changes in price volatility on the option and any associated hedged or portfolio position. For more on the use of options to manage financial risk, see Boyle (1992).

Use of bond options to hedge against interest rate changes

To hedge a position against losses from an increase (decrease) in rates, an insurer could purchase a put (call) option on a bond of appropriate term. The put (call) option value increases with increases in rates above (below) the rate equivalent to the option strike price. These option gains hedge the losses on the position hedged.

Use of bond options to hedge convexity exposures

Typically, an insurer "sells" call options to borrowers, who have the right to prepay bonds, mortgages, mortgage-backed securities, collateralized mortgage obligations, and so forth. These sold call options mean that the asset duration will shorten relatively rapidly with a fall in rates, as prepayments are made early, and will lengthen relatively rapidly with a rise in rates, as prepayments drop below expected levels.

At the same time, an insurer typically sells options to policyholders, who have the right to make additional deposits that earn a guaranteed rate or to withdraw funds without a full market adjustment. These sold put options mean that the liability duration will lengthen relatively rapidly with a fall in rates, as policyholders make additional deposits that earn above-market rates, and decline rapidly with a rise in rates, as policyholders withdraw funds to take advantage of higher investment rates.

In combination, this means that, for a typical insurer, the liability value increases relatively more rapidly than the asset value when rates fall and the liability value decreases relatively less rapidly than the asset value when rates rise. The insurer is said to have a convexity mismatch that implies losses whether rates rise or fall. Bond call options can be purchased to mitigate the losses incurred when rates decline, and bond put options can be purchased to mitigate the losses when rates rise.

For any given rate decline, a bond call option can be purchased that will increase in value by an amount that, when added to the increase in value of the assets resulting from the rate decline, will equal the increase in value of the liabilities resulting from the rate decline. A series of call options would be required to protect against a range of interest rate declines. A call option could be purchased to protect against a 0.25 percent decline in rates, say. A second call option could be purchased, taking into account the change in value of the first call option, to protect against a 0.5 percent rate decline, and so on.

For any given rate increase, a bond put option can be purchased that will increase in value by an amount that, when added to the decrease in value of the assets resulting from the rate increase, will equal the decrease in value of the liabilities resulting from the rate increase. A series of put options would be required to protect against a range of interest rate increases. This series can be constructed in the same way as the series of call options just described, beginning with the put option required to protect against an increase of 0.25 percent and so on.

Use of stock options to hedge a stock portfolio

To hedge against a decline in value of a stock portfolio that is highly correlated with a stock index, put options can be bought on the index. If the index declines in value, falling below the put strike price, the put option will increase dollar for dollar in value. Assuming that the amount of puts purchased bought protection for the entire portfolio and that portfolio losses are no greater than losses on the index, the gains on the puts will cover the losses on the portfolio.

Use of option spreads to reduce costs and risk exposures

To reduce costs, the purchaser of a call (put) can simultaneously sell an otherwise identical call (put) with a strike price that is higher (lower) than the strike price of the purchased option. This combination of simultaneously purchasing and selling options is called an option spread. The premium received on the call (put) written reduces the premium paid for the call (put) that is purchased.

For example, a put on a stock with a strike price of $30 is purchased, and a put with a strike price of $28 is sold. If the stock price is above $30 at the strike date, both puts expire worthless. If the stock price is between $28 and $30 at expiry, the put option sold expires worthless, but the put option purchased has a value equal to the excess of $30 over the stock price (maximum $2). If the stock price is below $28 at expiry, then both options have value and spread has a net value of $2.

While option spreads can be used to manage risk exposures, supervisors and insurers should understand that the protection provided might be very limited. If the insurer owns the stock and purchases the option spread just described to protect against stock losses, the protection purchased has a maximum value of only $2. The insurer has no protection for losses arising from declines in the stock below $28. Nonetheless, the protection provided can be precisely what is desired, if the equity analyst believes that the stock is likely to decline in value below $30 but that the likelihood of a decline below $28 is remote. While the equity analyst could simply sell the stock, the analyst may not wish to do so, because the analyst also believes that there is a strong likelihood that the stock will increase in value above $30. Such a view could arise if there were short-term uncertainty about some pending outcome. If the outcome is unfavorable, a modest decline in the stock value is expected. If the outcome is favorable, however, a strong rebound in value is expected.

Use of collars to reduce costs and risk exposures

To reduce costs, the purchaser of a put (call) can simultaneously sell a call (put) with the same notional amount, maturity date, underlying asset, or reference rate, but with a

higher strike price. The combined option position is referred to as a collar. If the strike prices are chosen so that the premium received on the call (put) that is sold equals the premium paid on the put (call) purchased, the collar is said to be "costless," since no net premium is paid.

An insurer feels that a particular stock or index is vulnerable to losses at current market levels of $29 or an equity index of 10,000, say. The insurer wishes to be protected from losses should the stock price or equity index drop significantly. The insurer is willing to forgo gains on the stock or index above a certain price or level, since the insurer expects the stock or index to drop in value. A collar allows the insurer to trade the upside gains on the stock or index above a certain price or level for downside protection below a certain price or level.

A put on a specific stock with a strike price of $28 is purchased, while a call with the same nominal amount and date of maturity on the same stock is sold with a strike price of $30. If the stock price on the strike date is below $28, the put pays the excess of $28 over the stock price and the call expires worthless. Thus the collar protects the insurer against declines in the stock price below $28. If the stock price on the strike date is between $28 and $30, both options expire worthless. If the stock price at expiry is above $30, the put expires worthless, and the insurer must pay the excess of the stock price over $30 to the purchaser of the call. Thus the collar means that the insurer forgoes any upside gain on the stock above $30.

Use of caps and floors to hedge interest rate guarantees

Options can be bundled together to form caps and floors. Caps and floors specify an amount of notional principle and a strike rate. If the index rate exceeds (is below) the strike rate on a reset date, the cap (floor) seller pays the purchaser an amount based on the product of the amount of notional principal, the difference in the rates, and the fraction of year since the previous reset date.

A floor protects floating-rate assets and fixed-rate liabilities from a drop in rates. A minimum rate guarantee in an insurance product is a "floor" that the insurer has embedded in its insurance product and sold to a client. The assets supporting a product may be unable to support fully the minimum rate if interest rates drop sufficiently. A floor can be purchased to cover some or all of the losses the insurer might incur from a drop in interest rates. Conversely, assets supporting a portfolio-rate product may be unable to support a competitive rate if interest rates rise sharply. A cap can be purchased to provide interest rate support.

Uses of interest rate swaps to manage interest rate exposures

Interest rate swaps can be used for a wide range of risk management and business purposes: (a) to increase or decrease interest rate exposures, (b) to hedge specific balance-sheet assets and liabilities, (c) to expand investment and marketing opportunities, and (d) to manage an asset portfolio.

Use of interest rate swaps to manage duration gaps

Interest rate swaps can be used to achieve virtually any interest rate management objective that can be achieved through the direct sale and purchase of assets. A common use of interest rate swaps is to manage the duration gap between a block of insurance liabilities and the supporting portfolio of assets, without directly buying or selling assets. The duration gap is the difference between the duration of the liabilities and the duration of the supporting assets.

The illiquidity of existing assets or market conditions may prevent the sale and purchase of sufficient, suitable assets to implement the desired interest rate risk management objective in a cost-effective and timely manner. Selling bonds may interfere with portfolio or trading strategies and may conflict with asset mix and other investment policy, risk, and cash management objectives. Selling may cause the loss of credit spreads on attractive assets. Finally, the realization of capital gains or losses on bond sales may have adverse tax or financial reporting impacts.

The following example explains how the purchase of a five-year interest rate swap achieves the same interest rate risk management objective as is achieved by selling five-year fixed-rate bonds and holding T-bills.

Suppose it is desirable to reduce interest rate exposure by selling $10 million of five-year 8 percent fixed bonds and purchasing $10 million of three-month T-bills. Instead of selling the bonds, a five-year interest rate swap can be purchased to pay a fixed rate of 7.5 percent for five years in exchange for the receipt of a three-month T-bill rate that is reset every three months. The net cash flow resulting from the sale of $10 million of five-year fixed-rate bonds with a coupon of 8 percent and the purchase of $10 million of three-month government T-bills is identical to that resulting from the purchase of a $10 million five-year interest rate swap to pay 8 percent and receive the three-month T-bill rate. Since the cash flows are the same in all situations, the interest rate impact of selling the fixed-rate bonds and purchasing the T-bills is identical to that of purchasing the five-year interest rate swap. If the five-year fixed-rate swap is 7.5 percent instead of 8 percent, then the undesired interest rate exposure to five-year rates can be eliminated by the swap strategy, and a 0.5 percent yield pickup can be achieved at the same time.

Suppose you are a portfolio manager who wants to sell $10 million of five-year bonds and hold cash in anticipation of rising interest rates. However, other investment, risk, tax, and financial statement objectives or market conditions make the sale unde-

sirable. A $10 million five-year interest rate swap to pay fixed and receive floating rates reduces the portfolio exposure to rising rates to the same extent as the proposed bond sale. If rates rise as anticipated, the unrealized capital loss on the $10 million five-year bond that was not sold as a result of this rise will be offset by the unrealized gain on the interest rate swap. An offsetting swap can be entered into once a neutral interest rate outlook has been adopted.

Similarly, a portfolio manager could develop a strategy using interest rate swaps that would enable the insurer to benefit from anticipated declines in interest rates without having to buy any assets directly.

Use of interest rate swaps to hedge specific liabilities

Assume that an insurer sells $50 million of five-year-term 7.5 percent GICs to its customers on May 28th. The 7.5 percent rate assumes that the insurer will invest the $50 million of GIC deposits in mortgages on May 28th at 9.5 percent. However, no mortgages are available until August 28th, when five-year mortgages yield 9 percent. If the GICs are not hedged, there is a 0.5 percent yield shortfall on $50 million due to the 0.5 percent decline in the mortgage rate.

The $50 million of 7.5 percent GICs can be hedged on May 28th by purchasing a $50 million five-year swap to receive a fixed rate of 8.25 percent and pay the three-month T-bill rate and by purchasing $50 million of three-month T-bills. When the $50 million of five-year mortgages are purchased on August 28th, a $50 million five-year swap to pay a fixed rate and receive a three-month T-bill rate is purchased to offset the May 28th swap.

The T-bill-rate sides of the two five-year swaps net to zero. If the fixed five-year swap rate on August 28th is 7.75 percent, fixed five-year swap rates will have moved in lockstep with five-year mortgage rates, since rates on both dropped 0.5 percent. The fixed-rate sides of the swaps combine to produce a net payment to the insurer of 0.5 percent (the net of receiving 8.25 percent on the first swap and paying 7.75 percent on the second swap). When this 0.5 percent is added to the 9 percent mortgage rate, a fixed rate of 9.50 percent is achieved over five years, as required to support the 7.5 percent GIC rate. Thus there is no yield shortfall.

There is no guarantee that fixed five-year swap rates will change in lockstep with five-year mortgage rates. Consequently, the hedge is not perfect and is subject to what is called basis risk. If fixed-swap rates on August 28th decreased by only 0.4 percent—to 7.85 percent—the net spread received on the two swaps is only 0.4 percent. Since mortgage rates dropped by 0.5 percent, the hedging strategy produces a 9.4 percent rate and a 0.1 percent shortfall.

There is a loss of spread for three months between May 28th and August 28th between the 9.5 percent mortgage rate needed to support the 7.5 percent GIC rate and the 8.25 percent fixed swap rate. When this 1.25 percent yield shortfall is spread over five

years, the resulting average shortfall is 0.0625 percent. If some loss is expected on May 28th, the GIC rate should be reduced accordingly.

Use of interest rate swaps to hedge specific assets

Assume that $50 million of five-year mortgages are purchased on May 28th at 9.50 percent to support the sale on May 28th of five-year GICs at 7.5 percent. However, suppose no GIC sales are made until August 28th, when $50 million of five-year GICs are sold. Competitive pricing pressures dictate that GIC pricing on August 28th will be based on the 10 percent five-year mortgage rate on August 28th. If the assets purchased on May 28th are not hedged, there will be a 0.5 percent yield shortfall.

Review the swap strategy used to "hedge" the specific liability and develop a strategy to "hedge" the May 28th asset purchase that eliminates the 0.5 percent yield shortfall, assuming that fixed five-year swap rates increase by the same 0.5 percent as the mortgage rates between May 28th and August 28th.

Suppose that an attractive $10 million five-year 8 percent bond can be purchased, but it is not appropriate to do so from the perspective of portfolio risk management, because its purchase increases the duration gap and reduces cash to an unacceptable level. Develop a swap strategy that allows for the bond purchase without increasing the duration gap or reducing the cash holding.

Suppose that a client wants a seven-year GIC, but only five-year assets are available. A seven-year swap to receive fixed and pay floating rates combined with a five-year swap to pay fixed and receive floating rates effectively eliminates the interest rate risk arising from the two-year mismatch between the seven-year GIC and the five-year asset. Develop an example that uses interest rate swaps to eliminate the interest rate risk, where the liability term is shorter than the assets.

Use of credit derivatives to hedge credit exposures

Suppose A has excessive credit exposure to a specific corporation or sector, C. A can eliminate the excessive exposure to C by entering into a credit default swap and can reduce or eliminate the credit exposure created by a specific portfolio of assets by entering into a total-return swap.

Use of securitizations to hedge "negative convexity"

Securitizations are used to source funds and to mitigate liquidity, credit, interest rate, concentration, and other risks. They are often more efficient and profitable than strategies involving the direct purchase and sale of assets.

Securitizations may involve assets, such as residential mortgages, which can be paid early with little penalty. As rates drop, the economic incentive to prepay (refinance) increases, and as rates rise, the incentive decreases. The former is prepayment risk, and the latter is extension risk. Both risks can produce material financial loss—far exceeding that on a noncallable bond with the same initial duration. Prepayment and extension risk can be difficult to analyze, since both depend on the dynamic interaction of the behavior of the borrower, the investor, and the mortgage broker, the circumstances of the borrower, and interest rates.

Investments whose duration increases (decreases) with a decrease (increase) in interest rates have positive convexity; those whose duration decreases (increases) with a decrease (increase) in interest rates have negative convexity. Investments with fixed cash flows that do not vary with interest rates, such as noncallable bonds, have positive convexity, since the present value of cash flows increases (decreases) with decreases (increases) in interest rates. Investments, such as callable bonds and mortgage-backed securities, in which cash flows vary with changes in interest rates can have either positive or negative convexity. If decreases (increases) in interest rates increase the likelihood that cash is paid later (earlier), as with callable bonds, cash-flow variability causes even greater positive convexity than investments with fixed cash flows. If decreases (increases) in interest rates increase the likelihood that cash is paid earlier (later), as with mortgage-backed securities, cash-flow variability can cause negative convexity. As interest rates drop, mortgages are refinanced to take advantage of lower rates, and securitized mortgage cash flows are paid earlier than they would have been if rates had not dropped.

The embedded guarantees of insurance company liabilities cause these liabilities to have negative convexity. For example, policyholders tend to surrender polices earlier when rates increase in order to invest at higher rates. However, they tend to hold onto policies longer when rates decrease in order to take advantage of higher rates guaranteed in their policies. Mortgage-backed securities can reduce the convexity mismatch that often exists between life insurance company assets and liabilities and thereby reduce insurance company interest rate risk.

Uses of structured (hybrid) investments

A bond with an embedded call on a stock index (equity-linked note) can preserve the upside exposure to stocks, while reducing the downside exposure compared to direct stock investments. The transaction cost and the cost for protection from the downside exposure to stocks are paid for by the call option premium, which is reflected in a lower coupon on the bond or through less than 100 percent participation in the upside. If an AA-rated dealer issues the bond, the risk exposure is that of an AA credit rather than that of stock.

Exercises

3. **Why are derivatives cost-effective?**
4. **How can derivatives diversify risk?**
5. **How do derivatives enhance market liquidity?**
6. **Explain the difference between hedging, risk management, speculation, and arbitraging. Why are these differences important to the supervisor?**
7. **List some of the objectives that can be achieved using derivatives.**
8. **List some of the uses of futures and forward contracts.**
9. **Describe how bond options can be used to mitigate losses from interest rate changes.**
10. **What features of insurer assets and liabilities are effectively embedded options sold by the insurer? What risk of loss do they bring, and how can options be used to manage this risk?**
11. **List some of the uses of interest rate swaps.**

B. Measurement and management of derivative credit and market risk exposures

This section explains the critical risk measurement, management, and mitigation techniques and concepts that insurance supervisors need to understand. It introduces the standard measures of transaction volume and credit risk exposure for derivatives and explains why potential exposure to credit risk and payment and closeout netting are critical to measuring derivative credit risk. It explains why sophisticated measures of potential credit risk exposures, such as those provided by Monte Carlo simulations, are necessary to measure credit risk exposures for insurers that use derivatives extensively. At the end of the section, you will understand how credit risk differs among different types of derivatives and how derivative credit exposures can be managed. You will appreciate some limitations of the "value-at-risk" measure of market risk and some reasons why stress testing and other techniques are a necessary complement.

Measures of derivative transaction volume and derivative credit and market risk exposures

The size of derivative markets or an insurer's derivative exposures are frequently expressed in terms of the dollar amount of the underlying asset or index to which the derivative is linked (the face amount, contract amount, or amount of notional principal). Face amount measures transaction volume, not credit or market risk.

The risks of derivatives are linked directly to the size and price volatility of the cash flows that the derivatives occasion and only indirectly to the face amount of the underlying asset or index. Risk of loss varies considerably across the range of derivative products for the same face amount. Derivative risks are frequently offsetting, a consideration that measures of face amount do not capture.

Credit risk and gross replacement cost

Gross replacement cost (calculated by marking the derivative contract to market) is a commonly reported measure of risk exposure. It is the amount that would need to be paid to replace the existing contract with an identical new contract. Gross replacement cost measures current credit exposure, since, should the counterparty default, the insurer can be made whole by incurring this replacement cost. If the derivative has negative replacement value, there is no current counterparty risk.

Gross replacement cost can, by itself, be a highly misleading measure of credit and market risks. It can give an excessive indication of risk in that it does not reflect netting arrangements with counterparties or the fact that not all counterparties will default at the same time and that there are likely to be recoveries in the event of default. It does not take account of different probabilities of default across counterparties, since an ac-

tual loss depends on the financial distress of the counterparty. Measures of potential credit loss should be combined with information on the quality of counterparty credit to measure credit risk. Gross replacement cost also does not take account of credit-enhancing features, which should be reflected in measures of derivative credit risk if they are legally enforceable. It can give an insufficient indication of risk in that the potential for future losses is not considered and may be material.

Measurement of potential credit risk using the BIS credit risk equivalent amount

The current market value of cash-market investments gives a reasonable indication of the potential credit loss that could result from owning them. Interests do affect the market value of fixed-income investments, there can be a material accrual of interest income on zero-coupon bonds, and the change in the market value of equity-type investments can be material. All these considerations mean that the future credit loss exposure of cash-market investments can differ from the current credit loss exposure. However, consideration of potential credit losses on cash-market investments is usually neither critical nor difficult.

Potential credit risk is a fundamental concern for derivatives, and current replacement cost gives little or no indication of potential credit exposure. A negative or small replacement cost indicates nothing about potential credit risk, since the underlying asset or index value can shift unexpectedly.

For this reason, the Bank for International Settlements (BIS) established a measure for potential derivative credit exposure that is used in setting bank capital requirements. The BIS credit risk measure adds to the current replacement cost an "add-on amount" designed to measure the potential credit exposure over the remaining life of the contract. The add-on amount is calculated by multiplying the amount of notional principal by the appropriate add-on factor (see table 1).

Table 1. BIS Add-on Factors

Residual maturity	*Interest rate*	*Exchange rate and gold*	*Equity*	*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	0.5	5.0	8.0	7.0	12.0
Over five years	1.5	7.5	10.0	8.0	15.0

The BIS measure is a relatively crude measure of credit and market risk, since it measures relative differences in price volatilities of the underlying asset or index to only a limited degree. The Basel II Capital Accord acknowledges the fundamental limitations of simple formulaic measures of risk by encouraging the use of model-based capital measures. Only sophisticated stochastic models can capture the full range of potential price fluctuations by projecting derivative cash flows over their lifetimes.

Insurance supervisors should be concerned about insurers that use derivatives extensively and rely on BIS or other formulaic measures of risk or rely on counterparties to measure risk. ICP 22, essential criterion g, states, "The supervisory authority requires that insurers have in place personnel with appropriate skills to vet models used by the front office and to price the instruments used and that pricing follows market convention."

Better measures of potential credit and market risk involve stochastic models or Monte Carlo simulations to determine—say, at the 99.5 percent confidence level—the largest derivative replacement cost over the remaining time to maturity of the contract. Option valuation models can also be used to assess potential credit and market risk. For more on measuring credit risk for swaps, see Bollier and Sorensen (1994); Simons (1989).

Managing derivative credit risk exposure

Supervisors should ensure that insurers manage their derivative credit exposures consistently with how they manage their cash-market credit exposures. Specifically, the credit decision process, procedures, controls, limits, review, and reports for derivatives should be both consistent and integrated with those for cash-market investments. Supervisors need to be satisfied that insurers understand and use effectively the risk management techniques discussed in this section.

Concentration by counterparty should be monitored carefully and limited to maximum counterparty exposures, with respect to both current and potential credit exposure. Steps should be taken to diversify away from any concentration. However, doing more transactions with the same counterparty can actually reduce derivative counterparty exposure. For example, an insurer might enter into an interest rate swap to receive fixed payments from a counterparty with a large potential exposure to a decrease in rates. This choice would actually reduce the potential exposure to this counterparty from a drop in rates.

Potential credit exposure increases with the remaining term of the exposure, both because the counterparty has a longer time to get into trouble and the derivative replacement cost has a longer time to grow. Thus more restrictive limits and controls might be considered for longer-term derivatives.

A range of credit-enhancing features can be built into derivative contracts. Credit exposure can be reduced by the use of good-quality, liquid collateral. Collateral could be required to cover all credit exposures or those credit exposures over a certain minimum amount. Use of collateral could increase with counterparty credit-rating downgrades.

An amount equal to the change in market value (replacement cost) might be required to be paid at regular intervals, possibly daily, or if the change in market value exceeds some specific amount.

The contract could be terminated automatically, with payment of replacement cost, in the event of a credit downgrade or default on any debt obligation of the counterparty.

A parent or third party with a strong credit rating could guarantee the contract, or a letter of credit could be provided. Special-purpose vehicles have been developed to provide credit enhancements and reassurance as to a high level of management and financial controls and expertise.

Separating the trading and credit risk assessment functions is critical for all market makers, since traders typically are motivated to do more and more transactions with each counterparty and to do transactions with all counterparties regardless of credit rating. While it makes sense to separate these functions, end users typically do not have to be concerned with keeping traders in check. End users can create a diversified list of well-known, highly rated (a financial rating of A or better), approved counterparties, known to have a high level of financial and operational controls and expertise. Derivative transactions with counterparties that are not on the approved list would be prohibited.

Managing market risk

Limits should be established for the acceptable range of net market risks. Limits on net market risk and individual transactions should be consistent with the maximum board-approved capital that can be put at risk. For end users, the limits on transactions should be consistent with the limits on market exposure established for cash-market investments.

Market makers manage derivative market risks by managing the net current and potential market risk exposures on a consolidated basis across the entire enterprise on a real-time or close to real-time basis. The management of net market risk for market makers should be independent from the approval of individual transactions. In contrast, end users manage market risk in the context of their total exposures to asset and liability market risk. Measuring derivative market risk on a real-time, but stand-alone, basis across the enterprise has little value for the derivative risk management of the end user.

Value at risk

Value at risk (VAR) is a widely used measure of market risk that relies on stochastic modeling techniques to measure aggregate risk exposures in dollar terms across all market risks and across both sides of the balance sheet on the basis of net exposure. VAR can be used as a measure of the net market risk exposure of the derivative portfolios of market makers, where these portfolios are considered on a stand-alone basis. It can also be used as a measure of the net market risk exposures of derivative portfolios together with the asset and liability portfolios they are used to manage. VAR is the expected loss from adverse market movement with a specified probability (confidence interval of, say, 99.5 percent) over a particular period of time (say, one year).

While there is general agreement that VAR is an excellent single measure of market risk exposure, there is less agreement on the precise details of how it should be calculated. VAR depends on the confidence level, the time horizon, the economic scenario generator (ESG), the ESG parameter values, the correlations assumed between different risks and within each risk, and the assumptions and methodology used to model and project cash flows in each economic scenario. Modelers must make critical assumptions about policyholder behavior and future management actions for which there is limited or no empirical evidence. Modelers make critical simplifying assumptions relating to the grouping of data or the use of lapse, expense, renewal, and cancellation assumptions that are deterministic, even though they are known to be dynamic and so on.

A time horizon of one day, or the length of time needed to unwind a position, may be best for day-to-day risk management, and a one-year horizon may be best for decisions regarding capital allocation and strategy. However, insurance supervisors should recognize that one-year horizons may be far too short to adequately measure the risk of insolvency for insurers with material embedded options and guarantees that create risk exposures extending over 50 years or more.

To eliminate a wide range of practice from company to company, to ensure comparability of VAR across companies, and to ensure minimum levels of rigor in the calculation, supervisory authorities could stipulate that the VAR must be calculated in a standardized way.

One limitation of VAR as a universally adequate measure of market risk exposure arises because it provides only a snapshot of the entire risk profile provided by the distribution. VAR does not measure the extent of losses from extreme events beyond the percentile chosen for the calculation.

Price changes that are highly improbable according to the stochastic processes typically used in VAR analyses have occurred with unsettling frequency. This may indicate that the wrong stochastic process is being used. Perhaps a stochastic process with much "fatter tails" is required to model the risk exposures being measured.

The relatively frequent occurrence of extreme events may also indicate that the experience being used to calibrate the model is too tame. The experience used to calibrate pricing models, which is universally used in VAR calculations, is typically restricted to

fairly recent market experience. Extreme price fluctuations and market discontinuities that have not occurred recently have little impact on market prices and can be safely ignored if pricing is the purpose of the exercise. Getting things right "in the tail" is simply not that important for pricing. However, it is precisely these extreme conditions that must be got right in order to measure the extent of losses that can be expected under extreme conditions.

Sometimes, extreme price shifts result from unanticipated geopolitical, political, trade, fiscal, or other economic developments, or they may simply be unexplained. Whatever the cause, sudden price changes can produce unacceptably large losses, even though VAR analysis gives no hint of this.

This limitation of VAR is compounded for insurance risk exposures that can persist for decades. An event that is extremely unlikely over a one-year horizon may well evolve over the course of many years as the environment in which markets operate undergoes fundamental and pervasive change.

For this reason, VAR measures are often supplemented with stress tests that use price changes that are more extreme than allowed for by the VAR measure. Also, tests over longer horizons than one year, and perhaps over the entire remaining lifetime of the liability portfolio, may be examined.

VAR models can be extended theoretically beyond interest, equity, and currency risk to real estate, credit, insurance, and other risks. Whether these extensions are well founded in practice is not entirely clear. One can make assumptions on a "best-efforts basis" about how these risks behave and interact, but the result may not be entirely reliable.

VAR models typically deal with correlations across different market risks and within each market risk in a simple way. For example, correlations are often measured based on relationships between the variables that have been experienced under all types of circumstances, rather than under extreme circumstances. This is very understandable, since the number of extreme circumstances is limited by definition. Nonetheless, the relationship between interest rates and equity returns, for example, may vary between "normal" conditions and "abnormal" conditions. If one is trying to measure what will happen under abnormal conditions—say, at the 99.5 percentile—it is not entirely clear that the "average relationship" between variables should be used to do the modeling. Approaches using copulas (a mathematical technique that is beyond the scope of this module) are being developed to adjust for this possibility, and these approaches can produce much higher measures of potential loss than are produced by the traditional VAR measure.

Exercises

12. **Explain the notional amount of a derivative and why it is a poor measure of risk exposure.**
13. **What is gross replacement cost, and why is it a poor measure of credit risk exposure?**
14. **What are some of the ways in which insurers can manage derivative credit risk?**
15. **What is value at risk (VAR)?**
16. **What are some of the limitations of VAR?**
17. **How might some of the limitations of VAR be addressed?**

C. A prudent derivative risk management framework for insurers

This section explains why and how insurance supervisors should be concerned about derivatives. While derivatives typically require little or no initial outlay of cash, may involve little initial risk of loss, and may appear harmless to the novice, they can cause huge financial losses.

Without controls and a prudential risk management framework, derivatives are a recipe for disaster, and the correct supervisory response is to prohibit or severely restrict their use. The section illustrates this point by referring to some large derivative losses suffered by a wide range of financial institutions, companies, and nonprofit and government agencies.

It would be useful to review the Barings derivative disaster or some similar case in detail, to summarize what went wrong, and to identify what steps companies and supervisors did take, and should take, to prevent another such disaster.

Supervisors must go beyond merely prohibiting the use of derivatives to confirming that the elements of prudential risk management govern the derivative activity of insurers. More often than not, actual derivative disasters happen not because companies deliberately set out to speculate, but because they speculate without knowing it.

The section explains the essential elements of prudent derivative risk management and control in the context of six lessons learned from the failures of prudence. The essential elements of prudential derivative risk management include the following:

- Controls, independent audit, compliance, and fraud prevention procedures
- Clear decision processes and accountabilities
- Active oversight of derivative activity by the board and senior management
- Procedures to ensure suitability and fit with bona fide insurance or risk management objectives
- Necessary expertise to transact, model, value, audit, supervise, and report on derivatives
- Reliable systems and models
- Sound and comprehensive derivative reports and accounts
- Documented derivative risk management policies and procedures
- Sound and timely risk measurement and valuation practices.

It does little good to have extensive documentation, policies, and procedures for managing derivative risk if employees are not familiar with the documentation and if they do not follow the policies and procedures. It does little good to have reports on the use of derivatives if the information in these reports is inappropriate, inaccurate, fraudulent, or not understood. It does little good to have sophisticated systems for monitoring and measuring derivative risk exposures if the derivatives are not suitable or if potential risk exposures are not understood.

The supervisor should therefore form an overall impression of the following:

- Whether the company is in complete control of its derivative operations
- Whether derivatives are well understood by those responsible for approving, managing, and monitoring them
- Whether the board and senior management are actively involved in overseeing derivative procedures, policies, and practices.

Doubts on any of these fundamentals must be actively investigated.
After completing this section, you will understand the following:

- All elements of the prudential derivative risk management framework must be in place and well coordinated if derivative risk exposures are to be managed effectively.
- Prudent derivative best practices will vary from insurer to insurer, depending on the range and complexity of derivative products and strategies employed and the frequency, volume, and objectives of their usage.
- The board and senior management must be actively involved with derivative risk management.
- Permitted derivative strategies and usage must be tightly constrained to ensure that derivative transactions are always suitable.
- Prudential derivative risk management is tied to and integrated with prudential risk management of cash-market investments.
- The prudent credit, market, and other risk management practices and policies of end users differ from those of market makers.

The risks of derivatives

In October 1993, Peter Baring, chairman of Baring Brothers, said, "Derivatives need to be well controlled and understood, but we believe we do that here." In February 1995, Barings was declared insolvent after Nick Leeson lost $1.36 billion on derivative speculation. The bankruptcy of this staid old British bank was brought about by the abuse of derivatives by a single employee and dramatically demonstrates why insurance supervisors must be concerned with derivatives.

The Barings derivative loss is far from unique. There have been a long string of large derivative losses across almost every type of financial institution, company, nonprofit, and government organization since the early 1990s. In some cases, bankruptcy ensued, while in others, share prices, public service, or benefits were curtailed. Often financial and other repercussions spread to many other companies and institutions. In at least one case, the collapse of a large hedge fund (Long Term Capital Management) put the entire financial system into crisis. These losses leave no doubt that misuse of derivatives can cause substantial financial loss and bankruptcy and therefore must be a concern to insurance regulators.

A list of notorious cases of derivatives losses since the early 1990s provides a good place to start for additional reading and illustrates just how frequent and widespread the range of derivative losses can be. The following organizations all experienced losses from derivatives:

- Allied Lyons, £147 million
- Boatman's National Bank, $20 million
- Gibson Greetings Inc., $20 million
- Harris Trust Bank, $51 million
- Dell Computer, $53 million
- Investors Equity Life Insurance Company (Hawaii), $80 million
- Yamichi Securities Company, $90 million
- Nippon Steel, $128 million
- Mellon Bank Corporation, $130 million
- Proctor and Gamble, $157 million
- Codelco (Chile), $200 million
- PaineWebber, $268 million
- Kidder, Peabody, and Company, $430 million
- Saloman Inc., $556 million
- Metallgesellschaft, $1.4 billion
- Showa Shell Sekiyu, $1.5 billion
- Orange County, California, $1.7 billion.

Detailed review of these derivative losses is highly instructive, but beyond the scope of this module. You are encouraged to investigate some of them to better understand the serious impact that these losses had on the organizations, how these losses came about, the patterns of risk management failures to look for in insurers that you supervise, and the steps that these organizations and supervisory authorities can take to prevent reoccurrences.

Six lessons to be learned from derivative losses

The losses listed at the start of this section make an eloquent case for why insurance supervisors must be concerned about the use of derivatives by insurers. But effective supervision requires that supervisors go beyond blind concern to an understanding of what specific practices and abuses lead to losses and what practices constitute good derivative risk management. The potential dangers of derivatives can be held in check through a combination of enlightened and effective legislation, regulation, and accounting standards; strong risk management controls and policies; and active board and senior management oversight. For regulatory approaches to risk management for

derivatives, see Bank of England, Derivatives Working Group (1993); Basel Committee on Banking Supervision (1994); U.S. Office Controller of the Currency (1993).

The primary danger arising from the use of derivatives lies with poor controls and risk management practices, not derivatives themselves. Therefore, if the expertise within a jurisdiction or a particular insurer is inadequate to provide for proper controls and effective risk management, the supervisory authority may need to restrict the use of derivatives significantly.

The first lesson to be learned from a review of the factors that have led to derivative losses is the critical importance of controls and processes for prudent derivative risk management. While derivatives do not introduce risks of a fundamentally different kind from those present in cash markets, they can be used to leverage risk in ways that make their control more difficult than the control of cash-market investments. Derivatives are dangerous in the same way that fire and creativity are dangerous. They can be used prudently to manage risk, or they can be used imprudently to leverage risk. Derivative controls and processes are needed to prevent imprudent leveraging of risk.

The second lesson is the critical importance of ensuring compliance with derivative policies and the accuracy of reports and financial accounts used to monitor, quantify, and report on derivative activities. Derivative policies and practices should be designed to ensure compliance and audited to confirm compliance and the accuracy and reliability of reports and financial accounts.

The third lesson is that most big failures happened not because companies decided to speculate or take high-risk positions, but because they speculated and took high-risk positions without knowing they were doing so. Clearly, supervisory authorities cannot simply restrict derivative activity to hedging on the grounds that all hedging activity is prudent. Sound supervision requires supervisors to confirm that insurers are following prudent derivative risk management practices.

The fourth lesson to be learned is that active oversight of the board and senior management of the policies, risk management, measurement, monitoring, reporting, and control procedures for derivatives is fundamental to prudent derivative risk management. Lack of understanding at the top is a recipe for disaster and should alarm the supervisor. The concern is that derivative activity is reported to, and approved by, senior managers and the board, but they do not understand what is reported. They simply rely on assurances that positions are "hedged" and transactions are "safe."

A fifth lesson is that suitability of a derivative must be central to end-user risk management. The counterpart to this lesson is "buyer beware." Supervisors should be aware that unscrupulous derivative traders are on the lookout for unsophisticated investors who will buy complex and high-risk derivative products without really understanding them. Insurers should not rely on dealer stories about the low risk of complex derivatives in recent circumstances and normal markets. Supervisory authorities should require insurers to have the expertise to analyze, evaluate, understand, and monitor derivatives and to explain the suitability and purpose of all derivative activity. Insurers'

policies should make clear what types of derivatives, strategies, and limits are permitted. Authorization processes should be designed to ensure suitability.

The sixth lesson to be learned is that greed and hubris at both the individual and firm level can fuel excessive risk taking and can block effective action to deal with known risk and control problems. The supervisor should be concerned if greed and hubris are intrinsic to a corporation's culture. They should be concerned about the possibility that troubled insurers are purchasing derivative products designed to disguise the real financial status of the company by distorting the balance-sheet and income statements and cash flows. Enron, the second largest corporate bankruptcy in history, is a dramatic example, but there are many others. If derivative disasters are to be avoided, compensation, control, audit, and prudent risk management policies and practices must take precedence over greed and hubris.

Controls and processes

ICP 22, essential criterion f, says, "The supervisory authority requires that insurers have in place adequate internal controls to ensure that derivatives activities are properly overseen and that transactions have been entered into only in accordance with the insurer's approved polices and procedures and legal and regulatory requirements."

Controls and processes must be put in place that are similar to those for cash-market transactions, but also prevent the "leveraging" of risk by means of derivatives. It is the leveraging of risk that makes derivatives of special concern for insurance supervisors. By means of derivatives, employees can enter into transactions that have huge financial implications for their employer, and they can do so with the outlay of little or no cash. The potential for huge derivative losses may not be apparent, since the immediate financial consequences are small or favorable, and the potential for huge losses may appear to be too remote for careful analysis and quantification.

Senior management should articulate, and the board should approve, derivative policies consistent with regulations and the insurer's overall appetite for risk and framework for capital and risk management. They should designate clear accountabilities for recommending, approving, and executing derivative transactions, quantifying and reporting derivative activity and risk exposures, and managing overall derivative risk exposure, control and audit procedures, and review processes. Those who recommend, approve, and execute derivative transactions should be independent from those who settle and do accounting entries and those who vet models and price derivatives (ICP 22, essential criteria f and g).

Controls and processes should be in place to ensure that derivative activity and practices comply with the company's policies and accountabilities. Controls and processes should be in place to monitor derivative activity and to prevent and quickly detect unauthorized transactions. Controls, procedures, and accountabilities for recommendation and approval should be in place to ensure that derivatives are not implemented

before completing a thorough review of the legal, regulatory, accounting, tax, and system implications and before confirming compliance.

Documented settlement and accounting controls, procedures, and accountabilities should be in place to ensure timely and accurate recording of trades, and cross-checking of the terms and conditions of the contracts with the terms and conditions agreed to by the trader and entered into the system. Accounting entries should provide a sufficient record and audit trail. Controls and procedures should be in place to safeguard derivative contracts and addenda.

Risk monitoring and reporting must quantify derivative risk exposures and positions in a timely, meaningful, and accurate fashion. The monitoring and reporting requirements will vary greatly with the volume, frequency, purpose, and variety of derivative transactions. For example, an end user whose usage is low volume and limited to standard types of products will have much more modest requirements than those of a market maker. ICP 22, essential criterion e, requires insurers to "have in place risk management systems, covering the risks from derivatives activities to ensure that the risks arising from all derivative transactions undertaken by the insurer can be analyzed and monitored individually and in aggregate and monitored and managed in an integrated manner with similar risks arising from nonderivatives so that exposures can be assessed regularly on a consolidated basis."

Compliance and audit

ICP 22, essential criterion i, says, "The supervisory authority requires that insurers have in place rigorous audit procedures that include coverage of their derivatives activities to ensure the timely identification of internal control weaknesses and operating system deficiencies. If the audit is performed internally, it should be independent of the function being reviewed."

Reports should be provided to senior management that quantify risk exposures and confirm compliance with policies, procedures, and practices. Those accountable for different functions should provide regular, written confirmation of compliance. Audits should be performed that confirm compliance with the company's risk management policies, accountabilities, and practices and the accuracy, timeliness, and appropriateness of financial accounts, financial statements, and management reports. Knowledgeable individuals who are independent from the functions being audited and who are empowered to be thorough should perform these audits.

Barings illustrates well what can happen if there is compliance failure. While Barings did many things right, management nonetheless failed to ensure that controls were in place to prevent employees from hiding unauthorized transactions.

Barings had a derivative policy that required no open positions to be held overnight. However, the derivative policy was not actually followed. Leeson was able to create massive open positions and keep them open for extended periods of time without

being detected. The board and senior management not only must create a policy but also must ensure that the company complies with the policy.

Barings had an asset-liability committee to review derivative exposure reports on a daily basis. However, the daily reports did not reveal the true risk position of the company. Instead, they showed a perfectly hedged position. Leeson was able to create these fictitious reports because he controlled the trading, settlement, and accounting entry functions. To ensure compliance with company policies, these three functions should be separated, and derivative reports should be subject to independent verification by knowledgeable individuals empowered to challenge discrepancies. ICP 22, essential criterion f, says that controls should "ensure appropriate segregation between those who measure, monitor, settle, and control derivatives and those who initiate transactions." Moreover, ICP 22, essential criterion g, specifically says that the function of vetting models and pricing derivatives should be separated from the front office, which recommends and approves derivatives.

Barings sent an audit team to investigate Leeson's trading activities because management were concerned about the large profits he was generating. The audit team did not get to the bottom of what Leeson was doing. It is not sufficient merely to perform an audit. Companies need to ensure that auditors, accountants, and actuaries assessing derivative controls and financial accounts and reports have adequate knowledge to justify the reliance placed in them and adequate authority to conduct a thorough investigation. It is not just the information in the financial statement that must be audited. Regular management reports must confirm compliance with all material elements of the policy, and these reports must be audited to confirm that the information they contain is accurate and reliable. These reports must be reviewed regularly by knowledgeable, senior management to ensure compliance.

Barings had a derivative policy, but it did not place limits on the volume of derivative activity. Had the derivative policy placed limits on the volume of activity, Barings' losses would have been smaller, and bankruptcy might have been avoided. Policies should cover all of the aspects of derivative risk management required to ensure that risks are well managed. In particular, policies should constrain derivative activity to a level appropriate for the company's board-approved risk appetite and circumstances.

Although Barings required Leeson to be supervised, accountability for supervising his actions was not clear, and no knowledgeable and informed manager adequately supervised his actions. Leeson had confusing lines of reporting, involving his immediate boss, Tokyo, and London, and no one individual understood and approved what he was doing. ICP 22, essential criterion d, requires derivative policies to address "the delineation of lines of responsibility and a framework of accountability for derivatives transactions."

Speculation, risk management, hedging, and prudence

ICP 22, explanatory note 5, says, "In monitoring the activities of insurers involved in derivatives, the supervisory authority must satisfy itself that insurers have the ability to recognize, measure, and prudently manage the risks associated with their use. The supervisory authority should obtain sufficient information on insurers' policies and procedures on the use of derivatives and may request information on the purpose for which particular derivatives are to be used and the rationale for undertaking particular transactions."

Regulators generally prohibit speculative uses of derivative instruments by financial institutions or pension funds because losses incurred through speculation may be several times the initial investment, which is inconsistent with the goal of capital preservation usually associated with prudence. However, supervision of derivative practices must extend well beyond a definitional approach that outlaws the use of derivatives for speculation. The supervisory authority must ensure that insurers have prudent derivative risk management policies and practices, sound controls to prevent misuse, monitoring and audit procedures to confirm compliance and the accuracy of financial and risk reports, expertise to ensure that activity is "suitable," and quality systems and models to ensure that derivative risks are measured accurately.

While the New Basel Capital Accord (Basel II) still includes some formulaic capital measures, it promotes a broader approach to supervision that requires assessment of a company's capital adequacy and risk management. Boards and senior management are to be accountable for putting in place good risk management policies and practices and reliably quantifying risks and capital requirements. Supervisors are to provide companies with incentives for good risk management and capital assessment. Quantitative measures of risk must be integrated into management processes. Internal models, stress testing, financial condition assessments, and stochastic models are essential. Supervision of insurers' use of derivatives, as described in the insurance core principles, is broadly consistent with the Basel II approach to the supervision of risk and capital.

The first difficulty with a supervisory approach that merely prohibits speculation is that calling something a hedge, and thinking that it is a hedge, does not make it one. An insurance supervisor should take little comfort from mere attestations that something is a hedge or low risk. Several so-called "hedging" strategies were actually high-risk speculation that resulted in huge losses and bankruptcy. Barings and Long Term Capital Management both went bankrupt while allegedly following well-hedged, low-risk derivative strategies, and Metallgesellschaft lost $1.4 billion in flawed oil future and forward "hedging" activity. Codelco (Chile) and Investors Equity Life Insurance Company of Hawaii also lost hundreds of millions of dollars on "hedging" activity. Many other large derivative losses have resulted from derivative strategies that were thought to be low risk but were not.

The second difficulty with this approach to supervision is closely connected with the first. Nothing intrinsic to a derivative contract establishes that it is being used in a

speculative or non-speculative way. Viewed in isolation, a derivative contract may appear to be speculative and imprudent. However, viewed in the context of an insurer's balance-sheet risk exposures, the same contract may be a valuable and prudent tool of risk management.

The third difficulty with this approach to supervision is closely connected to the first. There are difficulties in defining what is or is not a hedge. Accounting standard-setting bodies have struggled for decades to set out clear and appropriate criteria for what constitutes a hedge for accounting purposes. It has been argued that a transaction can be a hedge for accounting purposes only if the cash flows or price changes of derivatives offset the cash flows or price changes, respectively, of a specific asset or liability, only if the derivative can be proven to reduce enterprise-wide risk, only if the derivative price changes are highly correlated with the price changes of a hedged position, and so on.

While some consensus has developed around what is an accounting hedge (see appendix II), many users of derivatives still find this consensus highly contentious. The concern is that there are many uses of derivatives that "hedge" or reduce risk but do not qualify for hedge accounting treatment. For example, derivatives can be used to reduce aggregate portfolio and balance-sheet risks, to mitigate risky features of specific assets and liabilities, or to "hedge" anticipated transactions, even though these uses do not qualify for hedge accounting treatment.

The fourth difficulty with this approach to supervision relates to the gray area surrounding the use of derivatives for risk and portfolio management that is neither a "hedge" nor speculation. Should regulators err on the side of caution and prohibit such uses simply because they are not hedges, or should they permit all uses that are not speculative? The former approach may hamstring insurers for no good reason, while the latter approach requires a definition of what constitutes speculation that may be open to abuse.

The fifth and most important difficulty with this approach is that it stops short of an active approach to supervision, which requires supervisors to confirm that insurers have actually implemented prudent risk management for derivatives. The supervisory focus should be on the following:

- The actual nature and magnitude of the risks involved
- The bona fide business purpose they serve
- The role of the board and senior management in oversight
- The creation of sound derivative management policies and practices
- The internal controls and procedures designed to ensure that prudent practices are followed
- The auditing of derivative activity to ensure compliance and the reliability of models and reports
- The expertise and integrity of those recommending, approving, and implementing derivative strategies
- The quality of the systems and models used to measure and monitor derivative activity and risk exposures.

The elements of prudent risk management for derivatives are similar to the elements of prudent risk management for cash-market investments. Since the risks entailed by derivatives are not fundamentally different from the risks entailed by cash-market investments, they should share the same prudential risk management framework. Prudent risk management policies, standards, practices, controls, procedures, risk quantification, and reporting for derivatives should be similar to, and well integrated with, those in place for cash-market investments. ICP 22, essential criterion d, requires insurers to have in place risk management systems ensuring that all derivative activities can be "monitored and managed in an integrated manner with similar risks from nonderivatives activities so that exposures can be regularly assessed on a consolidated basis."

Extending the prudent risk management and control framework for cash-market transactions to derivatives leads logically to the conclusion that derivatives should be subject to the condition that combined exposure to risk arising from cash-market investments and from derivatives should be no greater than the risk exposure that is accepted, attainable, and prudent from cash-market investments. The use of derivatives, subject to this constraint, is no more speculative or imprudent than investment in the cash market.

While using derivatives to increase risk is not hedging, this does not automatically imply that all of the uses of derivatives that increase risk are speculative or imprudent. Derivatives can be used prudently to increase risk exposure, but only if the increase in risk is no greater than that which is deemed prudent for direct cash-market investments. This integrated approach directly addresses the issue of how to control and prevent leveraging of risk through derivatives.

If it is prudent to invest directly in a bond or stock market, even though this increases the exposure to interest rate and equity price fluctuations, why should it be any less prudent to achieve the same exposures by investing in money-market investments and entering into an interest rate or equity swap? This unleveraged method of using derivatives to increase the exposure to the bond and stock markets is an alternative to direct investment and is not speculation.

This approach to establishing a prudential framework treats derivatives as alternatives to prudent cash-market transactions that achieve similar risk exposures. Regarding derivatives as a substitute for cash-market investments enables them to be used prudently to manage portfolio risk exposures, asset mix, debt, capital, and treasury functions and to modify undesired features of assets and liabilities, even if they do not qualify for hedge accounting.

Basel II identifies market discipline as the third pillar in supervisory oversight of banks' capital and risk management. Supervisory authorities are to facilitate the functioning of market discipline by developing disclosure requirements that make a company's risk profile, risk management practices, and capital assessments transparent to the market. ICP 22, essential criterion b, makes it essential for insurance supervisory authorities to establish disclosure requirements for derivatives and similar commitments. The authority should review the accounting disclosure requirements and establish ad-

ditional requirements to encourage the operation of market discipline, as appropriate. See appendix II on accounting for derivatives.

Board and senior management oversight

ICP 22, essential criterion c, says, "The supervisory authority requires the board of directors to satisfy itself that collectively the board has sufficient expertise to understand the important issues related to the use of derivatives and that all individuals conducting and monitoring derivatives activities are suitably qualified and competent."

Oversight of derivative policies, controls, and activity should receive the highest attention from senior management and the board. The scope of a company's involvement with derivatives and the necessary policies to ensure their prudent use within this scope must be determined at the level of senior management and approved by the board. This principle follows from the simple fact that derivatives can provide significant benefits or cause material harm to the company. There must be continuity of awareness and understanding of derivatives at the board level, through senior management, and down to the transaction level. An island of knowledge at the transaction level is very dangerous for derivatives.

Senior management should develop a well-articulated derivatives policy that is fully consistent with the board's authorizations and that fully reflects the nature of the company's business and investment activities, capital strength, expertise, and general risk appetite. ICP 22, essential criterion d, says, "The supervisory authority requires the board to have in place an appropriate policy for their use that must be approved and reviewed annually by the board of directors. This policy should be consistent with the insurer's activities, its overall strategic investment policy and asset-liability management policy, and its risk tolerance." Permitted and prohibited or restricted strategies or types of derivatives should be clearly specified (ICP 22, essential criterion d). Maximum thresholds for controlling market and credit risk in total and exposure to a single counterparty should be specified in terms of market values, amount of notional principal, and potential exposure.

Senior management and the board must ensure that derivatives are subject to appropriate operating guidelines and audit, control, monitoring, and reporting policies and that these are reviewed regularly. Guidelines and limits should be set for each type of derivative, taking into account their intended uses, their risks, and uncertainties (ICP 22, essential criterion d). Board approval of all new types and all new uses of derivatives could be required. Lists of approved counterparties could be established. Limits could be placed on exposure to any one counterparty. A list of permitted uses of derivatives could be compiled. Monitoring, documentation, disclosure, accounting, regulatory, tax, and legal review requirements should be established.

Insurance supervisors, the board, and senior management should ensure that knowledgeable, experienced practitioners and quality systems to model, monitor, price,

and measure derivatives risks are in place. ICP 22, essential criterion g, requires insurers to have skilled personnel for vetting models and pricing derivatives. ICP 22, essential criterion h, requires the board to ensure that it can independently verify pricing of over-the-counter derivatives. Senior management should ensure, and the board should confirm, that adequate resources are available to support the hiring of experts and the development and maintenance of quality systems consistent with the level of the insurer's use of derivatives.

Suitability

ICP 22, essential criterion d, requires an insurer's derivative policy to address "the purposes for which derivatives can be used" and to establish structured exposure limits "taking into account the purpose of their use and the uncertainty caused by market, credit, liquidity, operations, and legal risk." ICP 22, explanatory note 5, encourages supervisors to "request information on the purposes for which particular derivatives are used and the rationale for undertaking particular transactions." The supervisor should pay close attention to the suitability of derivatives, if a high volume or large, complex, and unusual derivatives are involved.

Best-practice guidelines for derivatives tend to focus on best practices for market makers, on the grounds that they have by far the greatest exposure and, therefore, presumably have the greatest need to apply best practices. However, derivative best practices for end users should not be merely watered down versions of those for market makers, because end users have their own distinct objectives and risk management requirements. See Global Derivatives Study Group of the Group of Thirty (1993); International Swaps and Derivatives Association (1994).

Prudent best practices for end users will vary from company to company, depending on the range and complexity of products and strategies employed, the materiality of the risk exposures being managed, and the frequency, magnitude, and objectives of their use. The risk exposures of an end user with only a handful of simple, easily understood, easily priced derivatives used in simple hedging strategies are quite different from those of an end user heavily involved in the full range of derivatives.

Where delta-hedging strategies are employed, even an end user should measure exposures daily and intradaily, as appropriate. If the derivative product or strategy is innovative and complex, the end user has a special responsibility to ensure that the derivative is thoroughly understood and properly authorized by the company's policies and senior management.

Risk-return trade-offs for market makers. For market makers, derivatives represent an opportunity to earn a profit, and the context and suitability of derivatives are not an issue. The desire to maximize profit drives market makers to take on the highest tolerable level of credit exposure to each counterparty and to transact with counterparties

with the lowest tolerable credit rating. Credit risk must be an all-consuming concern, since traders could expose the company to excessive amounts of credit risk.

The derivative portfolio of a market maker can be understood and analyzed on a stand-alone basis, without consideration of either the context or suitability. Capital allocation, risk measures, stress testing, disclosure, and best practices can be applied directly to the market maker's portfolio of derivatives on a stand-alone basis. This is because a gain or loss on its portfolio of derivatives is not offset by a gain or loss elsewhere on the balance sheet. The gain or loss passes directly to the bottom line.

Consequently, the rationale and the potential profit or loss from the market maker's derivative transactions depend on accurately measuring and pricing the derivative's market risk. Thus it is critical to measure risk exposures across the entire enterprise on the basis of a consistent, real-time measurement system. Credit risk management is central to achieving the market maker's risk-return objectives.

Suitability for end users. Suitability should be an all-consuming concern of end users. They should focus on requirements that ensure that the use of derivatives is appropriate to their circumstances and objectives.

Proctor and Gamble, Gibson Greetings, Dell Computer, and Air Products and Chemicals had material losses on leveraged interest rate, yield-curve, "diff", or currency swaps. Proctor and Gamble and Gibson Greetings filed lawsuits against their dealers. Whether these companies were innocent victims or willing participants is moot. The salient fact is that all four companies acquired derivatives that were entirely unsuitable for them.

Attempts to understand and analyze the use of derivatives by end users on a stand-alone basis, without considering their context and suitability, are of little value and perverse. They are perverse because focusing on an end user's derivatives portfolio in isolation from its asset-liability portfolio diverts attention away from the fundamental question of suitability.

Derivatives should represent a solution to a problem. They should be used to manage the risks inherent in a business and its net asset-liability exposure, to manage the risk-return trade-offs of asset portfolios, and to achieve financing or capital management objectives. ICP 22, explanatory note 2, says, "Derivatives should be considered in the context of a prudent overall asset-liability management strategy."

Specifically, capital allocation, risk measures, stress testing, disclosure, and best practices cannot be usefully applied directly to an end user's derivative portfolio on a stand-alone basis. Moreover, provided that the end user's derivatives are suitable, the net market risk in this broader context will be modest. This is because gains and losses on the derivative portfolios of end users will generally be offset elsewhere on the balance sheet or will be consistent with acceptable cash-market exposures if the derivatives are suitable.

Ensuring that derivatives are suitable is tantamount to ensuring that current and potential net exposures are consistent with the end users' risk appetite. The assurance

that each derivative transaction successfully resolves the problem that it is designed to meet is central to the end user's management of derivative risk.

Consider an end user that purchases bond futures contracts and establishes a cash position with a combined duration matching that of a liability. Considering the capital put at risk by the bond futures contracts, in isolation from the relevant cash and liabilities, is essentially a useless exercise. The actual net capital at risk as a result of the futures contract and the liability it supports is minimal. It is essentially the same as the capital put at risk through the direct purchase of a government bond. An end user can readily use bond futures to reduce its capital at risk by reducing the duration mismatch between the asset and liability portfolios.

If derivatives are suitable for a company's circumstances, the frequent valuation of derivatives on a stand-alone basis using state-of-the-art pricing models is not as fundamental a concern as it is for market makers. Real-time pricing and stress testing of enterprise-wide derivative portfolio exposures are not essential.

Consider, for example, an end user that employs currency swaps to hedge specific foreign currency liabilities, which are funded with domestic currency bonds, or one that uses interest rate swaps to create fixed-rate bonds or debt from floating-rate bonds or debt. With the possible exception of assessing potential credit risk, accurately pricing and measuring the exposures of these swaps on a stand-alone basis will shed little light on the end user's financial income and capital position at risk or whether the derivatives are fulfilling the function for which they were purchased.

Steps to ensure suitability. To ensure suitability, the board-approved derivative policy should set out the purposes for which derivatives can be used and structure exposure limits for derivatives taking into account these purposes and the risks and uncertainties associated with derivatives (ICP 22, essential criterion d). The policy should restrict or prohibit types of derivatives that are likely to be unsuitable, such as those where potential market risks cannot be measured reliably, those that are highly illiquid, or those whose price and risks cannot be quantified by the company's personnel.

To ensure suitability, those with the authority to recommend and approve derivative transactions and strategies should have the requisite expertise, knowledge, skills, training, and experience to assess suitability and to manage derivative risks. They must have a thorough understanding of the purpose and benefits of the transactions and strategies in the company's circumstances, the factors affecting derivative prices, and how these prices will change through time, especially in unusual market conditions. Those who process, report, control, and audit derivative activities must have the requisite skills, experience, and training. Compensation must be consistent with the requisite knowledge and expertise.

To ensure suitability, the end user should have personnel who can value derivatives independently from the dealer from which derivatives are purchased and who can measure potential market and credit exposures and stress test derivatives using cash-flow-projection models. ICP 22, essential criterion f, says, "The supervisory authority

requires that insurers have in place personnel with appropriate skills to vet models used by the front office and to price the instruments used and that pricing follows market convention." ICP 22, essential criterion h, requires the board to ensure that it has the "appropriate capability to verify pricing independently where the use of over-the-counter derivatives is permitted under the insurer's policy."

The rationale underlying the decision to enter into the financial contract and the analysis of alternative strategies should be recorded. Such records should indicate that the decision was based on accurate, appropriate, and sufficient information. ICP 22, explanatory note 1, says, "Insurers choosing to engage in derivative activities should clearly define their objectives."

To confirm suitability, end users should compare derivative transactions with their best cash-market alternative and compare complex derivatives with simpler ones. Unless the risk profiles are clearly understood and the cost-benefit analysis is supportive, cash-market transactions should be preferred to derivatives, and simple derivatives should be preferred to complex ones. It should be possible to demonstrate that the magnitude, complexity, and risks arising from derivatives are justified by the benefits of their use.

The cost-benefit comparison with the best cash-market solution will provide confidence and insight into why a derivative solution is suitable. Either the cash-market transaction or derivatives may be the best solution because they are cheaper, more flexible, more liquid, and easier to implement, modify, manage, unwind, or understand. The clear delineation of the purpose, the best cash-market solution, and the factors that make a derivative solution preferable to the cash-market solution will go a long way to ensuring that the transaction is prudent and suitable and is documented as such.

Another good practice for end users is to obtain multiple bids and advice from more than one counterparty, especially when dealing with a type of derivative new to the marketplace or to the insurer. This will help to ensure not only that the price is fair but also that the planned use of the derivative is suitable and will achieve the desired objective.

End users should assess suitability not just at the outset, but also over the lifetime of the transaction. After derivative positions are unwound or expire or at the end of each accounting period, the actual results should be compared with the results that would have been achieved if the derivative transaction had not been entered into or if an even larger derivative exposure had been taken on. For example, partial hedging could be compared to no hedging or complete hedging. Benchmarking promotes understanding and accountability.

Credit risk management for end users. Derivative credit risk management is more straightforward for end users than for market makers, because end users typically have little incentive to transact in large volumes or to expose themselves excessively to any one counterparty or to counterparties with low credit ratings. There are many highly rated counterparties with which to transact if volumes are limited, and the additional

costs of transacting with high-quality counterparties are usually minimal. End users can manage credit risk through the following, among others: (a) requirements to transact with diversified, well-known, highly rated counterparties, (b) requirements for credit enhancements, and (c) counterparty exposure limits.

Concentration risk and costs can be an issue for large, complex, and unusual derivatives. Only a limited number of counterparties may be able to transact, and the additional cost to transact with highly rated counterparties may be more of an issue. Even here, however, much of the risk of loss can be mitigated. While cost is always a consideration, risk management, rather than profit maximization, should be the end user's motivation. The additional cost to transact with highly rated counterparties or to use risk mitigation tools is fully warranted in this context.

Compensation policies, noncompliance, and fraud

The risk of noncompliance, fraud, and rogue trading is considerable with derivative market makers, because profits from client transactions, trading, and position taking are a significant portion of the market maker's total profit. Where risk controls and policies are considered to destroy or reduce profit, market makers may be reluctant to use them. Market makers generally make these difficult choices by relating the profit to the cost of capital allocated to the risks involved. In addition, market makers provide substantial incentives to their traders to originate the maximum possible volume of transactions and the maximum possible profit from position taking. Typically, 10–12 percent of a trader's net profits are paid as a bonus. This creates a huge incentive for the trader to take big bets, since the trader gets his bonus on the upside, and there is little personal downside. It is the firm that suffers the financial damage if losses emerge.

In contrast, derivatives are not a material source of profit for the typical end user, which uses derivatives to solve problems and achieve risk and portfolio management objectives; erring on the side of prudence has little or no downside. This difference does not mean that compliance, compensation policies, and fraud are not issues for end users. Rather, it creates differences in the way these issues affect end users and market makers. Policies essential to prevent fraud and noncompliance at market makers may be less appropriate and less effective for end users and vice versa. For example, it is critical for market makers to separate the analysis of counterparty credit, the setting of credit limits, the valuation of the portfolio, and the monitoring of derivatives from the functions of trading and transacting. This separation is generally desirable for an end user, but it is critical only where the volume of transactions and risk exposures make it economically justified.

The board and senior management at end users generally have every incentive to insist on prudent derivative controls and risk management policies. In addition, those who recommend and approve derivative transactions at a typical end user have no per-

sonal financial incentive to increase the volume of transactions or to take material exposures.

Policy noncompliance at end users is often due to incompetence. Some derivative losses have occurred because of mistakes. End users so poorly understood what they were doing that they purchased the wrong derivative and ended up increasing their risk exposures, when their intention was to do the opposite. Some losses occurred because end users believed that they were purchasing relatively safe, policy-compliant derivatives, only to discover that the derivatives were high risk and unsuitable. Noncompliance may result from ignorance about the company's policies, practices, and controls or mistakes in determining whether particular transactions are compliant. End users can avoid such problems by ensuring that those recommending and approving derivatives have the requisite competence, expertise, and training to understand the risks.

Fraud at end users can arise in many ways. For example, fraud may be used to cover up noncompliance when losses emerge. In such cases, derivative exposures may be increased many times above the original exposure, in a desperate attempt to make a large profit that will recuperate all the accumulated losses. Fraud can also arise where an individual uses derivatives to generate profits or to achieve an objective for which he or she receives compensation. The fraud could be to cover up derivative risk exposures that are not permitted at all or exposures that exceed limits. Derivatives can be used fraudulently to cover up the true financial position of the company. For example, a structured bond with exotic cash flow might be used to create the false impression that high investment returns are being earned in order to justify the payment of higher bonuses to policyholders. Both insurers and supervisors need to be alert to the various motivations and possibilities for fraud.

Exercises

18. What are the essential elements of prudent management of derivative risk for insurers?
19. How does prudent risk management of derivatives relate to prudent risk management of cash-market investments for insurers?
20. Why are controls and sound risk management practices critical to the prudent use of derivatives by insurers?
21. Why are independent audit, compliance, and fraud prevention processes critical to insurers' use of derivatives?
22. What are some important areas of focus for audit and compliance?
23. Why is it not sufficient to rely on requirements restricting the use of derivatives to hedging?
24. What are some ways in which prudent derivative risk management differs between market makers and end users?
25. Why should the board and senior management actively oversee derivative activities?
26. What aspects of derivative risk management require the attention of the board and senior management?
27. Why is suitability such an important consideration for end users, but of little importance to market makers?
28. What should end users do to ensure that derivative transactions are suitable?
29. Describe some ways in which the management of derivative credit risk differs between market makers and end users.
30. Discuss the risks of noncompliance and fraud at end users and market makers.
31. What are some of the elements of policies and guidelines for derivative risks?

D. References

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Appendix I. ICP 22

ICP 22 Derivatives and similar commitments
The supervisory authority requires insurers to comply with standards on the use of derivatives and similar commitments. These standards address restrictions in their use and disclosure requirements as well as internal controls and monitoring of the related positions.

Explanatory notes

22.1. A derivative is a financial asset or liability whose value depends on (or is derived from) other assets, liabilities, or indices (the "underlying asset"). Derivatives are financial contracts and include a wide assortment of instruments, such as forwards, futures, options, warrants, and swaps. These features can be embedded in hybrid instruments (for example, a bond whose maturity value is tied to an equity index is a hybrid instrument that contains a derivative). Insurers choosing to engage in derivative activities should clearly define their objectives, ensuring that these are consistent with any legislative restrictions.

22.2. Given the nature of insurance operations, derivatives should be used preferably as a risk mitigation mechanism. Supervisory authorities may restrict the use of derivatives to the reduction of investment risk or efficient portfolio management. Derivatives should be considered in the context of a prudent overall asset-liability management strategy.

22.3. This principle also applies to financial instruments that have the economic effect of derivatives and could apply to commodity derivatives, where insurers are permitted to engage in these transactions. Where a jurisdiction completely prohibits the use of derivatives and similar commitments, then the assessment criteria clearly do not apply. The prohibition of the use of derivatives is particularly appropriate where a jurisdiction does not fully observe the conditions for effective supervision (refer to ICP 1).

22.4. The criteria of transparent and structured decisionmaking procedures of policy setting, execution, monitoring, reporting, and control apply equally to similar commitments that are not derivatives transactions but which may be included in some jurisdictions as "off-balance-sheet" items. Equivalent requirements and controls should be in place for commitments transacted through special-purpose vehicles.

22.5. Derivatives, used appropriately, can be useful tools in the reduction of portfolio risk of insurers. In monitoring the activities of insurers involved in derivatives, the supervisory authority must satisfy itself that insurers have the ability to recognize, measure, and prudently manage the risks associated with their use. The supervisory author-

ity should obtain sufficient information on insurers' policies and procedures regarding the use of derivatives and may request information on the purpose for which particular derivatives are to be used and the rationale for undertaking particular transactions.

Essential criteria

a. Requirements regarding the use of derivatives are in place, either in the law or in supervisory rules. The requirements consider the risks in the use of derivatives and similar commitments.
b. The supervisory authority establishes disclosure requirements for derivatives and similar commitments.
c. The supervisory authority requires the board of directors to satisfy itself that collectively the board has sufficient expertise to understand the important issues related to the use of derivatives and that all individuals conducting and monitoring derivatives activities are suitably qualified and competent.
d. The supervisory authority requires insurers using derivatives to have in place an appropriate policy for their use that must be approved and reviewed annually by the board of directors. This policy should be consistent with the insurer's activities, its overall strategic investment policy and asset-liability management strategy, and its risk tolerance. It addresses at least the following elements:

    - The purposes for which derivatives can be used
    - The establishment of appropriately structured exposure limits for derivatives, taking into account the purpose of their use and the uncertainty caused by market, credit, liquidity, operations, and legal risk
    - The extent to which the holding of some types of derivatives is restricted or not authorized; for example, where the potential exposure cannot be reliably measured, the closing out or disposal of the derivative could be difficult, due to its lack of marketability (as may be the case with over-the-counter instruments) or the illiquidity of the market, or where independent (that is, external) verification of pricing is not available
    - The delineation of lines of responsibility and a framework of accountability for derivatives transactions.

e. The supervisory authority requires that insurers have in place risk management systems, covering the risks from derivatives activities to ensure that the risks arising from all derivatives transactions undertaken by the insurer can be:

    - Analyzed and monitored individually and in aggregate
    - Monitored and managed in an integrated manner with similar risks arising from nonderivatives activities so that exposures can be regularly assessed on a consolidated basis.

f. The supervisory authority requires that insurers have in place adequate internal controls to ensure that derivatives activities are properly overseen and that transactions have been entered into only in accordance with the insurer's approved policies and procedures and legal and regulatory requirements. These controls ensure appropriate segregation between those who measure, monitor, settle, and control derivatives and those who initiate transactions (refer to ICP 10).
g. The supervisory authority requires that insurers have in place personnel with appropriate skills to vet models used by the front office and to price the instruments used and that pricing follows market convention. These functions should also be separate from the front office.
h. The supervisory authority requires that the board of directors ensure that the insurer has the appropriate capability to verify pricing independently where the use of "over-the-counter" derivatives is permitted under the insurer's policy.
i. The supervisory authority requires that insurers have in place rigorous audit procedures that include coverage of their derivatives activities to ensure the timely identification of internal control weaknesses and operating system deficiencies. If the audit is performed internally, it should be independent of the function being reviewed.

Appendix II. Accounting for derivatives

International, European, and North American generally accepted accounting principles (GAAP) are converging, and, in particular, there is strong convergence in accounting standards for financial instruments and derivatives. In 1997 the International Accounting Standards Board (IASB) began the Insurance Contracts Project. Phase 1 of this project is to apply to financial statements of companies listed on European exchanges commencing in 2005. Phase 1 requires fair-value accounting for derivatives embedded in insurance contracts, unless the embedded derivative itself is an insurance contract. Fair-value accounting for derivatives in general is required by IAS 39, which applies to all companies, including insurers. Phase 2 may require fair-value accounting for all liabilities. Its effective date has not yet been decided.

The Financial Accounting Standards Board (FASB) is publicly committed to convergence with international standards. Considerable convergence is evident in that many of the international accounting standards follow U.S. financial accounting standards quite closely. This is especially true of accounting standards for derivatives.

The U.S. Statement of Financial Accounting Standards (SFAS) 133, Accounting for Derivative Instruments and Hedging Activities, provides the U.S. GAAP accounting requirements. SFAS 138 provides additional guidance on certain derivatives and hedging activities, and SFAS 149 provides amendments to SFAS 133. The SFAS 133 Derivative Implementation Group (DIG) has issued a number of binding documents on various issues.

Both IAS 39, Financial Instruments: Recognition and Measurement, and SFAS 133 provide substantially similar accounting standards for derivatives, reflecting the strong drive to convergence of accounting standards. Both provide comprehensive accounting frameworks for derivatives founded on the same two fundamental principles. First, derivatives create rights or obligations that must be settled in cash and therefore are assets or liabilities that must be recorded separately on the balance sheet. Second, fair value is the only relevant measure of value for derivatives. Thus both reject off-balance-sheet accounting for derivatives and valuations of derivatives based on forward value, spot rates, intrinsic value, or historical cost.

IAS 39 and SFAS 115 also provide substantially similar accounting treatments of asset categories: held to maturity (book value = book value for both balance sheet and income statement), available for sale (fair value = fair value for balance sheet, book value for income statement), and trading (fair value for both balance sheet and income statement).

Fair value and hedge accounting for derivatives

Hedge accounting applies when specific conditions are met. SFAS 133 sets out detailed criteria that must be met by both the hedging instrument and the hedged item to qual-

ify for hedge accounting. Hedge accounting requires clear documentation of the risk management objective and strategy for entering into the hedge. Hedge accounting recognizes gains or losses on derivatives in the same accounting period, as changes in the fair value (or earnings impact of cash-flow variability) of a hedged asset, liability, or commitment are recognized. Hedge accounting is generally desirable, since it eliminates a source of earnings volatility.

What constitutes a hedge is controversial. SFAS 52 required demonstration that currency futures and swaps reduce the hedged item's risk, and SFAS 80 required demonstration that commodity and interest rate futures reduce enterprise risk. The transaction risk reduction requirement eliminated hedge accounting for many sound risk management strategies. The enterprise risk reduction requirement was impractical for large enterprises.

SFAS 133 supersedes and replaces these requirements with a requirement to demonstrate high effectiveness in the offsetting of changes in fair value or cash flows of the derivative and the hedged item, both at the outset and at least every three months thereafter. High effectiveness is often taken to mean, in practice, that the cumulative changes in value of the hedging instrument should be between 80 and 125 percent of the offsetting cumulative changes in fair value or cash flows of the hedged item. SFAS 133 provides no simple practical rule like this.

The specified conditions for hedge accounting are controversial, since sound economic risk management may not meet these conditions and financial statement objectives may only be achieved with hedge accounting. For example, SFAS 133 imposes strict requirements for hedge accounting of hedges for a portfolio of "similar" items and prohibits it for portfolios of dissimilar items. Both IAS 39 and SFAS 133 prohibit hedge accounting treatment of many sound risk management strategies, such as hedging of the net interest rate exposure in portfolios containing assets and liabilities. The IASB is exploring hedging of net interest rate exposures.

Hedges must be designated as fair value, cash flow, or foreign currency hedges and be attributed to fair value, cash flow, or foreign currency risks of particular assets, liabilities, or commitments. Under both IAS 39 and SFAS 133, fair-value hedges must hedge exposures to changes in the fair value of a hedged item that is attributable to a particular risk and that affects income. For fair-value hedges and foreign currency hedges of firm commitments and available-for-sale securities, changes in the fair value of the derivative and the hedged item flow through earnings as they occur but are offsetting. Fair-value hedges extend fair-value accounting to assets, liabilities, and commitments that might not otherwise be subject to fair-value accounting.

For cash-flow hedges and foreign currency cash-flow hedges, the fair value of the derivative that is offset by gains or losses on the forecasted transaction or cash flows of the hedged item flow into comprehensive income, not earnings. Accumulated gains or losses are reclassified as earnings when the gains or losses on the hedged item affect earnings. The requirement to report gains and losses on cash-flow hedges in the category of other comprehensive income causes volatility in equity, since the offsetting

gain or loss on the hedged item is recognized only in some future reporting period. SFAS 133 prohibits previously permitted deferral accounting for cash-flow hedges. For foreign currency hedges of net investments in foreign operations, the effective portion of the hedge is reported in comprehensive income as part of the currency translation account.

A synthetic financial instrument combines a primary financial instrument with a derivative to create another financial instrument. For example, a floating-rate five-year bond or debt could be combined with a five-year interest rate swap to receive fixed rates and thus create a "synthetic" fixed-rate five-year bond or debt. Synthetic or accrual accounting treats the floating-rate bond or debt and swap in combination as a five-year bond or debt. SFAS 133 requires separate accounting for both components, which can create income volatility relative to the treatment of direct instruments with identical cash flows to those of the synthetic instrument.

Embedded derivatives

Certain "hybrid" instruments, including structured investments and some insurance products that are not derivatives, contain embedded derivatives. Embedded derivatives were covered in SFAS 133 to prevent end users from embedding derivatives in other "host" contracts and therefore circumventing SFAS 133. SFAS 133 requires that the embedded derivative be reported separately from its host contract at fair value, with changes in fair value flowing through income. "Bifurcation" is not required if and only if the economic characteristics and risk of the embedded derivative are clearly and closely related to those of the host contract and the hybrid contract is marked to market.

The SFAS 133 Derivative Implementation Group (DIG), issue 36 document, effective September 15, 2003, requires embedded derivative accounting in any situation where receivables and payables are determined by reference to a pool of assets or an index. Experience refunds on reinsurance and group insurance contracts and immediate participation guarantee (IPG) annuity contracts that reflect actual investment returns involve the transfer of credit risk; hence DIG 36 requires embedded derivative accounting. More significantly, it requires separate fair-value reporting of the derivative embedded in modified coinsurance (ModCo) and coinsurance with funds withheld (CFW) reinsurance contracts. In both ModCo and CFW contracts, the reinsurer is paid amounts that reflect the credit experience on the ceding company's general account assets or a portion of them. Effectively, the ceding company has purchased credit protection from the reinsurer, and both must reflect a fair value for this embedded derivative.

Although for many ModCo and CFW reinsurance contracts the embedded derivative is solely a "credit"-type derivative, for others the fair value of the embedded derivative needs to reflect the fact that the embedded derivative combines credit risk with interest rate or other risks.

Depending on the facts and circumstances of each reinsurance, group insurance, or annuity contract, the embedded derivative may be "fair valued" as a total-return swap or a credit derivative. The approach needs the approval of management and auditors. The embedded derivative may have minimal or material value, depending on whether the credit risk transferred is like that of treasury or low-quality bonds.

This requirement has a profound impact on reporting of these reinsurance and group insurance contracts, since changes in the fair value of embedded derivatives flow through income. Gains and losses on embedded derivatives are part of the stream of gross profits, thereby affecting amortization of deferred acquisition costs, unearned revenue liabilities, and other GAAP items. Income will be more volatile, and explanations of profit trends will be more complex.

IFRS 4 and related implementation guidance also address the issue of embedded derivatives.

Appendix III. Answer key

1. *Review the example in the previous section that explains how to calculate the number of CGB futures contracts to eliminate a duration gap. A liability with duration five today has been priced today at $50 million. The CGB that can be delivered to meet the requirements of one CGB futures contract has a duration today of six and a market value today of $105,000. Determine how many CGB contracts must be purchased to hedge the liability, until the outstanding premium is received.*

   To hedge the $50 million of liability with duration five, the insurer could purchase $50 million of bonds with duration five. Now, $50 x (5 / 6) = $41.667 million of bonds with duration six has approximately the same interest sensitivity as $50 million of bonds with duration five. The liability has been priced and consequently represents an interest rate exposure to the insurer. However, the insurer has no funds with which to purchase these bonds in order to hedge the interest rate exposure, since the premium is outstanding.

   CGB bond futures can be purchased to hedge the interest rate exposure, until the outstanding premium is received and invested in the cash market. The case study indicates that the CGB that can be delivered to meet the CGB futures contract has a current duration of six and a market value of $105,000. Purchasing 416.67 / 1.05 = 396.8 CGB futures contracts will require delivery of CGB bonds with current duration of six and current market value of about $41.667 million. Thus purchasing 397 CGB futures contracts will hedge the $50 million outstanding premium.

2. *An insurer wishes to issue $300 million of duration-eight debt at today's interest rates. However, the legal paperwork has not been executed, and so the debt cannot be issued for a few weeks. The insurer is concerned that market conditions will become much less favorable between today and when the debt is actually issued. Futures may be sold to hedge future debt issues against rises in interest rates. If rates rise, then the bond futures contracts sold will result in gains that offset the extra cost of issuing debt at the higher rates. If rates drop, a loss will be incurred on the bond futures, representing an opportunity cost—that is, the opportunity to benefit from issuing debt at lower rates is forgone. The CGB bond that can be delivered to meet the requirements of one CGB futures contract has a duration today of six and a market value today of $105,000. Determine how many CGB futures contracts must be sold to hedge the debt issue.*

   To hedge the future debt issue, the insurer could sell $300 million of duration-eight assets today and hold cash until the debt is used. If rates rise, the loss that would otherwise have occurred on the bonds sold, but which was avoided by the sale, will compensate for the higher costs of debt service. If rates drop, the gain

that was forgone on the bonds sold will offset the lower costs of debt service. Thus such a sale "hedges" the interest rate exposure associated with the fact that the debt will be issued in the future and not today. However, the insurer does not wish to sell bonds, because of the tax, financial, and investment implications of such a sale.

Now, $300 x (8 / 6) = $400 million of bonds with duration six has approximately the same interest rate sensitivity as $300 million of bonds with duration eight. CGB bond futures can be sold to hedge the interest rate exposure, until the debt is issued. The case study indicates that the CGB that can be delivered to meet the CGB futures contract has a current duration of six and a market value of $105,000. Selling 4,000 / 1.05 = 3,809.5 CGB futures contracts will require delivery of CGB bonds with current duration of six and current market value of about $400 million. Thus selling 3,810 CGB futures contracts will hedge the $300 million future debt issue.

3. *Why are derivatives cost-effective?*

The price to lay off risk through the use of derivatives can be considerably less than the price charged to clients for taking on the risk. This is because the retail pricing of risk is different from the wholesale pricing of risk and because costs are incurred only at the margin and only after the netting of offsetting risks. Derivatives can exchange the costs, environment, burdens, and constraints in the capital markets of one jurisdiction for those in another.

4. *How can derivatives diversify risk?*

Derivatives facilitate the netting of risks across financial institutions and financial markets. Risks can be transferred to a party that is well positioned to absorb the risk without having to put up much or any capital. For example, investors may have offsetting risk exposures (one is too long, and the other is too short) that can be netted against each other using derivatives.

5. *How do derivatives enhance market liquidity?*

Securitization serves to bring new investors into the market for the asset securitized.

The investor may have neither the interest nor the ability to source and evaluate the assets securitized (auto loans, card receivables, and residential mortgages, for example) or to service and administer these assets. The illiquidity of the securitized asset may be unacceptable to the investor. Securitization removes these obstacles to ownership, creating liquidity, investment, and risk management opportunities.

The simplicity and liquidity of interest rate swaps combine to make them an extremely cost-effective tool for transferring risk. Cross-currency swaps mean that the entire financial world can participate in the swap market of any country.

6. *Explain the differences among hedging, risk management, speculation, and arbitraging. Why are these differences important to the supervisor?*

Derivatives do not themselves create financial risk. Rather, the fundamental concern is with how insurers use derivatives. Thus supervisors must understand the distinct ways in which derivatives can be used in order to recognize when insurers are using derivatives to manage risk "in the context of a prudent overall asset-liability management strategy" (ICP 22, explanatory note 2) rather than as part of a risky speculative strategy.

Derivatives generally are used to reduce risk (hedging), to manage risk (portfolio management), or to assume "naked" risk (speculation). In hedging and portfolio management, derivatives are used to solve problems or achieve objectives created by an existing portfolio of assets and liabilities. These uses can be contrasted with stand-alone, speculative uses of derivatives that have no context in the broader portfolio. Price arbitrage arises when it is possible to buy and sell the same or a similar position in different markets and jurisdictions at a profit. The arbitrageur takes on offsetting risk exposures and so has little or no net risk.

7. *List some of the objectives that can be achieved using derivatives.*

Derivatives can be used to (a) manage risk-return trade-offs, (b) allocate assets efficiently, (c) manage balance-sheet and income statements, (d) improve access to capital, (e) enhance treasury functions, (f) manage debt, and (g) transfer price.

8. *List some of the uses of futures and forward contracts.*

Futures can be sold to hedge excess assets or bought to hedge excess liabilities or to gain market exposure until an outstanding premium is received or excess cash can be invested. Futures are useful where it is desirable to increase or decrease financial exposure to an asset, but there are cash flow, liquidity, tax, market, or other reasons to defer the actual purchase or sale of the asset. Futures are useful as a substitute for asset transactions where regulatory, contractual, or other constraints prevent an actual purchase or sale or where lack of expertise, lack of resources, and high transaction costs make an actual transaction difficult. Futures on bonds or money-market instruments can be bought and

sold to increase or decrease portfolio duration and eliminate an asset-liability duration gap. Futures can be used to overlay and replicate assets and to hedge specific debt issues, liabilities, and assets. Futures provide a fast, efficient way for portfolio managers to implement investment strategies without affecting their portfolio. They can be used to rebalance relatively illiquid portfolios.

9. *Describe how bond options can be used to mitigate losses from a change in interest rates.*

To hedge a position against losses from an increase (decrease) in rates, a put (call) option on a bond of appropriate term could be purchased. The put (call) option value increases with increases in rates above (below) the rate equivalent to the option strike price. These option gains "hedge" the losses on the position hedged.

10. *What features of an insurer's assets and liabilities are effectively embedded options sold by the insurer? What risk of loss do they bring, and how can options be used to manage this risk?*

Typically, an insurer "sells" call options to borrowers, who have the right to prepay bonds, mortgages, mortgage-backed securities, and so forth, and sells options to policyholders, who have the right to make additional deposits at guaranteed rates or withdraw funds without a full market adjustment.

These options embedded in an insurer's assets mean that asset duration will shorten and liability duration will lengthen with a fall in rates and that asset duration will lengthen and liability duration will shorten with a rise in rates. The insurer is said to have a "convexity mismatch," which implies losses whether rates rise or fall.

Bond call options can be purchased to mitigate the losses incurred when rates decline, and bond put options can be purchased to mitigate the losses when rates rise.

For any given decline in rates, a bond call option can be purchased that will increase in value by an amount that, when added to the increase in value of the assets resulting from the rate decline, will equal the increase in value of the liabilities resulting from the rate decline. A series of call options would be required to protect against a range of interest rate declines. A call option could be purchased to protect against a 0.25 percent decline in rates, say. A second call option could be purchased, taking into account the change in value of the first call option, to protect against a 0.5 percent rate decline, and so on.

For any given rate increase, a bond put option can be purchased that will increase in value by an amount that, when added to the decrease in value of the assets resulting from the rate increase, will equal the decrease in value of

the liabilities resulting from the rate increase. A series of put options would be required to protect against a range of interest rate increases. This series can be constructed in the same way as the series of call options just described, beginning with the put option required to protect against an increase of 0.25 percent and so on.

11. *List some of the uses of interest rate swaps.*

Interest rate swaps can be used to achieve virtually any interest rate management objective that can be achieved through the direct sale and purchase of assets. Interest rate swaps can be used to (a) manage the asset-liability duration gap, (b) hedge specific balance-sheet assets and liabilities, (c) expand investment and marketing opportunities, and (d) manage an asset portfolio.

12. *Explain the notional amount of a derivative and why it is not a good measure of risk exposure.*

The notional amount of a derivative is the dollar amount of the underlying asset or index to which the derivative is linked. It is used to define the obligations under the derivative contract. The risks of derivatives are linked directly to the size and price volatility of the cash flows the derivatives occasion and only indirectly to the "face amount" of the underlying asset or index.

13. *What is gross replacement cost, and why is it a poor measure of credit risk exposure?*

Gross replacement cost is the amount that would need to be paid to replace the existing contract with a new, identical contract. Gross replacement cost can give an excessive indication of risk in that (a) it does not reflect netting arrangements with counterparties, (b) not all counterparties will default at the same time, and (c) there are likely to be recoveries in the event of default. It does not take account of different probabilities of default across counterparties and credit-enhancing features. It can give an insufficient indication of risk in that the potential for future losses is not considered and may be material.

14. *What are some of the ways in which insurers can manage derivative credit risk?*

Insurers should manage their derivative credit exposures consistently with how they manage their cash-market credit exposures. Specifically, the credit decision process, procedures, controls, limits, review, and reports of derivatives should be both consistent and integrated with those for cash-market investments.

Concentration by counterparty should be monitored carefully and limited to maximum counterparty exposures, with respect to both current and potential credit exposure. More restrictive limits and controls might be considered for longer-term derivatives.

A range of credit-enhancing features can be built into derivative contracts. These include (a) use of good-quality, liquid collateral, (b) frequent settlement of amounts owing, (c) termination clauses, and (d) parent or third-party guarantees.

Separating the trading and credit risk assessment functions is critical for all market makers and useful for end users. End users can create a diversified list of well-known, highly rated (A financial rating or better), approved counterparties, known to have a high level of financial and operational controls and expertise.

15. What is value at risk (VAR)?

Value at risk (VAR) is a widely used measure of market risk that relies on stochastic modeling techniques to measure aggregate risk exposures in dollar terms across all market risks and across both sides of the balance sheet on the basis of net exposure. VAR is the expected loss from adverse market movement with a specified probability (confidence interval of 99.5 percent, say) over a particular period of time (one year, say).

16. What are some of the limitations of VAR?

VAR is not a uniquely defined measure. VAR depends on the confidence level, the time horizon, the economic scenario generator (ESG), the ESG parameter values, the correlations assumed between different risks and within each risk, and the assumptions and methodology used to model and project cash flows in each economic scenario. Modelers must make critical assumptions about policyholder behavior and future management actions, for which there is limited or no empirical evidence. Modelers make critical simplifying assumptions relating to grouping of data or use of lapse, expense, renewal, cancellation, and so forth that are deterministic, even though they are known to be dynamic. Modelers sometimes extend their models to cover real estate, credit, insurance, and other risks, but assumptions about how these risks behave and interact may not be entirely reliable.

VAR is often measured over one-year or shorter time horizons for risk management and capital allocation and other strategic planning purposes. However, insurance supervisors should recognize that one-year horizons may be far too short to measure adequately the risk of insolvency for insurers with material

embedded options and guarantees that create risk exposures extending over 50 years or more.

VAR provides only a snapshot of the entire risk profile provided by the distribution. The extent of losses from extreme events beyond the percentile chosen for the calculation of value at risk is not captured. However, price changes that are highly improbable according to stochastic processes typically used in VAR analyses have occurred with unsettling frequency. This may indicate that the wrong stochastic process is being used or that the experience being used to calibrate the model is too tame. This limitation is compounded for insurance risk exposures, where extreme outcomes can evolve over the course of many years.

VAR models typically rely on correlation assumptions based primarily on experience in typical, rather than extreme, conditions. However, VAR is a measure of the losses expected under extreme conditions. It may well be the case that the relationship between risk exposures varies between "typical" and "abnormal" conditions. Approaches using copulas that are designed to address this issue seem to confirm that correlation benefits may be overstated in typical VAR models.

17. *How might some of the limitations of VAR be addressed?*

To eliminate a wide range of practice from company to company, to ensure comparability of VAR across companies, and to ensure minimum levels of rigor in the calculation, supervisory authorities could stipulate that the VAR be calculated in a standardized way. To address the short time horizon used in the VAR measure, "runoff tests" that examine financial strength over longer time horizons could also be required. To address concerns about extreme events not included in the VAR measure, stress tests that measure losses under more extreme conditions could be required. To address concerns over the extent of reliance on correlation benefits based primarily on "normal" conditions, supervisors could require stronger support for correlation assumptions, restrict the use of aggressive correlation assumptions, or require the use of more sophisticated techniques to model interactions between risks.

18. *What are some of the essential elements of prudent derivative risk management for insurers?*

The essential elements of prudent derivative risk management include (a) controls, audit, compliance, and fraud prevention procedures, (b) clear decision processes and accountabilities, (c) active oversight of derivative activity by the board and senior management, (d) procedures to ensure suitability and bona fide fit with insurance and risk management objectives, (e) necessary expertise to transact, model, value, audit, supervise, and report on derivatives, (f) reliable

systems and models, (g) sound and comprehensive derivative reports and accounts, (h) documented derivative risk management policies and procedures, and (i) sound and timely risk measurement and valuation practices.

19. How does prudent risk management of derivatives relate to prudent risk management of cash-market investments for insurers?

The elements of prudent derivative risk management are similar to the elements of prudent risk management for cash-market investments. Since the risks entailed by derivatives are not fundamentally different from the risks entailed by cash-market investments, they should share the same prudential risk management framework.

Prudent risk management policies, standards, practices, controls, procedures, risk quantification, and reporting for derivatives should be similar to, and well integrated with, those in place for cash-market investments. Derivatives should be subject to the condition that combined exposure to risk arising from cash-market investments and from derivatives should be no greater than the exposure to risk that is accepted, attainable, and prudent from cash-market investments. This integrated approach directly addresses the issue of how to control and prevent leveraging of risk through derivatives. This approach to establishing a prudential framework treats derivatives as alternatives to prudent cash-market transactions that achieve similar prudent risk exposures.

20. Why are controls and sound risk management practices critical to the prudent use of derivatives by insurers?

Derivatives do not introduce risks of a fundamentally different kind from those present in cash markets. Nonetheless, derivatives can be used to leverage risk in ways that make the control of derivatives a more difficult task than the control of cash-market investments. By means of derivatives, employees can enter into transactions that have huge financial implications for their employer, and they can do so with the outlay of little or no cash. Moreover, the potential for huge derivative losses may not be apparent, since the immediate financial consequences are small or favorable and the potential for huge losses may appear to be too remote for careful analysis and quantification.

Controls and processes must be put in place that are similar to those for cash-market transactions but also prevent the "leveraging" of risk by means of derivatives. Controls must be in place to prevent employees from hiding unauthorized transactions. Consequently, controls and authorizations should be in place to ensure that trading, settlement, and accounting entry functions are separate and independent. Controls should be in place to ensure that employees do not knowingly understate derivative risk exposures and so on. If insurers do

not have adequate controls or effective risk management, their use of derivatives should be severely restricted.

21. *Why are independent audit, compliance, and fraud prevention processes critical to insurers' use of derivatives?*

Insurers must not only have sound derivative risk management policies, but also must take the necessary steps to ensure that the company complies with the policies. Insurers must not only have timely and accurate derivative risk exposure reports, but also must take steps to ensure that these reports are accurate and complete measures of risk exposures.

Barings sent an audit team to investigate Leeson's trading activities. However, the audit team did not get to the bottom of what Leeson was doing. It is not sufficient merely to perform an audit. Companies need to ensure that auditors, accountants, and actuaries assessing derivative controls and financial accounts and reports have adequate knowledge to justify the reliance placed in them and adequate authority to do a thorough investigation.

22. *What are some important areas of focus for audit and compliance?*

Compliance with derivative policies, procedures, and practices should be confirmed regularly. Independent audits and regular reviews by senior management should be performed to confirm this compliance. Independent audits should be performed to ensure the accuracy, timeliness, and appropriateness of financial accounts, financial statements, and management reports. Audits should confirm that accountabilities for all derivative processes, authorities, and supervision are clear, understood, and effective.

23. *Why is it not sufficient to rely on requirements restricting the use of derivatives to hedging?*

Derivative disasters have often happened, not because companies decided to speculate or take high-risk positions, but because they speculated and took high-risk positions without knowing they were doing so. Calling something a hedge, and thinking that it is a hedge, does not make it one. Insurance supervisors should take little comfort from mere attestations that a strategy is a hedge or low risk. Sound supervision requires supervisors to confirm that insurers are following prudent derivative risk management practices.

In October 1993, Peter Baring, chairman of Baring Brothers said, "Derivatives need to be well controlled and understood, but we believe we do that here." In spite of his belief that his company did not misuse derivatives, Barings was declared insolvent in February 1995 after losing $1.36 billion on derivative specu-

lation. Long-Term Capital Management went bankrupt, Metallgesellschaft lost $1.4 billion, and Codelco (Chile) and Investors Equity Life Insurance Company of Hawaii went bankrupt or lost hundreds of millions or billions of dollars on "hedging" strategies.

24. What are some ways in which prudent derivative risk management differs between market makers and end users?

Best-practice guidelines for derivatives tend to focus on best practices for market makers, on the grounds that they have by far the greatest exposure and, therefore, presumably have the greatest need to apply best practices. However, derivative best practices for end users should not be merely watered down versions of those for market makers, because end users have their own distinct objectives and risk management requirements.

Credit risk management, state-of-the-art pricing models, and enterprise-wide, real-time risk measurement are fundamental to market makers, but less so for end users. Suitability and board and senior management oversight are central concerns to best-practice management of derivative risk by end users.

25. Why should the board and senior management actively oversee derivative activities?

Board and senior management should take an active role in overseeing derivative activities because derivatives can provide significant benefits or cause material harm to the company. There must be continuity of awareness and understanding of derivatives from the board level, through senior management, and down to the transaction level. An island of knowledge at the transaction level is very dangerous for derivatives. Boards and senior management cannot simply trust in assurances from derivative experts. They must have an appropriate understanding of the significance of the reports on derivatives made to them.

26. What aspects of derivative risk management require the attention of the board and senior management?

The scope of a company's involvement with derivatives and the policies needed to ensure their prudent use within this scope must be determined at the level of senior management and approved by the board. Active board and senior management oversight of derivative policies, risk management, measurement, monitoring, reporting, and control procedures is fundamental to prudent derivative risk management.

Senior management should ensure, and the board should confirm, that adequate resources are available to support the hiring of experts and the develop-

ment and maintenance of quality systems consistent with the insurer's use of derivatives.

27. Why is suitability such an important consideration for end users, but of little importance to market makers?

Using derivatives in a suitable way means that derivatives are used to achieve sound insurance and risk management objectives. Derivatives are suitable if and only if they resolve the problem they are designed to meet.

Analyzing the use of derivatives by end users on a stand-alone basis, without considering their context and purpose, is perverse because it diverts attention away from the fundamental question of their suitability. Specifically, capital allocation, risk measures, stress testing, disclosure, and best practices cannot be usefully applied to an end user's portfolio of derivatives on a stand-alone basis. If derivatives are suitable, the net market risk of an end user should be modest, because gains and losses on their portfolio of derivatives will generally be offset elsewhere on the balance sheet.

To market makers, derivatives represent an opportunity to earn a profit, and suitability is not an issue. The derivative portfolio of a market maker can generally be understood and analyzed on a stand-alone basis, without consideration of the context or suitability. Specifically, capital allocation, risk measures, stress testing, disclosure, and best practices can be applied directly to the market maker's portfolio of derivatives on a stand-alone basis. This is because a gain or loss on the derivative portfolio is not offset by a gain or loss elsewhere on the balance sheet.

28. What should end users do to ensure that derivative transactions are suitable?

Authorization processes and documentation should be designed to ensure the suitability of all derivatives. Insurers must have the expertise and experience to analyze, evaluate, price, understand, and monitor derivatives and to explain the suitability and purpose of all derivative activity. Records outlining the rationale underlying the decision to enter into the financial contract and the analysis of alternative strategies should be maintained. Suitability should be assessed not just at the outset, but also over the lifetime of the transaction. Results should be compared with what would have resulted if alternative derivative and cash-market strategies had been employed.

Policies could restrict or prohibit certain types of derivatives (complex, difficult to understand and value, illiquid, and so forth) that are likely to be unsuitable. Guidelines might be established setting out the purposes for which derivatives can be used. Exposure limits can be structured taking into account these purposes.

29. Describe some ways in which derivative credit risk management differs between market makers and end users.

For market makers, the desire to maximize profit drives traders to take on the highest tolerable level of credit exposure to each counterparty and to transact with counterparties with the lowest possible credit ratings. Credit is thus an all-consuming concern for market makers and subject to complex risk-return trade-offs.

For end users, derivative transactions represent solutions to problems rather than opportunities to make a profit. They are a means, not an end in themselves. Consequently, end users should have little incentive to transact in large volumes or to expose themselves excessively to any one counterparty or to counterparties with low credit ratings.

End users can restrict transactions to diversified, well-known, highly rated counterparties. Credit enhancements and concentration limits can be mandated to limit potential credit exposure. While cost is always a consideration, risk management, rather than profit maximization, should be the end user's motivation. The additional cost to transact imposed by such limits and requirements is readily justified.

30. Discuss the risks of noncompliance and fraud at end users and market makers.

The risk of noncompliance, fraud, and rogue trading is considerable with derivative market makers, because profits from client transactions, trading, and position taking are a significant portion of the market maker's total profit and traders' personal compensation. Traders have a huge incentive to take big bets, since they get the bonus on the upside and there is little personal downside. Where there is the perception that risk controls reduce profit and bonuses, traders will resist using them.

In contrast, derivatives are not a material source of profit for the typical end user. Erring on the side of prudence usually has little or no downside. Policy noncompliance at end users is often due to lack of understanding or experience, ignorance, incompetence, or mistakes. End users can address these problems by ensuring that those recommending, approving, valuing, and monitoring derivatives have the requisite competence, expertise, and training. Fraud at end users can arise in order to cover up the true financial position of the company, derivative losses, and policy noncompliance or to boost profit objectives and personal bonuses.

31. What are some of the elements of policies and guidelines for derivative risks?

Senior management should articulate and the board should approve derivative policies consistent with regulations and the insurer's overall risk appetite and capital and risk management framework. These policies should be consistent with and integrated with the company's overall risk management policies and, in particular, with policies for those cash-market investments.

Policies and guidelines should cover (a) how the board and senior management will maintain active oversight; (b) clear lines of authority for approvals, decisions, and supervision; (c) separation of functions among transacting, settling, recording, valuing, and reporting; (d) the purposes or strategies for which derivatives can be used; (e) the types of derivative transactions that are permitted or prohibited; (f) the approval process for new types of derivatives and new purposes; (g) restrictions on types of counterparties; (h) limits on the maximum market and credit risk by type of derivative and by counterparty; (i) control, monitoring, reporting, documentation, and disclosure requirements; (j) accounting, regulatory, tax, and legal review requirements; (k) requirements to ensure necessary expertise and experience; (l) requirements to ensure suitability; and (m) audit compliance and fraud prevention requirements.