

Derivatives Debacles

Case Studies of Large Losses in Derivatives Markets

Anatoli Kuprianov

To avoid all mistakes in the conduct of great enterprises is beyond man's powers. Plutarch, Lives: Fabius.

Recent years have witnessed numerous accounts of derivatives-related losses on the part of established and reputable firms. These episodes have precipitated concern, and even alarm, over the recent rapid growth of derivatives markets and the dangers posed by the widespread use of such instruments.

What lessons do these events hold for policymakers? Do they indicate the need for stricter government supervision of derivatives markets, or for new laws and regulations to limit the use of these instruments? A better understanding of the events surrounding recent derivatives debacles can help to answer such questions.

This article presents accounts of two of the costliest and most highly publicized derivatives-related losses to date. The episodes examined involve the firms of Metallgesellschaft AG and Barings PLC. Each account begins with a review of the events leading to the derivatives-related loss in question, followed by an analysis of the factors responsible for the debacle. Both incidents raise a number of public policy questions: Can government intervention stop such incidents from happening again? Is it appropriate for the government even to try? And if so, what reforms are indicated? These issues are addressed at the end of each case study, where the lessons and public policy concerns highlighted by each episode are discussed.

■ Alex Mendoza assisted in the preparation of this article. Ned Prescott, John Walter, and John Weinberg provided valuable comments on earlier drafts. Any remaining errors or omissions are the responsibility of the author. The views expressed are those of the author and do not necessarily represent those of the Federal Reserve Bank of Richmond or the Federal Reserve System.

1. RISK AND REGULATION IN DERIVATIVES MARKETS

Perhaps the most widely cited report on the risks associated with derivatives was published in 1993 by the Group of Thirty—a group consisting of prominent members of the international financial community and noted academics. The report identified four basic kinds of risks associated with the use of derivatives.¹ *Market risk* is defined as the risk to earnings from adverse movements in market prices. Press accounts of derivatives-related losses have tended to emphasize market risk; but the incidents examined in this article illustrate the importance of *operational risk*—the risk of losses occurring as a result of inadequate systems and control, human error, or management failure.

Counterparty credit risk is the risk that a party to a derivative contract will fail to perform on its obligation. Exposure to counterparty credit risk is determined by the cost of replacing a contract if a counterparty (as a party to a derivatives contract is known) were to default.

Legal risk is the risk of loss because a contract is found not to be legally enforceable. Derivatives are legal contracts. Like any other contract, they require a legal infrastructure to provide for the resolution of conflicts and the enforcement of contract provisions. Legal risk is a prime public policy concern, since it can interfere with the orderly functioning of markets.

These risks are not unique to derivative instruments. They are the same types of risks involved in more traditional types of financial intermediation, such as banking and securities underwriting. Legal risk does pose special problems for derivatives markets, however. The novelty of many derivatives makes them susceptible to legal risk because of the uncertainty that exists over the applicability of existing laws and regulations to such contracts.

Although the risks associated with derivatives are much the same as those in other areas of finance, there nonetheless seems to be a popular perception that the rapid growth of derivatives trading in recent years poses special problems for financial markets. Most of these concerns have centered on the growth of the over-the-counter (OTC) derivatives market. As Stoll (1995) notes, concern about the growth of OTC derivatives markets has arisen because these instruments are nonstandard contracts, without secondary trading and with limited public price information. Moreover, OTC markets lack some of the financial safeguards used by futures and options exchanges, such as margining systems and the daily marking to market of contracts, designed to ensure that all market participants settle any losses promptly. The absence of such safeguards, along with the complexity of many of the new generation of financial derivatives and the sheer size of the market, has given rise to concerns that the growth of derivatives trading might somehow contribute to financial instability. Finally,

¹ See Global Derivatives Study Group (1993).

there is some concern among policymakers that the federal financial regulatory agencies have failed to keep pace with the rapid innovation in OTC derivatives markets.² Such concerns have only been reinforced by frequent reports of derivatives-related losses in recent years.

The traditional rationale for regulating financial markets stems from concerns that events in these markets can have a significant impact on the economy. Much of the present-day financial regulatory system in the United States evolved as a response to financial panics that accompanied widespread economic recessions and depressions. For example, the creation of the Federal Reserve System was prompted in large part by the Panic of 1907; the advent of federal deposit insurance was a response to the thousands of bank failures that accompanied the Great Depression.

The present-day financial regulatory system has several goals. The most important is to maintain smoothly functioning financial markets. A prime responsibility of institutions like the Federal Reserve is to keep isolated events, such as the failure of a single bank, from disrupting the operation of financial markets generally. During the twentieth century, U.S. financial market regulation expanded to encompass at least two more goals. The creation of a system of federal deposit insurance in 1933 gave the federal government a stake in the financial condition of individual commercial banks, since a federal agency was now responsible for meeting a bank's obligations to its insured depositors in the event of insolvency. In addition, Congress enacted the Securities Exchange Act to help protect investors by requiring firms issuing publicly traded securities to provide accurate financial reports. The act created the Securities and Exchange Commission (SEC) to regulate the sales and trading practices of securities brokers, as well as to enforce the provisions of the law more generally.

Although financial market regulation deals largely with the problem of managing risk, it cannot eliminate all risk. Risk is inherent in all economic activity. Financial intermediaries such as commercial and investment banks specialize in managing financial risks. Regulation can seek to encourage such institutions to manage risks prudently, but it cannot eliminate the risks inherent in financial intermediation. There is a tension here. Regulators seek to reduce the risks taken on by the firms they regulate. At the same time, however, firms cannot earn profits without taking risks. Thus, an overzealous attempt to reduce risk could prove counterproductive—a firm will not survive if it cannot earn profits.

Conventional wisdom views derivatives markets as markets for risk transfer. According to this view, derivatives markets exist to facilitate the transfer of market risk from firms that wish to avoid such risks to others more willing

² See U.S. General Accounting Office (1994).

or better suited to manage those risks. The important thing to note in this regard is that derivatives markets do not create new risks—they just facilitate risk management. Viewed from this perspective, the rapid growth of derivatives markets in recent years simply reflects advances in the technology of risk management. Used properly, derivatives can help organizations reduce financial risk. Although incidents involving large losses receive the most public attention, such incidents are the exception rather than the rule in derivatives markets.

Most public policy concerns center around the speculative use of derivatives. Speculation involves the voluntary assumption of market risk in the hope of realizing a financial gain. The existence of speculation need not concern policymakers as long as all speculative losses are borne privately—that is, only by those individuals or organizations that choose to engage in such activities. But many policymakers fear that large losses on the part of one firm may lead to a widespread disruption of financial markets. The collapse of Barings illustrates some of the foundations for such concerns. In the case of an insured bank, regulators discourage speculation because it can lead to losses that may ultimately become the burden of the government.³

A view implicit in many recent calls for more comprehensive regulation of derivatives markets is that these markets are subject to only minimal regulation at present. But exchange-traded derivatives, such as futures contracts, have long been subject to comprehensive government regulation. In the United States, the SEC regulates securities and options exchanges while the Commodity Futures Trading Commission (CFTC) regulates futures exchanges and futures brokers. Although OTC derivatives markets are not regulated by any single federal agency, most OTC dealers, such as commercial banks and brokerage firms, are subject to federal regulation.⁴ As it happens, both incidents examined in this article involve instruments traded on regulated exchanges. Any judgment as to whether these incidents indicate a need for more comprehensive regulation of these markets requires some understanding of just what happened in each case.

2. METALLGESELLSCHAFT

Metallgesellschaft AG (hereafter, MG) is a large industrial conglomerate engaged in a wide range of activities, from mining and engineering to trade and financial services. In December 1993, the firm reported huge derivatives-related

³ Recent losses by firms such as Gibson Greetings and Procter & Gamble have also raised concerns about sales practices and the disclosure of risks associated with complex financial derivatives. Neither of the cases examined in this study involves such concerns, however.

⁴ Many securities companies book their OTC derivatives through unregulated subsidiaries. Although these subsidiaries are not subject to formal SEC regulation, the largest brokerage firms have agreed to abide by certain regulatory guidelines and to make regular disclosures to both the SEC and CFTC about their management of derivatives-related risks. See Taylor (1995a).

losses at its U.S. oil subsidiary, Metallgesellschaft Refining and Marketing (MGRM). These losses were later estimated at over \$1 billion, the largest derivatives-related losses ever reported by any firm at the time. The incident helped bring MG—then Germany’s fourteenth largest industrial corporation—to the brink of bankruptcy. After dismissing the firm’s executive chairman, Heinz Schimmelbusch, and several other senior managers, MG’s board of supervisors was forced to negotiate a \$1.9 billion rescue package with the firm’s 120 creditor banks (Roth 1994a, b).

MG’s board blamed the firm’s problems on lax operational control by senior management, charging that “speculative oil deals . . . had plunged Metallgesellschaft into the crisis.”⁵ Early press reports on the incident echoed this interpretation of events, but subsequent studies report that MGRM’s use of energy derivatives was an integral part of a combined marketing and hedging program under which the firm offered customers long-term price guarantees on deliveries of petroleum products such as gasoline and heating oil. Reports that MG’s losses were attributable to a hedging program have raised a host of new questions. Many analysts remain puzzled by the question of how a firm could lose over \$1 billion by hedging.

The Metallgesellschaft debacle has sparked a lively debate on the shortcomings of the firm’s hedging strategy and the lessons to be learned from the incident. The ensuing account draws from a number of recent articles, notably Culp and Hanke (1994); Culp and Miller (1994a, b, 1995a, b, c, d); Edwards and Canter (1995a, b); and Mello and Parsons (1995a, b).

MGRM’s Marketing Program

In 1992, MGRM began implementing an aggressive marketing program in which it offered long-term price guarantees on deliveries of gasoline, heating oil, and diesel fuels for up to five or ten years. This program included several novel contracts, two of which are relevant to this study. The first was a “firm-fixed” program, under which a customer agreed to fixed monthly deliveries at fixed prices. The second, known as the “firm-flexible” contract, specified a fixed price and total volume of future deliveries but gave the customer some flexibility to set the delivery schedule. Under the second program, a customer could request 20 percent of its contracted volume for any one year with 45 days’ notice. By September 1993, MGRM had committed to sell forward the equivalent of over 150 million barrels of oil for delivery at fixed prices, with most contracts for terms of ten years.

Both types of contracts included options for early termination. These “cash-out provisions” permitted customers to call for cash settlement on the full volume of outstanding deliveries if market prices for oil rose above the

⁵ As cited in Edwards and Canter (1995b), p. 86.

contracted price. The firm-fixed contract permitted a customer to receive one-half the difference between the current nearby futures price (that is, the price of the futures contract closest to expiration) and the contracted delivery price, multiplied by the entire remaining quantity of scheduled deliveries. The firm-flexible contract permitted a customer to receive the full difference between the second-nearest futures price and the contract price, multiplied by all remaining deliverable quantities.⁶

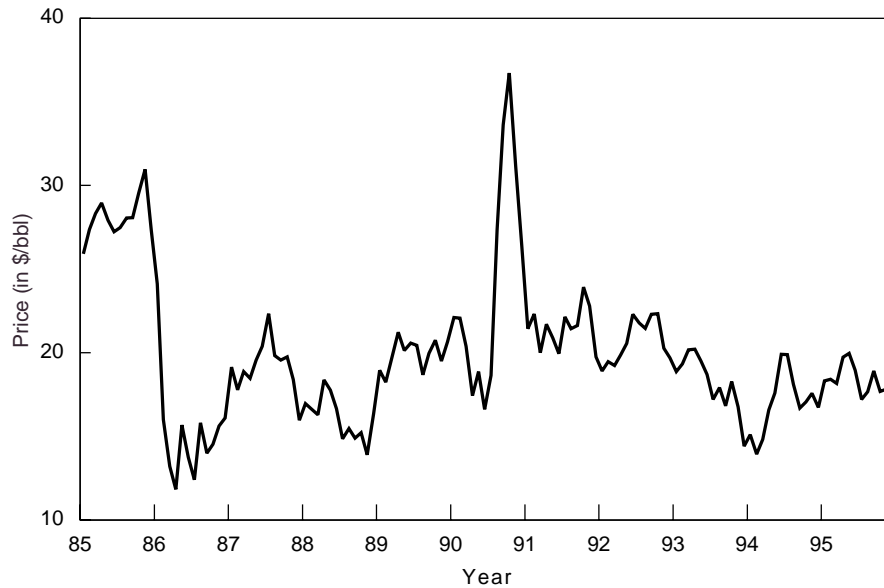
MGRM negotiated most of its contracts in the summer of 1993. Its contracted delivery prices reflected a premium of \$3 to \$5 per barrel over the prevailing spot price of oil. As is evident in Figure 1, energy prices were relatively low by recent historical standards during this period and were continuing to fall. As long as oil prices kept falling, or at least did not rise appreciably, MGRM stood to make a handsome profit from this marketing arrangement. But a significant increase in energy prices could have exposed the firm to massive losses unless it hedged its exposure.

MGRM sought to offset the exposure resulting from its delivery commitments by buying a combination of short-dated oil swaps and futures contracts as part of a strategy known as a “stack-and-roll” hedge. In its simplest form, a stack-and-roll hedge involves repeatedly buying a bundle, or “stack,” of short-dated futures or forward contracts to hedge a longer-term exposure. Each stack is rolled over just before expiration by selling the existing contracts while buying another stack of contracts for a more distant delivery date; hence the term stack-and-roll. MGRM implemented its hedging strategy by maintaining long positions in a wide variety of contract months, which it shifted between contracts for different oil products (crude oil, gasoline, and heating oil) in a manner intended to minimize the costs of rolling over its positions.

Had oil prices risen, the accompanying gain in the value of MGRM’s hedge would have produced positive cash flows that would have offset losses stemming from its commitments to deliver oil at below-market prices. As it happened, however, oil prices fell even further in late 1993. Moreover, declines in spot and near-term oil futures and forward prices significantly exceeded declines in long-term forward prices. As a result, contemporaneous realized losses from the hedge appeared to exceed any potential offsetting gains accruing to MGRM’s long-term forward commitments.

This precipitous decline in oil prices caused funding problems for MGRM. The practice in futures markets of marking futures contracts to market at the end of each trading session forced the firm to recognize its futures trading losses immediately, triggering huge margin calls. Normally, forward contracts have the advantage of permitting hedgers to defer recognition of losses on long-term commitments. But MGRM’s stack-and-roll hedge substituted

⁶ Mello and Parsons (1995b) provide a detailed description of these contracts.

Figure 1 Crude Oil Prices: 1985–1995

short-term forward contracts (in the form of short-term energy swaps maturing in late 1993) for long-term forward contracts. As these contracts matured, MGRM was forced to make large payments to its counterparties, putting further pressure on its cash flows. At the same time, most offsetting gains on its forward delivery commitments were deferred.

Rumors of MGRM's problems began to surface in early December. In response to these developments, the New York Mercantile Exchange (NYMEX), the exchange on which MGRM had been trading energy futures, raised its margin requirements for the firm. This action, which was intended to protect the exchange in case of a default, further exacerbated MGRM's funding problems. Rumors of the firm's financial difficulties led many of its OTC counterparties to begin terminating their contracts. Others began demanding that it post collateral to secure contract performance.

Upon learning of these circumstances, MG's board of supervisors fired the firm's chief executive and installed new management. The board instructed MG's new managers to begin liquidating MGRM's hedge and to enter into negotiations to cancel its long-term contracts with its customers. This action further complicated matters, however. NYMEX withdrew its hedging exemption once MGRM announced the end of its hedging program. Hedging exemptions permit firms to take on much larger positions in exchange-traded futures than

those allowed for unhedged, speculative positions. The loss of its hedging exemption forced MGRM to reduce its positions in energy futures still further (Culp and Miller 1994b).

The actions of MG's board of supervisors in this incident have spurred widespread debate and criticism, as well as several lawsuits. Some analysts argue that MGRM's hedging program was seriously flawed and that MG's board was right to terminate it. Others, including Nobel Prize-winning economist Merton Miller, argue that the hedging program was sound and that MG's board exacerbated any hedging-related losses by terminating the program prematurely. The discussion that follows reviews the hedging alternatives that were open to the firm, the risks associated with the strategy it chose, and critiques of that strategy offered by a number of economists.

Hedging Alternatives

In common usage, the term "hedging" refers to an attempt to avoid the risk of loss by matching a given risk exposure with a counterbalancing risk, as in hedging a bet. Elementary finance textbooks are replete with examples of perfect hedges, wherein a firm uses futures or forward contracts to offset perfectly some given exposure. Hedging strategies employed by firms tend to be somewhat more complex, however. In practice, a perfect hedge can be difficult to arrange. And even when feasible, such a strategy often leaves little room for profit.

Edwards and Canter (1995a, b) note that MGRM had at least three hedging options open to it: physical storage, long-dated forward contracts, and some variant of a stack-and-roll strategy. Physical storage would have required MGRM to purchase the oil products it had committed itself to deliver in the future and then store those products until the promised delivery dates. Physical storage would have been expensive, however. First, it would have required MGRM to finance the cost of the required inventories. Second, it would have entailed the cost of the requisite storage facilities. Together, these two costs comprise what is known as the cost of carry. Available evidence suggests that the costs associated with physical storage would have rendered MGRM's marketing program unprofitable.⁷

Alternatively, MGRM could have chosen among a number of derivatives-based hedging strategies involving either futures or forward contracts, or some combination of both. Putting together a perfect hedge using such instruments would have required the purchase of a bundle of oil futures or forward contracts with expiration dates just matching MGRM's promised delivery dates. But oil futures typically trade only for maturities of three years or less. Moreover, liquidity tends to be poor for contracts with maturities over 18 months. Thus, MGRM would have had to buy a bundle of long-dated forward contracts from

⁷ See Edwards and Canter (1995a, b), and Mello and Parsons (1995b).

an OTC derivatives dealer to put together a hedge that just offset its exposure to long-term energy prices.

Like physical storage, however, the cost associated with buying a bundle of long-dated forward contracts probably would have been prohibitive. To understand why, note that buying a futures or forward contract is equivalent to physical storage in the sense that both strategies ensure the future availability of an item at some predetermined cost. For this reason, the strategy of buying futures or forward contracts to lock in the cost of future delivery is sometimes termed “synthetic storage.” Accordingly, Arbitrage Pricing Theory predicts that the forward price for a commodity should reflect its cost of carry. Based on the factors considered to this point, then, the theoretical no-arbitrage or benchmark forward price should be

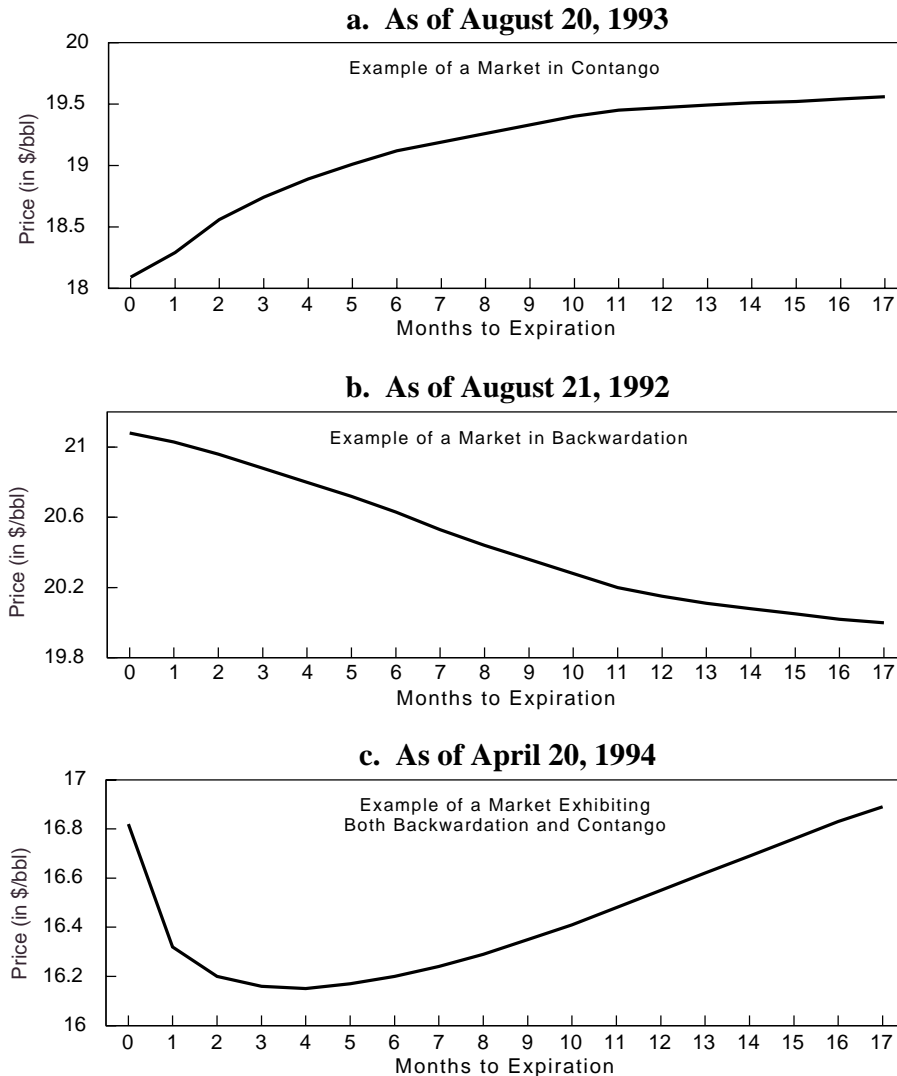
$$\text{THEORETICAL FORWARD PRICE} = \text{SPOT PRICE} + \text{COST OF CARRY.}$$

Notice that this relationship implies that buyers of futures and forward contracts should pay a premium for deferred delivery. This premium is known as contango in the parlance of futures markets. Figure 2a, which shows the term structure of crude oil futures prices as of August 20, 1993, provides an example of a contango market.

These theoretical considerations suggest that futures prices should always exhibit contango. As is evident in Figure 2b, however, they do not always do so. Arbitrage ensures that the forward price of a commodity can never exceed the theoretical benchmark price, but it evidently does not prevent futures and forward prices from falling below this theoretical benchmark. To understand why, consider the opportunities for arbitrage that would arise if futures prices exceeded the benchmark forward price derived above. In this case, an arbitrageur could earn riskless profits by buying and storing the commodity in question while selling it forward at a price exceeding the purchase price plus the cost of carry. Futures prices can fail to reflect a commodity’s full cost of carry if firms place a premium on current availability, however, as they sometimes do when available supplies of the commodity are scarce. In such cases there is said to be a convenience yield associated with physical storage. The simple cost-of-carry price relation presented above fails to take account of convenience yields, but it does suggest a way to measure them. The convenience yield for an item can be measured by computing the difference between the benchmark forward price (the sum of the current spot price and the cost of carry) and the prevailing market-determined forward price.

$$\begin{aligned} \text{CONVENIENCE YIELD} = \\ \text{SPOT PRICE} + \text{COST OF CARRY} - \text{ACTUAL FORWARD PRICE} \end{aligned}$$

Sometimes the convenience yield is high enough to offset the cost of carry, causing forward prices to be lower than spot prices, as in Figure 2b. This latter phenomenon is known as backwardation.

Figure 2 Term Structure of Crude Oil Futures Prices

When it exists, backwardation in commodity markets tends to be evident only in short-term futures and forward prices. Carrying costs increase with time to delivery so that longer-term futures or forward contracts typically sell at a premium even when prices for short-dated contracts exhibit backwardation. Figure 2b shows that the pattern of backwardation extended out to at least 18

months as of August 21, 1992. At other times, however, futures prices begin increasing at shorter horizons. Figure 2c shows the term structure of crude oil futures prices as of April 20, 1994. On this latter date, futures prices exhibited backwardation only for the first four delivery months and then began rising.

The foregoing discussion shows that a hedging strategy based on long-term forward contracts can be almost as expensive as physical storage, even when short-term futures and forward prices exhibit backwardation. So although MGRM could have hedged its exposure by buying long-term forward contracts from an OTC derivatives dealer, doing so would have reduced, if not eliminated, any profits from its marketing program. Moreover, any dealer selling such contracts would have faced similar hedging problems.

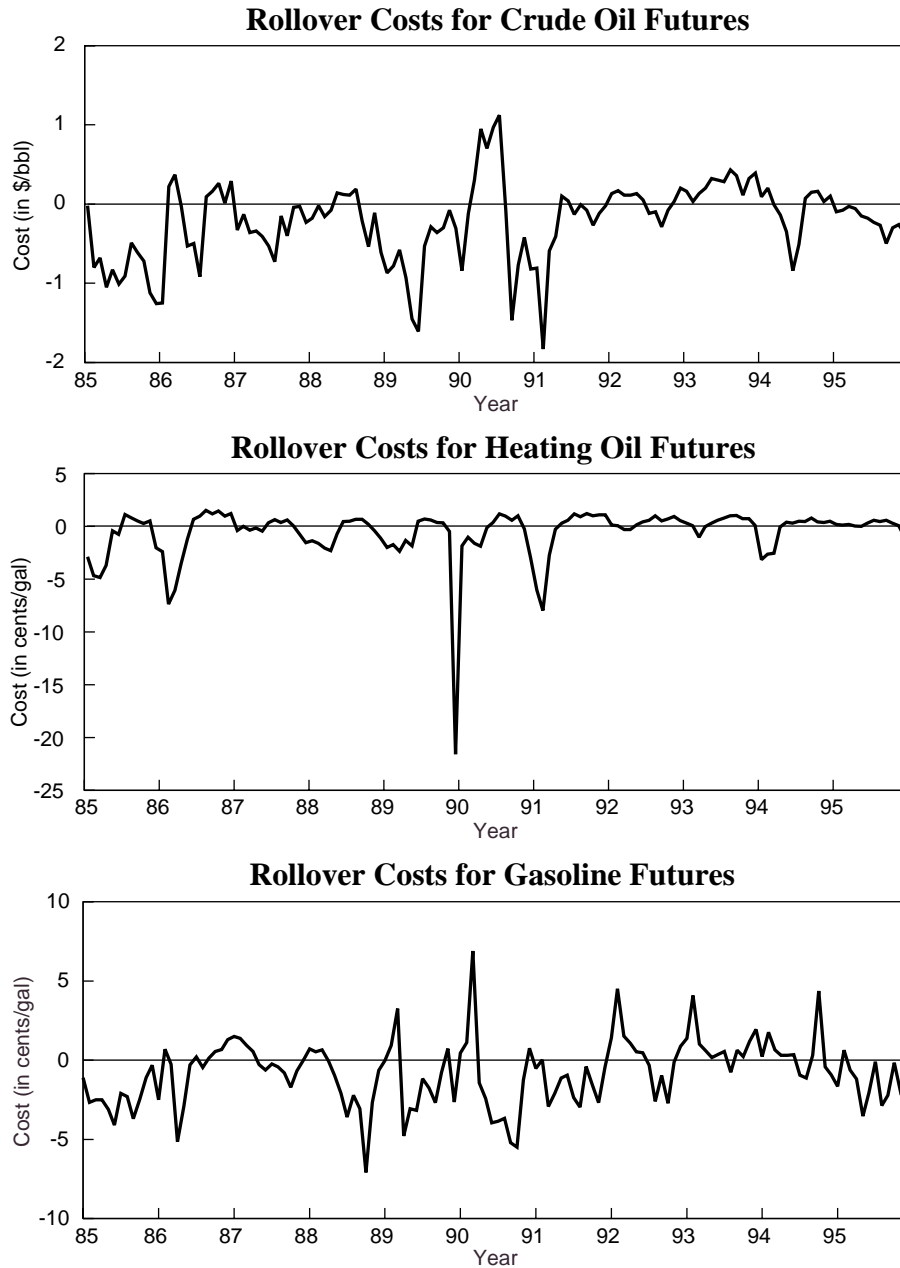
A stack-and-roll strategy appeared to offer a means of avoiding such carrying costs because short-dated futures markets for oil products historically have tended to exhibit backwardation. In markets that exhibit persistent backwardation, a strategy of rolling over a stack of expiring contracts every month can generate profits. Thus, MGRM's management apparently thought that a stack-and-roll hedging strategy offered a cost-effective means of locking in a spread between current spot prices and the long-term price guarantees it had sold to its customers. As noted earlier, however, this strategy was not without risks. These risks are examined in more detail below.

Basis Risk

The term "basis" refers to the difference between the spot price of an item and its futures price. Basis changes over the life of a contract, usually for fundamental economic reasons but sometimes for reasons that are not well understood. MGRM's stack-and-roll hedging strategy exposed it to basis risk—the risk that the price behavior of its stack of short-dated oil contracts might diverge from that of its long-term forward commitments. As it happened, the behavior of energy futures prices became most unusual in 1993—in that short-term energy futures exhibited a pattern of contango rather than backwardation for most of the year. Once near-dated energy futures and forward markets began to exhibit contango, MGRM was forced to pay a premium to roll over each stack of short-term contracts as they expired. These rollover costs reflected the cost of carry normally associated with physical storage.

This shift is evident in Figure 3, which shows the behavior of rollover costs for three different energy futures contracts (crude oil, heating oil, and gasoline) from 1985 through the end of 1995.⁸ As is evident from these figures, rollover costs were positive for most of 1993. The expected profitability of MGRM's

⁸ Here, rollover costs are measured by the difference between the closing price of the nearby futures contract three days before the contract expiration date and the price of the next more distant futures contract, as in Edwards and Canter (1995a).

Figure 3

Note: Rollover costs are measured as of three days before contract expiration.

combined marketing and hedging program was predicated on the assumption that energy futures markets would continue to exhibit a pattern of backwardation, however. MG's board of supervisors apparently feared that the need to pay these rollover costs could add further to MGRM's losses and chose to liquidate the subsidiary's hedge and terminate its long-term delivery contracts with its customers.

Critiques of MGRM's Hedging Program

As Figure 1 shows, oil prices began rising in 1994, soon after MGRM's new management lifted the firm's hedge. It thus appears that MGRM could have recouped most if not all of its losses simply by sticking to its hedging program. Whether management should have been able to anticipate this outcome is the topic of an active debate, however.

Criticisms of MGRM's hedging program have focused on two issues. The first deals with the assumptions the architects of MGRM's hedging strategy made regarding the likely future behavior of basis in oil futures and forward markets. The second concerns the steps MGRM could have taken to reduce the variability of its cash flows.

Both Edwards and Canter (1995a) and Mello and Parsons (1995b) show that MGRM's hedging program would have generated huge losses if contango energy markets had persisted throughout 1994. A key question, then, is whether MG's board of supervisors should have viewed the behavior of energy futures prices during 1993 as a temporary aberration, or whether it had reasonable grounds to believe that this price behavior could persist indefinitely.

Edwards and Canter conclude that permanent changes in the behavior of basis are possible and have occurred in other futures markets. As evidence, they cite experience with two other commodity futures contracts: soybeans and copper. Both markets were characterized by backwardation from 1965 to 1975, but then began exhibiting persistent contango. Thus, while a stack-and-roll hedging strategy for either commodity would have produced positive cash flows on average before 1975, such a strategy would have lost money consistently over the ensuing ten-year period—meaning that a hedger employing a stack-and-roll strategy of the type used by MGRM in either soybean or copper futures markets would have experienced large and persistent losses after 1975.

Along with Mello and Parsons (1995a, b), Edwards and Canter (1995a, b) argue that MGRM was overhedged because short-term oil futures prices tend to be much more volatile than prices on long-term forward contracts. According to these authors, MGRM's managers could have—and should have—designed a hedge that would have reduced the variability of the firm's short-term cash flows. Edwards and Canter find that the correlation of short-term energy futures and forward prices with long-term prices is approximately 50 percent. Thus, they argue that MGRM could have minimized the variance of

its cash flows with a hedge approximately 50 percent smaller than the total of its future delivery commitments.⁹ Mello and Parsons observe that the exact size of a minimum-variance hedge is difficult to calculate because MGRM's contracts gave its customers options to terminate their contracts after three years. They find that the minimum-variance hedge ratio could be as high as 75 percent if one assumes that all such options would be exercised at the end of three years.

While critical of certain aspects of MGRM's hedging strategy, Edwards and Canter are agnostic as to whether MG's board was correct to terminate its U.S. subsidiary's oil-hedging program.¹⁰ Mello and Parsons (1995a, b) are more critical of MGRM's hedging strategy, arguing that it was speculative in its design and intent. They base their views on a written strategic plan prepared by MGRM's management, which outlined a plan to exploit backwardation in futures markets as part of its hedging program. Where the plan went wrong, according to Mello and Parsons, was in assuming that the firm could take advantage of backwardation to price its long-term customer contracts below the full cost of carry. They conclude that viewing MGRM's stack-and-roll strategy as a hedge reverses the order of cause and effect, arguing that it should be viewed as a misguided speculative attempt to profit from the backwardation normally present in futures markets for petroleum products while using forward delivery contracts as a partial hedge.

A Defense of MGRM's Hedging Strategy

Culp and Miller (1994a, b, 1995a, b, c, d) and Culp and Hanke (1994) are critical of MG's board of supervisors for terminating MGRM's marketing and hedging program. These authors argue that MGRM's hedging strategy was sound and that the firm's losses are attributable primarily to the way the board terminated the program.

While acknowledging that the volatility of short-term oil prices did make MGRM's cash flows volatile, Culp and Miller argue that short-term cash flow volatility is irrelevant to judgments about the efficacy of MGRM's hedging program. They base this argument on two considerations. The first stems from a theoretical analysis of the properties of a stack-and-roll hedge, the second from a practical analysis of MG's ability to continue funding the program.

First, Culp and Miller (1994b, 1995d) demonstrate that a stack-and-roll hedge of the type employed by MGRM will offset perfectly any changes in the

⁹ A 50 percent hedge ratio does not take into account that changes in the value of a long-term forward contract will not be realized for many years, however. The procedure for doing so is known as "tailing the hedge" (see Kawaller [1986] for a description). Tailing the hedge lowers the recommended hedge ratio even further. Edwards and Canter estimate that MGRM could have minimized the variance of its cash flows by buying short-term futures contracts for 61 million barrels of oil to hedge a 160 million barrel long-term exposure.

¹⁰ In a more recent article, however, Edwards (1995) is somewhat more critical of the decision to liquidate MGRM's forward delivery contracts.

value of a long-term forward commitment so long as the factors determining basis—interest rates, storage costs, and the implicit convenience yield associated with physical storage—do not change. Thus, according to Culp and Miller, it is misleading to blame MG's losses on changes in the term structure of oil prices. While short-term price volatility can make cash flows volatile, it does not affect the net present value of the hedged exposure as long as basis remains unchanged.

As noted earlier, however, the behavior of basis did change in the summer of 1993. Culp and Miller acknowledge that MGRM's hedging strategy exposed the firm to basis risk, but they argue that this risk was relatively small considering the historical behavior of energy futures prices. Their analysis shows that changes in basis affect only the portion of carrying costs borne by the hedger. The hedger bears no carrying costs as long as the convenience yield is greater than or equal to the cost of carry—that is, when the market exhibits backwardation—but must bear at least some portion of carrying costs in a contango market. These carrying costs appear as rollover costs.

No one has attempted to refute Culp and Miller's theoretical results. Rather, other authors question the presumption that oil markets would always tend to exhibit backwardation, whereas Culp and Miller argue that any long-run expected losses due to basis risk were minimal considering historical patterns of backwardation in energy markets.

At first glance, the results of Culp and Miller's analysis appear difficult to reconcile with the \$1.3 billion loss auditors later attributed to MGRM's marketing and hedging program. Culp and Miller (1995c) take issue with this estimate, however, arguing that MG's auditors underestimated the value of MGRM's contracts with its customers. They argue that taking proper account of unrealized gains in the value of such contracts results in a net loss of \$170 million rather than \$1.3 billion. According to Culp and Miller, most of MG's reported losses were attributable to the manner in which its new management chose to terminate its subsidiary's marketing program, not to defects in its hedging strategy. It is not unusual for the parties to such agreements to negotiate termination of a contract before it expires. The normal practice in such circumstances involves payment by one party to the other to compensate for any changes in the value of the contract. In contrast, it appears that MGRM's new management simply agreed to terminate its contracts with its customers without asking for any payment to reflect changes in the value of those contracts. The hedge—however imperfect—effectively was transformed by this action into a huge speculative transaction after the fact.

Although Culp and Miller do find that MGRM's hedging program had suffered losses (albeit much smaller losses than those calculated by MG's auditors), they argue that those losses did not justify terminating MGRM's hedging program. First, they emphasize that any past losses were sunk costs. At the same time, they find that the program had a positive expected net present

value at the end of 1993.¹¹ Thus, they argue that the firm had good reason to continue the program. Culp and Miller reject the board's argument that terminating MGRM's hedge was the only way of dealing with the subsidiary's massive cash outflows. They note that the firm could have bought options to remain hedged while it sought solutions to its longer-term funding problems. Moreover, they argue that short-term cash flow constraints should not have presented any insurmountable problems in view of MG's long-standing and close relations with Deutsche Bank, Germany's largest commercial bank. They emphasize that Deutsche Bank was not only a creditor to MG but also one of its largest shareholders. In addition, a Deutsche Bank executive, Ronaldo Schmitz, was chairman of MG's board of supervisors at the time. Accordingly, Culp and Miller conclude that the Deutsche Bank should have been willing to continue financing MGRM's hedge in view of its close relations with MG and its expertise in finance.

At the very least, Culp and Miller suggest, MG's management could have bought options to hedge its oil exposure while seeking a longer-term solution to its funding problems, as suggested by MGRM's management. As a longer-term solution, they argue that the firm could have spun off the combined marketing and hedging program into a separate subsidiary, which could have been sold to another firm. This argument is supported by Edwards (1995), who reports that at least one major U.S. bank had offered to provide secured financing to MGRM based on a plan to securitize its forward delivery contracts.

Besides taking issue with the actions of MG's board of supervisors, Culp and Hanke (1994) fault NYMEX for the actions the exchange took against MGRM. They argue that these actions needlessly exacerbated MGRM's temporary cash flow problems and thereby helped to precipitate a funding crisis for the firm.

Reconciling Opposing Views

Disagreements over the efficacy of MGRM's hedging program stem from differing assumptions about (1) the goal of the hedging program (or, perhaps more accurately, what the goal should have been), and (2) the feasibility of continuing the program in light of the large negative cash flows MGRM experienced in late 1993. Both Edwards and Canter (1995a, b) and Mello and Parsons (1995a, b) emphasize the difficulties that the large negative cash flows produced by the hedging program caused the parent company. These authors argue that MGRM's management should have sought to avoid such difficulties by designing a hedge that would have minimized the volatility of its cash flows.

Although they are critical of MGRM's hedging strategy, Edwards and Canter offer no opinion as to whether MG's board was right to terminate

¹¹ Note, however, that this estimate is based on the assumption that expected carrying costs would be zero over the long run. See Culp and Miller (1995a, b, d).

the program. Like Culp and Miller, they are puzzled about the decision to terminate existing contracts with customers without negotiating some payment to compensate for the increase in the value of those contracts.

Mello and Parsons's criticisms of MGRM's hedging strategy are unequivocal. They argue that MGRM's strategy was fatally flawed, and they defend the decision to terminate the hedging program as the only means of limiting even greater potential future losses. They also emphasize the difficulty that MG's new management would have had in securing the financing necessary to maintain MGRM's hedging program and argue that funding considerations should have led the subsidiary's managers to synthesize a hedge using long-dated forward contracts. In this context, Mello and Parsons note that the parent firm already had accumulated a cash flow deficit of DM 5.65 billion between 1988 and 1993. This deficit had been financed largely by bank loans. Considering these circumstances, they find the reluctance of MG's creditor banks to fund the continued operation of the oil marketing program understandable.

Culp and Miller accept that MGRM's hedge was intended to exploit the backwardation normally present in energy futures markets, but they reject the argument that its hedging program represented reckless speculation. They emphasize that few, if any, commodity dealers always hedge away all risks, citing the results of previous studies on the behavior of commodity dealers to support their assertions (Culp and Miller 1995a, b). Thus, they conclude that short-term cash flow constraints should not have presented any insurmountable problems in view of MG's long-standing and close relations with Deutsche Bank, which they feel should have been willing to continue financing MGRM's hedging program.

These disagreements over the efficacy of MGRM's hedging strategy seem unlikely ever to be resolved, based as they are on different assumptions about the goals management should have had for its strategy. The main issue, then, is whether MG's senior management and board of supervisors fully appreciated the risks the firm's U.S. oil subsidiary had assumed. If they did, the firm should have arranged for a line of credit to fund its short-term cash flows. Indeed, Culp and Miller (1995a, b, d) claim that MGRM had secured lines of credit with its banks just to prepare for such contingencies. Yet the subsequent behavior of MG's board suggests that its members had very little prior knowledge of MGRM's marketing program and were uncomfortable with its hedging strategy, despite the existence of a written strategic plan.

It is difficult for an outside observer to assign responsibility for any misunderstandings between MG's managers and its board of supervisors. MG's board ultimately held Heinz Schimmelbusch, the firm's executive chairman, responsible for the firm's losses, claiming that he and other senior managers had lost control over the activities of the firm and concealed evidence of losses.¹² In

¹² See *The Wall Street Journal* (1993) and *The Economist* (1993).

response, Schimmelbusch has filed suit against Ronaldo Schmitz and Deutsche Bank, seeking \$10 million in general and punitive damages (Taylor 1995b). Arthur Benson, former head of MGRM and architect of the firm's ill-fated hedging program, is suing MG's board for \$1 billion on charges of defamation (Taylor 1994). Thus, the issue of blame appears destined to be settled by the U.S. courts.

Response of the CFTC

The Metallgesellschaft debacle did not escape the attention of U.S. regulators. In July 1995, the U.S. Commodity Futures Trading Commission (CFTC) instituted administrative proceedings against MGRM and MG Futures, Inc. (MGFI), an affiliated Futures Commission Merchant that processed trades for MGRM and other MG subsidiaries.¹³ The CFTC order charged both MGRM and MGFI with "material inadequacies in internal control systems" associated with MGRM's activity in energy and futures markets. In addition, MGFI was charged with failing to inform the CFTC of these material inadequacies, while MGRM was charged with selling illegal, off-exchange futures contracts. The two MG subsidiaries settled the CFTC action without admitting or denying the charges and agreed to pay the CFTC a \$2.5 million settlement. They also agreed to implement a series of CFTC recommendations to reform their internal controls and to refrain from violating CFTC regulations. The CFTC's action rendered MGRM's firm-fixed agreements "illegal and void."¹⁴ Thus, the CFTC's action would have created legal risk for Metallgesellschaft and its customers except that the firm had already canceled most of the contracts in question.

The CFTC's actions in this case have proven somewhat controversial. Under the Commodity Exchange Act, the CFTC is charged with regulating exchange-traded futures contracts. At the same time, the act explicitly excludes ordinary commercial forward contracts from the jurisdiction of the CFTC. The legal definition of a futures contract is open to differing interpretations, however, leading to some uncertainty over the legal status of OTC derivatives under the Commodity Exchange Act. Most market participants felt that this uncertainty was resolved in 1993 when, at the behest of Congress, the CFTC agreed to exempt off-exchange forward and swaps contracts from regulations governing exchange-traded contracts. CFTC chairman Mary Schapiro maintains that the agency's action against MGRM does not represent a reversal of its policy on OTC contracts. According to Schapiro, the CFTC's order is worded narrowly so as to apply only to contracts such as the firm-fixed (45-day) agreements sold

¹³ A Futures Commission Merchant is a broker that accepts and executes orders for transactions on futures exchanges for customers. Futures Commission Merchants are regulated by the CFTC.

¹⁴ See U.S. Commodity Futures Trading Commission (1995a, b).

by MGRM in this case.¹⁵ Nonetheless, this action has prompted some critics to charge the agency with creating uncertainty about the legal status of commercial forward contracts. Critics of the action include Miller and Culp (1995) and Wendy Gramm, a former chairman of the CFTC.¹⁶ The CFTC's action has also been criticized by at least two prominent members of Congress—Rep. Thomas J. Bliley, Jr., Chairman of the House Commerce Committee; and Rep. Pat Roberts, Chairman of the House Agricultural Committee.¹⁷

Since the CFTC's action against Metallgesellschaft is narrowly directed and involves somewhat esoteric legal arguments, it is too soon to know what its effect will be on OTC derivatives markets generally. Still, commodity dealers must now take extra care in designing long-term delivery contracts to avoid potential legal problems.¹⁸

An Overview of Policy Concerns

Considering the debate over the merits of MGRM's hedging strategy, it would seem naive simply to blame the firm's problems on its speculative use of derivatives. It is true that MGRM's hedging program was not without risks. But the firm's losses are attributable more to operational risk—the risk of loss caused by inadequate systems and control or management failure—than to market risk. If MG's supervisory board is to be believed, the firm's previous management lost control of the firm and then acted to conceal its losses from board members. If one sides with the firm's previous managers (as well as with Culp, Hanke, and Miller), then the supervisory board and its bankers misjudged the risks associated with MGRM's hedging program and panicked when faced with large, short-term funding demands. Either way, the loss was attributable to poor management.

Does this episode indicate the need for new government policies or more comprehensive regulation of derivatives markets? The answer appears to be no. MGRM's losses do not appear ever to have threatened the stability of financial markets. Moreover, those losses were due in large part to the firm's use of futures contracts, which trade in a market that is already subject to comprehensive regulation. The actions taken by the CFTC in this instance demonstrate clearly that U.S. regulators already have the authority to intervene when they deem it necessary. Unfortunately, the nature of those actions in this case may create added legal risk for other market participants.

To view the entire incident in its proper perspective, it must be remembered that MG's losses were incurred in connection with a marketing program

¹⁵ See *BNA's Banking Report* (1995a).

¹⁶ For a summary of Gramm's comments see *The Wall Street Journal* (1995).

¹⁷ See Fox (1995).

¹⁸ See Rance (1995) for a legal analysis of these issues.

aimed at providing long-term, fixed-price delivery contracts to customers—a type of arrangement common to many types of commercial activity. Systematic attempts to discourage such arrangements would seem to be poor public policy.

Finally, MG's financial difficulties were not attributable solely to its use of derivatives. As noted earlier, the firm's troubles stemmed in part from the heavy debt load it had accumulated in previous years. Moreover, MGRM's oil marketing program was not the only source of its parent company's losses during 1993. MG reported losses of DM 1.8 billion on its operations for the fiscal year ended September 30, 1993, in addition to the DM 1.5 billion loss auditors attributed to its hedging program as of the same date (Roth 1994a). Simply stated, the MG debacle resulted from poor management. As a practical matter, government policy cannot prevent firms such as Metallgesellschaft from making mistakes. Nor should it attempt to do so.

3. BARINGS

At the time of its demise in February 1995, Barings PLC was the oldest merchant bank in Great Britain. Founded in 1762 by the sons of German immigrants, the bank had a long and distinguished history. Barings had helped a fledgling United States of America arrange the financing of the Louisiana Purchase in 1803. It had also helped Britain finance the Napoleonic Wars, a feat that prompted the British government to bestow five noble titles on the Baring family.

Although it was once the largest merchant bank in Britain, Barings was no longer the powerhouse it had been in the nineteenth century. With total shareholder equity of £440 million, it was far from the largest or most important banking organization in Great Britain. Nonetheless, it continued to rank among the nation's most prestigious institutions. Its clients included the Queen of England and other members of the royal family.

Barings had long enjoyed a reputation as a conservatively run institution. But that reputation was shattered on February 24, 1995, when Peter Baring, the bank's chairman, contacted the Bank of England to explain that a trader in the firm's Singapore futures subsidiary had lost huge sums of money speculating on Nikkei-225 stock index futures and options. In the days that followed, investigators found that the bank's total losses exceeded US\$1 billion, a sum large enough to bankrupt the institution.

Barings had almost failed once before in 1890 after losing millions in loans to Argentina, but it was rescued on that occasion by a consortium led by the Bank of England. A similar effort was mounted in February 1995, but the attempt failed when no immediate buyer could be found and the Bank of England refused to assume liability for Barings's losses. On the evening of Sunday, February 26, the Bank of England took action to place Barings into

administration, a legal proceeding resembling Chapter 11 bankruptcy-court proceedings in the United States. The crisis brought about by Barings's insolvency ended just over one week later when a large Dutch financial conglomerate, the Internationale Nederlanden Groep (ING), assumed the assets and liabilities of the failed merchant bank.

What has shocked most observers is that such a highly regarded institution could fall victim to such a fate. The ensuing account examines the events leading up to the failure of Barings, the factors responsible for the debacle, and the repercussions of that event on world financial markets.¹⁹ This account is followed by an examination of the policy concerns arising from the episode and the lessons these events hold for market participants and policymakers.

Unauthorized Trading Activities

In 1992, Barings sent Nicholas Leeson, a clerk from its London office, to manage the back-office accounting and settlement operations at its Singapore futures subsidiary. Baring Futures (Singapore), hereafter BFS, was established to enable Barings to execute trades on the Singapore International Monetary Exchange (SIMEX). The subsidiary's profits were expected to come primarily from brokerage commissions for trades executed on behalf of customers and other Barings subsidiaries.²⁰

Soon after arriving in Singapore, Leeson asked permission to take the SIMEX examinations that would permit him to trade on the floor of the exchange. He passed the examinations and began trading later that year. Some time during late 1992 or early 1993, Leeson was named general manager and head trader of BFS. Normally the functions of trading and settlements are kept separate within an organization, as the head of settlements is expected to provide independent verification of records of trading activity. But Leeson was never relieved of his authority over the subsidiary's back-office operations when his responsibilities were expanded to include trading.

¹⁹ This account is based on the findings of a report by the Board of Banking Supervision of the Bank of England (1995) and on a number of press accounts dealing with the episode. Except where otherwise noted, all information on this episode was taken from the Board of Banking Supervision's published inquiry.

²⁰ Most of BFS's business was concentrated in executing trades for a limited number of financial futures and options contracts. These were the Nikkei-225 contract, the 10-year Japanese Government Bond (JGB) contract, the three-month Euroyen contract, and options on those contracts (known as futures options). The Nikkei-225 contract is a futures contract whose value is based on the Nikkei-225 stock index, an index of the aggregate value of the stocks of 225 of the largest corporations in Japan. The JGB contract is for the future delivery of ten-year Japanese government bonds. The Euroyen contract is a futures contract whose value is determined by changes in the three-month Euroyen deposit rate. A futures option is a contract that gives the buyer the right, but not the obligation, to buy or sell a futures contract at a stipulated price on or before some specified expiration date.

Leeson soon began to engage in proprietary trading—that is, trading for the firm’s own account. Barings’s management understood that such trading involved arbitrage in Nikkei-225 stock index futures and 10-year Japanese Government Bond (JGB) futures. Both contracts trade on SIMEX and the Osaka Securities Exchange (OSE). At times price discrepancies can develop between the same contract on different exchanges, leaving room for an arbitrageur to earn profits by buying the lower-priced contract on one exchange while selling the higher-priced contract on the other. In theory this type of arbitrage involves only perfectly hedged positions, and so it is commonly regarded as a low-risk activity. Unbeknownst to the bank’s management, however, Leeson soon embarked upon a much riskier trading strategy. Rather than engaging in arbitrage, as Barings management believed, he began placing bets on the direction of price movements on the Tokyo stock exchange.

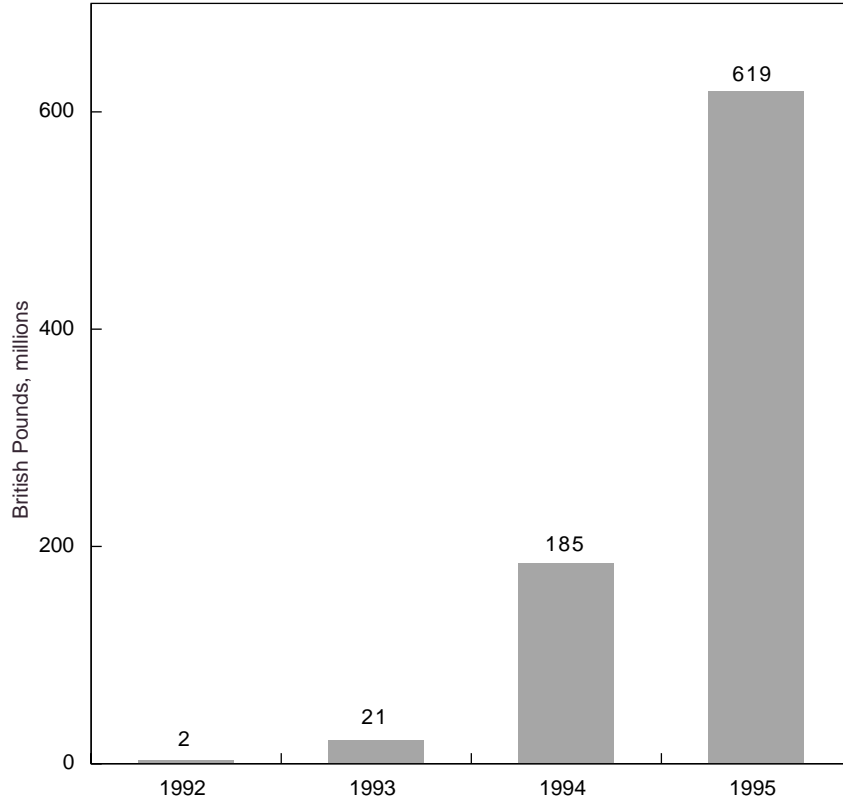
Leeson’s reported trading profits were spectacular. His earnings soon came to account for a significant share of Barings total profits; the bank’s senior management regarded him as a star performer. After Barings failed, however, investigators found that Leeson’s reported profits had been fictitious from the start. Because his duties included supervision of both trading and settlements for the Singapore subsidiary, Leeson was able to manufacture fictitious reports concerning his trading activities. He had set up a special account—account number 88888—in July 1992, and instructed his clerks to omit information on that account from their reports to the London head office. By manipulating information on his trading activity, Leeson was able to conceal his trading losses and report large profits instead.

Figure 4 shows Leeson’s trading losses from 1992 through the end of February 1995. By the end of 1992—just a few months after he had begun trading—Leeson had accumulated a hidden loss of £2 million. That figure remained unchanged until October 1993, when his losses began to rise sharply. He lost another £21 million in 1993 and £185 million in 1994. Total cumulative losses at the end of 1994 stood at £208 million. That amount was slightly larger than the £205 million profit reported by the Barings Group as a whole, before accounting for taxes and for £102 million in scheduled bonuses.

A major part of Leeson’s trading strategy involved the sale of options on Nikkei-225 futures contracts. Figures 5a and 5b show the payoff at expiration accruing to the seller of a call or put option, respectively. The seller of an option earns a premium in return for accepting the obligation to buy or sell the underlying item at a stipulated strike price. If the option expires “out-of-the-money,” the option premium becomes the seller’s profit. If prices turn out to be more volatile than expected, however, an option seller’s potential losses are virtually unlimited.

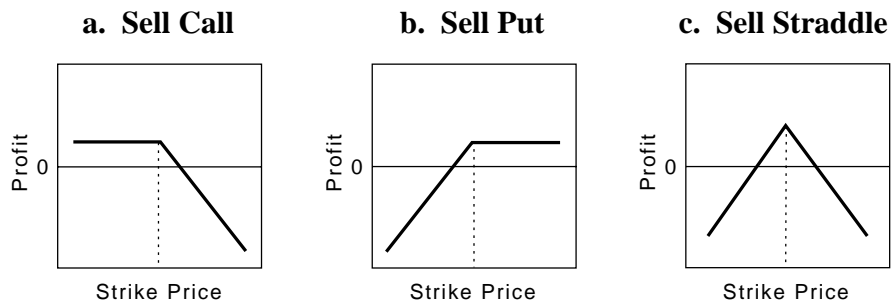
Some time in 1994, Leeson began selling large numbers of option straddles, a strategy that involved the simultaneous sale of both calls and puts on Nikkei-225 futures. Figure 5c shows the payoff at expiration to a sold option

Figure 4 Concealed Trading Losses



Source: Bank of England, Board of Banking Supervision

Figure 5 Payoffs to Selected Options Trading Strategies



straddle. Option prices reflect the market's expectation of the price volatility of the underlying item. The seller of an option straddle earns a profit only if the market proves less volatile than predicted by option prices. As is evident in Figure 5c, Leeson's strategy amounted to a bet that the Japanese stock market would neither fall nor increase by a great deal—any large movement in Japanese stock prices would result in losses. By January 1, 1995, Leeson was short 37,925 Nikkei calls and 32,967 Nikkei puts. He also held a long position of just over 1,000 contracts in Nikkei stock index futures, which would gain in value if the stock market were to rise.

Disaster struck on January 17 when news of a violent earthquake in Kobe, Japan, sent the Japanese stock market into a tailspin. Over the next five days, the Nikkei index fell over 1,500 points—Leeson's options positions sustained a loss of £68 million. As stock prices fell, he began buying massive amounts of Nikkei stock index futures. He also placed a side bet on Japanese interest rates, selling Japanese government bond futures by the thousands in the expectation of rising interest rates.

This strategy seemed to work for a short time. By February 6, the Japanese stock market had recovered by over 1,000 points, making it possible for Leeson to recoup most of the losses resulting from the market's reaction to the earthquake. His cumulative losses on that date totaled £253 million, about 20 percent higher than they had been at the start of the year. But within days the market began falling again—Leeson's losses began to multiply. He continued to increase his exposure as the market kept falling. By February 23, Leeson had bought over 61,000 Nikkei futures contracts, representing 49 percent of total open interest in the March 1995 Nikkei futures contract and 24 percent of the open interest in the June contract. His position in Japanese government bond futures totaled just over 26,000 contracts sold, representing 88 percent of the open interest in the June 1995 contract. Leeson also took on positions in Euroyen futures. He began 1995 with long positions in Euroyen contracts (a bet that Japanese interest rates would fall) but then switched to selling the contracts. By February 23 he had accumulated a short position in Euroyen futures equivalent to 5 percent of the open interest in the June 1995 contract and 1 percent of the open interest in both the September and December contracts.

Barings faced massive margin calls as Leeson's losses mounted. While these margin calls raised eyebrows at the bank's London and Tokyo offices, they did not prompt an immediate inquiry into Leeson's activities. It was not until February 6 that Barings's group treasurer, Tony Hawes, flew to Singapore to investigate irregularities with the accounts at BFS. Accompanying Hawes was Tony Railton, a settlements clerk from the London office.

While in Singapore, Hawes met with SIMEX officials, who had expressed concern over Barings's extraordinarily large positions. Hawes assured them that his firm was aware of these positions and stood ready to meet its obligations

to the exchange. His assurances were predicated on the belief that the firm's exposure on the Singapore exchange had been hedged with offsetting positions on the Osaka exchange. He was soon to learn that this belief was incorrect.

Leeson's requests for additional funding continued during February, and Barings's London office continued to meet those requests—in all, Barings had committed a total of £742 million to finance margin calls for BFS. Meanwhile, Tony Railton, the clerk Hawes had dispatched to Singapore, found that he could not reconcile the accounts of BFS. Particularly disturbing was a US\$190 million discrepancy in one of BFS's accounts. For over a week, Railton attempted to meet with Leeson to resolve these discrepancies. Leeson had become hard to find, however. Railton finally tracked him down on the floor of the Singapore exchange on Thursday, February 23, and persuaded Leeson to meet with him that evening. When the meeting began, Railton began asking a series of difficult questions. At that point Leeson excused himself, stating that he would return shortly. But he never did return. Instead, he and his wife left Singapore that evening. The next day, Leeson faxed his resignation to Barings's London office from a hotel in Kuala Lumpur, stating in part, "My sincere apologies for the predicament I have left you in. It was neither my intention nor aim for this to happen."²¹

After Leeson failed to return, Railton and others at Barings's Singapore office began investigating his private records and quickly discovered evidence that he had lost astronomical sums of money. Peter Baring, the bank's chairman, did not learn of the bank's difficulties until the next day, when he was forced to call the Bank of England to ask for assistance. Ironically, this was the same day that Barings was to inform its staff of their bonuses. Leeson was to receive a £450,000 bonus, up from £130,000 the previous year, on the strength of his reported profits. Baring himself expected to receive £1 million.

The Bank of England's Board of Banking Supervision (1995) subsequently conducted an inquiry into the collapse of Barings. According to the Board's report, total losses attributable to Leeson's actions came to £927 million (approximately US\$1.4 billion), including liquidation costs; an amount far in excess of Barings total equity of £440 million. Most of the cost of the Barings debacle was borne by its shareholders and by ING, the firm that bought Barings. Barings was a privately held firm; most of its equity was held by the Baring Foundation, a charity registered in the United Kingdom. Barings's executive committee held the firm's voting shares, which constituted a small fraction of the firm's total equity. Although ING was able to buy the failed merchant bank for a token amount of £1, it had to pay £660 million to recapitalize the firm. SIMEX subsequently reported that the funds Barings had on deposit with the exchange were sufficient to meet the costs incurred in liquidating its positions

²¹ The full text of Leeson's letter of resignation can be found in Springett (1995).

(Szala, Nusbaum, and Reerink 1995). It is not known whether the OSE suffered any losses as a result of Barings's collapse.

Leeson was later detained by authorities at the airport in Frankfurt, Germany, and was extradited to Singapore the following November. In Singapore, Leeson pleaded guilty to charges of fraud and was sentenced to a 6½-year prison term (Mark 1995).

Certain material facts regarding the entire incident are not yet known, as Leeson refused to cooperate with British authorities unless extradited to Great Britain. He later contested the findings of the Banking Board's inquiry, however. A letter to the board from his solicitors states,

These conclusions are inaccurate in various respects. Indeed, in relation to certain of the matters they betray a fundamental misunderstanding of the actual events. Unfortunately, given the uncertainty regarding Mr. Leeson's position we are not able to provide you with a detailed response to your letter.²²

Leeson has promised to write a book describing his own version of events while serving out his prison term in Singapore.

Market Aftershocks

Once the Singapore and Osaka exchanges learned that Barings would not be able to meet its margin calls, they took control of all the bank's open positions. The Nikkei index fell precipitously when market participants learned that the exchanges would be liquidating such large positions. Thus, in the days immediately following the announcement of Barings's collapse, it was not known whether the margin money the bank had deposited with the exchanges would cover the losses stemming from the liquidation of its positions.

Matters were further complicated when SIMEX announced it would double margin requirements on its Nikkei stock index futures contract effective Tuesday, February 28. Fearing that their margin money might be used to pay for Barings's losses, several of the exchange's U.S. clearing members threatened to withhold payment of the additional margin SIMEX was demanding of them unless given assurances that such margin payments would be used solely to collateralize their own accounts. A refusal to pay would have caused the affected dealers to forfeit their positions. If that had happened, SIMEX would have been faced with a series of defaults. According to CFTC chairman Schapiro, such an event could have "destroyed the ability of SIMEX to manage the situation."²³ Indeed, there are reports that many market participants feared that the very solvency of the SIMEX clearinghouse was in question. To complicate matters further, Japanese and Singaporean regulators were slow to

²² Board of Banking Supervision (1995), para. 1.77.

²³ As cited in McGee (1995b).

inform market participants of the steps they were taking to insure the financial integrity of the exchange clearinghouses. This lack of communication served only to exacerbate the fears of market participants (Falloon 1995; Irving 1995; McGee 1995b, c; Szala, Nusbaum, and Reerink 1995).

Upon learning of the situation, Chairman Schapiro contacted the Monetary Authority of Singapore (MAS) to persuade the agency to assure SIMEX's clearing members that their margin deposits would not be used to offset Barings's proprietary losses. The MAS subsequently acceded to these requests and provided its assurance in a short statement released before the start of trading on Tuesday. SIMEX's margin calls were met and a potential crisis was avoided.

This was not the end of headaches for Barings's customers, however. BFS was one of the largest clearing member firms on SIMEX. As such, it handled clearing and settlement for 16 U.S. firms and held approximately \$480 million in margin funds on their behalf when it went bankrupt.

U.S. futures exchanges typically arrange the immediate transfer to other firms of all customer accounts of a financially troubled clearing member. Laws in the United States facilitate such transfers because they provide for strict segregation of customer accounts, which prevents the creditors of a broker or clearing member firm from attaching the assets of customers. That Japanese law contains no such provisions was not well known before the collapse of Barings. Although laws in Singapore do recognize the segregation of accounts, SIMEX had never before dealt with the insolvency of a clearing member firm. To complicate matters further, most of BFS's customer accounts had been booked through Baring Securities in London. Consequently, SIMEX did not have detailed information on individual customer positions. It had records only on a single commingled account for Baring Securities. Finally, much of the information that Leeson had provided to the exchange, as well as to Barings's other offices, was false. These circumstances made the task of sorting out the positions of individual customers extremely difficult.

During the next week, Barings's U.S. customers scrambled to reproduce documentation of their transactions with the bank and supplied this information to SIMEX and the OSE. But while this information made it possible for the exchanges to identify customer positions, Barings's bankruptcy administrator in London had asked the exchanges to block access to all Barings's margin deposits. The bankruptcy administrator had raised questions about whether U.K. laws on the segregation of customer accounts were applicable in an insolvency of this kind (Szala, Nusbaum, and Reerink 1995).

It was not until ING took over Barings on March 9 that the bank's customers were assured of access to their funds. Even then, access was delayed in many cases. By one account, several major clients waited more than three weeks before their funds were returned (Irving 1995).

Policy Concerns Highlighted by Barings's Default

All futures exchanges maintain systems to prevent the accumulation of large speculative losses. But events surrounding the collapse of Barings have served to highlight weaknesses in risk management on the part of SIMEX and other futures exchanges. They also suggest a need for closer international cooperation among futures exchanges and their regulators, and for clearer laws on the status of customer accounts when a clearing member firm becomes insolvent.

Futures exchanges maintain stringent speculative position limits for individual firms and traders to prevent large losses and to limit their exposure. It appears that SIMEX relaxed some of these restrictions for BFS, however. It is not unusual for futures exchanges to grant exemptions to established position limits for hedged positions, such as those Leeson claimed to maintain. But it is normal for the exchange clearinghouse to monitor closely the activities of firms receiving such exemptions and to take steps to verify the existence of offsetting exposures. It now appears that SIMEX failed to pursue such precautions in its dealings with Barings.

The exchange's attitude toward Barings was influenced in part by the bank's strong international reputation, but its willingness to relax normal risk management guidelines also may have been attributable to its desire to attract business. Although the OSE was first to list Japanese government bond and Nikkei-225 stock index futures, SIMEX soon began listing similar contracts in direct competition with the Osaka exchange. Thereafter, the two exchanges battled each other for market share. Barings was one of the most active firms on SIMEX—and Leeson was responsible for much of the exchange's trading volume in Nikkei stock index futures and options. Thus, some observers believe that SIMEX may have been too willing to accommodate BFS (McGee 1995c). Critics include representatives of U.S. futures exchanges, who maintain that their risk management standards are more stringent.²⁴ A report on the incident commissioned by the government of Singapore came to a similar conclusion, finding that the exchange may have been too liberal in granting increases in position limits.²⁵

Communication between exchanges can be important for identifying and resolving potential problems. Communication between SIMEX and the OSE was minimal, however. This lack of communication not only helped make it possible for Leeson to accumulate large losses but also hampered efforts to contain the damage once Barings collapsed. Although the OSE routinely published a list of the positions of its most active traders, SIMEX did not make such disclosures. It now seems apparent that SIMEX officials never consulted

²⁴ See *BNA's Banking Report* (1995f) and Falloon (1995).

²⁵ See *The Economist* (1995).

the OSE's list to verify Leeson's claim that he was hedging his large positions in Singapore with offsetting exposures on the Osaka exchange.

Some observers blame this lack of communication on the rivalry between the two exchanges. Arrangements existing between U.S. exchanges suggest that competition need not preclude information sharing, however. In the United States, futures exchanges attempt to coordinate their activities with the CFTC and other futures exchanges. Each exchange maintains strict speculative position limits established under CFTC oversight. The CFTC monitors compliance through a comprehensive surveillance policy that includes a large-trader reporting system. Market participants are required to justify unusually large positions. This system enabled the CFTC to ascertain quickly that Barings had no significant positions on any U.S. futures exchange at the time of its collapse.²⁶

While competitive concerns may sometimes give exchanges incentives to relax prudential standards, as many observers seem to think that SIMEX did, it does not follow that regulators should seek to discourage such competition. Competition among exchanges serves an important economic function by encouraging innovation. Securities and futures exchanges constantly compete with one another to provide new products to their customers. Thus, whereas futures exchanges once listed contracts only for agricultural and other commodities, a significant fraction of all futures trading today involves contracts for financial instruments. The growth of trading in such instruments has provided important benefits to international financial markets, helping to make them more efficient while facilitating risk management by financial intermediaries and commercial firms alike. Moreover, competition gives futures exchanges an incentive to maintain strong financial controls and risk management systems, as most market participants seek to avoid risks like those faced by SIMEX customers after the collapse of Barings. Finally, policymakers need not restrict competition to address the problems highlighted by the Barings debacle.

The events surrounding the collapse of Barings led futures industry regulators from 16 nations to meet in Windsor, England, in May 1995 to discuss the need for legal and regulatory reform. At that meeting, officials agreed on a plan of action now known as the Windsor Declaration. The declaration calls for regulators to promote, as appropriate, "national provisions and market procedures that facilitate the prompt liquidation and/or transfer of positions, funds and assets, from failing members of futures exchanges," and to support measures "to enhance emergency procedures at financial intermediaries, market members and markets and to improve existing mechanisms for international co-operation and communication among market authorities and regulators."²⁷ The International Organization of Securities Commissions (IOSCO) later endorsed the Windsor

²⁶ See the summary of Chairman Schapiro's testimony before Congress in *BNA's Banking Report* (1995e, f).

²⁷ As cited in *BNA's Banking Report* (1995d).

Declaration and pledged to study the issues it raised. IOSCO also asked its members to promote declaration measures in cross-border transactions.²⁸

The Barings debacle has also spurred efforts by market participants to strengthen financial safeguards at futures and options exchanges. In March 1995, the Futures Industry Association (FIA) organized a task force to investigate measures to improve the financial integrity of futures and options exchanges. The association's Global Task Force on Financial Integrity (1995) subsequently published a report containing 60 recommendations, ranging from risk management practices to customer protection issues. The FIA report encourages all nations to review their bankruptcy laws to clarify the status of customer funds and to modify provisions that might conflict with the laws of other nations. It recommends that exchanges and their regulators establish procedures for the transfer of a troubled clearing member firm's customer assets *before* it is declared insolvent, as is now typically done in the United States. In addition, the report encourages exchange clearinghouses to monitor their clearing member firms closely and to perform periodic audits. Thus, the FIA's recommendations are broadly consistent with the principles espoused by the Windsor Declaration, especially in their emphasis on customer protection and the need for improved information sharing among exchanges and government authorities.

Subsequently, the clearing organizations for 19 U.S. stock, stock option, and futures exchanges announced their intent to begin pooling data on transactions of member firms (McGee 1995a). In addition, CFTC Chairman Schapiro has announced that her staff will work with the futures industry to develop concrete customer protection proposals.²⁹

The Barings debacle has served to galvanize an international effort—one that has been joined by government officials and market participants alike—to reevaluate risk management systems, customer protection laws, and procedures for dealing with the failure of a large clearinghouse member. It also has prompted increased communication and pledges of greater cooperation among regulators from different nations. It is still too early to pass judgment on the ultimate success of such initiatives, however. While regulators have pledged increased international cooperation, recent press accounts have noted that officials in Britain, Japan, and Singapore have not always cooperated with one another in conducting their investigations of the Barings case.³⁰

Lessons from the Barings Debacle

The losses suffered by Barings provide a good example of the market risk associated with derivatives. But, as with the case of Metallgesellschaft, the

²⁸ See *BNA's Banking Report* (1995b).

²⁹ See *BNA's Banking Report* (1995c).

³⁰ See *The Economist* (1995).

Barings debacle best illustrates operational risk and legal risk. In this regard, the Bank of England's Board of Banking Supervision inquiry concluded,

Barings' collapse was due to the unauthorized and ultimately catastrophic activities of, it appears, one individual (Leeson) that went undetected as a consequence of a failure of management and other internal controls of the most basic kind. Management failed at various levels and in a variety of ways . . . to institute a proper system of internal controls, to enforce accountability for all profits, risks and operations, and adequately to follow up on a number of warning signals over a prolonged period.³¹

The board's inquiry found nine separate warning signs that should have alerted Barings management to problems with its Singapore futures subsidiary. A partial list of those warning signs includes the following:

- *The lack of segregation of duties between front and back offices.* This lack was identified as a weakness and potential problem area in an internal audit report following a review of BFS's operations in the summer of 1994. Barings's management failed to act on the report's recommendations to remedy this situation.
- *The high level of funding requested by Leeson.* Between December 31, 1994, and February 24, 1995, Barings provided Leeson with £521 million to meet margin calls. Total funding of BFS stood at £742 million, more than twice the reported capital of the Barings Group, when Leeson's activities were finally discovered on February 24.³²
- *The unreconciled balance of funds transferred to BFS to meet margin calls.* In his requests for additional funding, Leeson often claimed the money was needed for client accounts but never provided detailed information about these accounts as was the usual practice. Nonetheless, the bank's head office in London paid those funds without any independent check on the validity of Leeson's requests and with no attempt to reconcile those requests with known trading positions. Perhaps the most troubling aspect of Barings's behavior in this regard is that SIMEX rules prohibit its members from financing the margin accounts of customers. Barings's management apparently ignored evidence that the firm might be doing so in violation of SIMEX rules.
- *The apparent high profitability of Leeson's trading activities relative to the low level of risk as perceived and authorized by Barings's management in London.* High returns typically entail high risk. Yet no one in senior management seriously questioned how Leeson's strong reported profits

³¹ Board of Banking Supervision (1995), para. 14.1.

³² Board of Banking Supervision (1995), para. 6.21.

could result from what was supposed to have been a low-risk activity. To be sure, at least one executive observed that “This guy must be busting his intraday limits or something.”³³ But Leeson’s reports were never challenged until too late, and management did little to restrain his trading activities. According to interviews with Barings’s staff, Leeson was regarded as “almost a miracle worker,” and there was “a concern not to do anything which might upset him.”³⁴

- *The discovery of discrepancies in Leeson’s accounts by outside auditors.* Barings’s auditors, the firm of Coopers & Lybrand, informed the bank’s management of a £50 million discrepancy in BFS’s accounts on or before February 1, 1995. Although this discrepancy ultimately did prompt Barings’s treasurer to investigate Leeson’s accounts, the Board of Banking Supervision concluded that management was too slow in responding to this warning sign.
- *Communications from SIMEX.* The rapid buildup of Leeson’s positions during January 1995 prompted SIMEX to seek assurances from Barings’s management in London regarding the ability of BFS to fund its margin calls. In retrospect, it appears that Barings’s management was too hasty in providing such assurances.
- *Market rumors and concerns made known to Barings’s management in January and February.* By late January, rumors were circulating on the OSE regarding Barings’s large positions in Nikkei futures. On January 27, the Bank for International Settlements in Basle, Switzerland, raised a high-level inquiry with Barings executives in London regarding a rumor that the bank had experienced losses and could not meet its margin calls on the OSE. On the same day, another Barings executive received a call from the Bloomberg information service inquiring into the bank’s large positions on the OSE.

Taken together, these warning signs suggest that Barings’s management had ample cause to be concerned about Leeson’s activities. But management was too slow to act on these warning signs. An on-site examination of Leeson’s accounts came too late to save the bank.

The Board of Banking Supervision’s report outlined a number of lessons to be learned from the failure of Barings. They emphasize five lessons for the management of financial institutions:

- Management teams have a duty to understand fully the businesses they manage;

³³ Board of Banking Supervision (1995), para. 3.57.

³⁴ Board of Banking Supervision (1995), para. 7.12.

- Responsibility for each business activity has to be clearly established and communicated;
- Clear segregation of duties is fundamental to any effective control system;
- Relevant internal controls, including independent risk management, have to be established for all business activities;
- Top management and the Audit Committee have to ensure that significant weaknesses, identified to them by internal audit or otherwise, are resolved quickly.³⁵

The report also had some criticisms for the Bank of England's supervision of Barings. U.K. banking regulations require all banks to notify the Bank of England before entering into a transaction that would expose more than 25 percent of the organization's capital to the risk of loss. A Bank of England manager granted Barings an informal concession permitting it to exceed this limit in its exposure to SIMEX and the OSE without first referring the matter to the Bank's senior management. But while the report is somewhat critical of the Bank of England on this matter, it concludes,

The events leading up to the collapse of Barings do not, in our view, of themselves point to the need for any fundamental change in the framework of regulation in the UK. There is, however, a need for improvements in the existing arrangements.³⁶

The report goes on to suggest a number of ways to improve the Bank of England's supervision of banks. According to the report,

- the Bank should explore ways of increasing its understanding of the non-banking businesses . . . undertaken by those banks for which it is responsible;³⁷
- it should prepare explicit internal guidelines to assist its supervisory staff in identifying activities that could pose material risks to banks and ensure that adequate safeguards are in place;
- it should work more closely with the Securities and Futures Authority, the agency responsible for regulating the domestic operations of British-based securities firms, as well as with regulators from other nations; and
- it should address deficiencies in the implementation of rules dealing with large exposures.

³⁵ Board of Banking Supervision (1995), para. 14.2.

³⁶ Board of Banking Supervision (1995), para. 14.5.

³⁷ Board of Banking Supervision (1995), para. 14.35.

The report also recommended an independent quality assurance review of the Bank of England's supervisory function.

The Board of Banking Supervision's report did not blame the collapse of Barings on its use of derivatives. Instead, it placed responsibility for the debacle on poor operational controls at Barings:

The failings at Barings were not a consequence of the complexity of the business, but were primarily a failure on the part of a number of individuals to do their jobs properly....While the use of futures and options contracts did enable Leeson to take much greater levels of risk (through their leverage) than might have been the case in some other markets, it was his ability to act without authority and without detection that brought Barings down.³⁸

This point has been reinforced recently by news of a similar debacle at the New York office of Daiwa Bank, where a trader concealed large trading losses for over ten years before finally confessing to his activities.³⁹ Parallels between the Daiwa and Barings debacles are striking, as both incidents resulted from the unauthorized activities of a single trader. Daiwa's losses were in no way related to derivatives, however. The bank incurred over \$1 billion in losses as a result of unauthorized trading in U.S. government bonds, widely regarded as the safest of financial instruments.

Some Final Observations on the Barings Debacle

The events surrounding the collapse of Barings have highlighted certain weaknesses in international financial markets that represent legitimate concerns for policymakers. The most notable of these weaknesses relate to (1) the lack of communication between securities and futures exchanges and regulators in different countries, and (2) conflicting laws on the legal status of customer accounts at futures brokers and clearing agents in the event of insolvency. These weaknesses can be addressed only by increased international cooperation among futures exchanges, regulators, and lawmakers.

At the same time, it does not appear that more stringent government regulation of futures markets could have prevented the Barings debacle. Leeson acted outside existing regulatory guidelines and outside the law in concealing the true nature of his trading activities and the losses resulting therefrom. Existing laws and regulations should have been able to prevent, or at least to detect, Leeson's activities before he could incur such astronomical losses. But Barings, SIMEX, and the Bank of England were all lax in enforcing those rules. Barings was lax in enforcing basic operational controls. In doing so, it violated not only official regulations but also commonly accepted market standards for managing risk. Similarly, it appears that SIMEX may have been

³⁸ Board of Banking Supervision (1995), para. 14.35.

³⁹ See Sapsford, Sesit, and O'Brien (1995) for early details of the Daiwa debacle.

too liberal in granting increases in position limits to BFS. Finally, the Bank of England granted Barings an exemption that helped make it possible for Leeson to continue his illicit activities undetected.

4. CONCLUDING COMMENTS

The cases of Metallgesellschaft and Barings provide an interesting study in contrasts. Both cases involve exchange-traded derivatives contracts. In both cases, senior management has been criticized for making an insufficient effort to understand fully the activities of their firms' subsidiaries and for failing to monitor and supervise the activities of those subsidiaries adequately. But while critics have faulted MG's management for overreacting to the large margin calls faced by one of its subsidiaries, Barings's management has been faulted for being overly complacent in the face of a large number of warning signs.

If these two disparate incidents offer any single lesson, it is the need for senior management to understand the nature of the firm's activities and the risks that those activities involve. In the case of Metallgesellschaft, the sheer scale of its U.S. oil subsidiary's marketing program exposed the firm to large risks. Although there is a great deal of disagreement over the efficacy of the hedging strategy employed by MGRM, it would seem difficult to argue that members of MG's board of supervisors fully appreciated the nature or magnitude of the risks assumed by the firm's U.S. oil subsidiary. If they had, they would not have been so shocked to find the firm facing large margin calls. In the case of Barings, senior management seemed content to accept that a single trader could earn huge profits without exposing the firm to large risks. With the benefit of hindsight, it seems clear that senior executives of both firms should have taken more effort to understand the activities of subordinates.

News of derivatives-related losses often prompts calls for more comprehensive regulation of derivatives markets. But the cases of Metallgesellschaft and Barings—which rank among the largest derivatives-related losses to date—involve instruments traded in markets already subject to comprehensive regulation. In the case of Barings, the debacle involved a regulated merchant bank trading in regulated futures markets. If anything, the Barings debacle illustrates the limits of regulation. Established rules and regulations should have been able to prevent a single trader from accumulating catastrophic losses. But both SIMEX and the Bank of England granted exemptions that helped make it possible for Leeson to continue his activities for years without being detected. It appears that regulatory organizations can also be subject to operational weaknesses.

Moreover, the instruments traded by these two firms—oil futures, stock index futures, and stock index options—are not the kinds of complex and exotic instruments responsible for concerns often expressed in connection with the

growth of derivatives markets. In the case of Barings, the Bank of England's Board of Banking Supervision concluded that it was not the complexity of the business but the failure of a large number of individuals to do their jobs properly that made the bank susceptible to catastrophic losses by a single trader. As the recent misfortune of Daiwa Bank shows, weaknesses in operational controls can lead to losses in many areas of a firm's operations, not just those involved with derivatives. The losses suffered by Daiwa resulted from trading in U.S. Treasury bonds, widely regarded as the safest of all securities.

Unfortunately, no amount of regulation can remove all risk from financial markets. Risk is inherent in all economic activity, and financial markets exist to help market participants diversify such risks. At the same time, regulation can impose costs on market participants. The Metallgesellschaft case shows that attempts at stringent regulation can sometimes have undesirable side effects. According to critics, the CFTC's action against MG's U.S. subsidiaries has introduced uncertainty about the legal status of commercial forward contracts. As a general rule, government policy should attempt to minimize legal risk rather than create it.

To be sure, the Barings debacle did highlight the need for certain legal and regulatory reforms and for more international cooperation among exchanges and their regulators. But market discipline is also a powerful form of regulation. Highly publicized accounts of derivatives-related losses have led many firms to scrutinize their risk management practices—not only in the area of derivatives, but in other areas of their operations as well. Thus, while it is true that derivatives debacles often reveal the existence of disturbing operational weaknesses among the firms involved, such incidents can also teach lessons that help to make financial markets safer in the long run. As the foregoing accounts show, regulation cannot substitute for sound management practices. At the same time, government policymakers can act to minimize the potential for disruption to financial markets by promoting laws and policies that minimize legal risk.

REFERENCES

- BNA's Banking Report*. "Schapiro Defends CFTC Action against Two MG Subsidiaries," vol. 65 (September 25, 1995a), p. 503.
- _____. "IOSCO Endorses Value-at-Risk Models for Capital Adequacy Calculations," vol. 65 (July 17, 1995b), pp. 120–21.
- _____. "Schapiro Says CFTC, Industry to Craft Customer Protection Proposals," vol. 65 (July 3, 1995c), pp. 15–16.

- _____. “World Futures Regulators Adopt Plan of Action in View of Barings,” vol. 64 (May 22, 1995d), pp. 1017–18.
- _____. “CFTC Undertaking Regulatory Review: Schapiro Address[es] Failure of Barings PLC,” vol. 64 (March 6, 1995e), pp. 469–70.
- _____. “CFTC Chairman Schapiro Tells Congress Barings-Type Disaster Unlikely in U.S.,” vol. 64 (March 6, 1995f), pp. 468–69.
- Board of Banking Supervision. *Report of the Board of Banking Supervision Inquiry into the Circumstances of the Collapse of Barings*. London: HMSO, 1995.
- Culp, Christopher L., and Steve H. Hanke. “Derivative Dingbats,” *The International Economy* (July/August 1994).
- Culp, Christopher L., and Merton H. Miller. “Basis Risk and Hedging Strategies: Reply to Mello and Parsons,” *Derivatives Quarterly*, vol. 1 (Summer 1995a), pp. 20–26.
- _____. “Hedging in the Theory of Corporate Finance: A Reply to Our Critics,” *Journal of Applied Corporate Finance*, vol. 8 (Spring 1995b), pp. 121–27.
- _____. “Auditing the Auditors,” *Risk*, vol. 8 (April 1995c), pp. 36–39.
- _____. “Metallgesellschaft and the Economics of Synthetic Storage,” *Journal of Applied Corporate Finance*, vol. 7 (Winter 1995d), pp. 62–76.
- _____. “Letter to the Editor,” *Risk*, vol. 11 (November 1994a), p. 18.
- _____. “Hedging a Flow of Commodity Deliveries with Futures: Lessons from Metallgesellschaft,” *Derivatives Quarterly*, vol. 1 (Fall 1994b), pp. 7–15.
- The Economist*. “The Barings Collapse: Spot the Smoking Receivable,” October 21, 1995, p. 79.
- _____. “Revolution at Metallgesellschaft,” December 25, 1993, p. 90.
- Edwards, Franklin R. “Derivatives Can Be Hazardous to Your Health: The Case of Metallgesellschaft,” *Derivatives Quarterly*, vol. 1 (Spring 1995), pp. 8–17.
- _____, and Michael S. Canter. “The Collapse of Metallgesellschaft: Unhedgeable Risks, Poor Hedging Strategy, or Just Bad Luck?” *The Journal of Futures Markets*, vol. 15 (May 1995a), pp. 211–64.
- _____. “The Collapse of Metallgesellschaft: Unhedgeable Risks, Poor Hedging Strategy, or Just Bad Luck?” *Journal of Applied Corporate Finance*, vol. 8 (Spring 1995b), pp. 86–105.
- Falloon, William. “Who’s Missing from the Picture?” *Risk*, vol. 8 (April 1995), pp. 19–22.
- Fox, Justin. “2 in House Fault Futures Trading Panel on Over-the-Counter Derivatives Ruling,” *American Banker*, December 26, 1995.

- Futures Industry Association Global Task Force on Financial Integrity. *Financial Integrity Recommendations*. Washington: Futures Industry Association, 1995.
- Global Derivatives Study Group. *Derivatives: Practices and Principles*. Washington: Group of Thirty, 1993.
- Irving, Richard. "Beyond Barings," *Risk*, vol. 8 (April 1995), p. 6.
- Kawaller, Ira. "Hedging with Futures Contracts: Going the Extra Mile," *Journal of Cash Management*, vol. 6 (July/August 1986), pp. 34–36.
- Mark, Jeremy. "With Leeson in Singapore Prison, Focus Shifts to Barings Executives," *The Wall Street Journal*, December 4, 1995.
- McGee, Suzanne. "Nineteen U.S. Exchanges To Share Data on Dealings," *The Wall Street Journal*, September 6, 1995a.
- . "New U.S. Futures Chief Is Crafting a Global Role," *The Wall Street Journal*, May 17, 1995b.
- . "Reform Sought to Prevent Future Barings," *The Wall Street Journal*, March 17, 1995c.
- Mello, Antonio S., and John E. Parsons. "Hedging a Flow of Commodity Deliveries with Futures: Problems with a Rolling Stack," *Derivatives Quarterly*, vol. 1 (Summer 1995a), pp. 16–19.
- . "Maturity Structure of a Hedge Matters: Lessons from the Metallgesellschaft Debacle," *Journal of Applied Corporate Finance*, vol. 8 (Spring 1995b), pp. 106–20.
- Miller, Merton H., and Christopher L. Culp. "Rein in the CFTC," *The Wall Street Journal*, August 17, 1995.
- Rance, Brian D. "The Commodity Futures Trading Commission Order of Settlement with MG Refining and Marketing, Inc. and MF Futures, Inc.," *Derivatives Quarterly*, vol. 2 (Winter 1995), pp. 13–17.
- Roth, Terrence. "German Firm's Bailout Package Gets Approved," *The Wall Street Journal*, January 17, 1994a.
- . "Metallgesellschaft Sets Shareholder Vote Despite Worries over Financial Package," *The Wall Street Journal*, January 14, 1994b.
- Sapsford, Jathon, Michael R. Sesit, and Timothy L. O'Brien. "How Daiwa Bond Man in New York Cost Bank \$1.1 Billion in Losses," *The Wall Street Journal*, September 27, 1995.
- Springett, Pauline. "The Barings Rescue: 'Apologies, but the pressures have become too much to bear,'" *The Guardian* (London), March 7, 1995.
- Stoll, Hans R. "Lost Barings: A Tale in Three Parts Concluding with a Lesson," *The Journal of Derivatives*, vol. 3 (Fall 1995), pp. 109–15.
- Szala, Ginger, David Nusbaum, and Jack Reerink. "Barings Abyss," *Futures*, vol. 24 (May 1995), pp. 68–74.

- Taylor, Jeffrey. "Securities Firms Agree to Set Controls on Derivatives," *The Wall Street Journal*, March 9, 1995a.
- _____. "Documents at MG Appear to Contradict Fired Chairman's Stance on Derivatives," *The Wall Street Journal*, January 27, 1995b.
- _____. "MG Corp. Aims to Stay Active in Oil Business," *The Wall Street Journal*, March 14, 1994.
- U.S. Commodity Futures Trading Commission. "Order Instituting Proceedings Pursuant to Sections 6(c) and 8(a) of the Commodity Exchange Act and Findings and Order Imposing Remedial Sanctions," CFTC Docket No. 95-14 (1995a).
- _____. "CFTC Order Imposes \$2.25 Million Civil Penalty against MG Refining and Marketing, Inc. and MG Futures, Inc.; Other Remedial Sanctions Include Review of Internal Control Systems for Risk Management," Release No. 3859-95 (July 27, 1995b).
- U.S. General Accounting Office. *Financial Derivatives: Actions Needed to Protect the Financial System*. GAO/GCD-94-133, May 1994.
- The Wall Street Journal*. "Former CFTC Chief Scores Agency's Move in Derivatives Case," December 1, 1995.
- _____. "Metallgesellschaft A.G. Dismisses Chairman and Finance Chief," December 20, 1993.