



# 34

C H A P T E R

## Derivatives Mishaps and What We Can Learn from Them

Since the mid-1980s there have been some spectacular losses in derivatives markets. Some of the losses made by financial institutions are listed in Business Snapshot 34.1, and some of those made by nonfinancial organizations in Business Snapshot 34.2. What is remarkable about these lists is the number of situations where huge losses arose from the activities of a single employee. In 1995, Nick Leeson's trading brought a 200-year-old British bank, Barings, to its knees; in 1994, Robert Citron's trading led to Orange County, a municipality in California, losing about \$2 billion. Joseph Jett's trading for Kidder Peabody lost \$350 million. John Rusnak's losses of \$700 million for Allied Irish Bank came to light in 2002. In 2006 the hedge fund Amaranth lost \$6 billion because of trading risks taken by Brian Hunter. In 2008, Jérôme Kerviel lost over \$7 billion trading equity index futures for Société Générale. The huge losses at Daiwa, Shell, and Sumitomo were also each the result of the activities of a single individual.

The losses should not be viewed as an indictment of the whole derivatives industry. The derivatives market is a vast multitrillion dollar market that by most measures has been outstandingly successful and has served the needs of its users well. To quote from Alan Greenspan (May 2003):

The use of a growing array of derivatives and the related application of more sophisticated methods for measuring and managing risk are key factors underpinning the enhanced resilience of our largest financial intermediaries.

The events listed in Business Snapshots 23.1 and 23.2 represent a tiny proportion of the total trades (both in number and value). Nevertheless, it is worth considering carefully the lessons that can be learned from them.

### 34.1 LESSONS FOR ALL USERS OF DERIVATIVES

First, we consider the lessons appropriate to all users of derivatives, whether they are financial or nonfinancial companies.

**Business Snapshot 34.1 Big Losses by Financial Institutions***Allied Irish bank*

This bank lost about \$700 million from speculative activities of one of its foreign exchange traders, John Rusnak, that lasted a number of years. Rusnak managed to cover up his losses for a number of years by creating fictitious option trades.

*Amaranth*

This hedge fund lost \$6 billion in 2006 betting on the future direction of natural gas prices.

*Barings (see page 15)*

This 200-year-old British bank was destroyed in 1995 by the activities of one trader, Nick Leeson, in Singapore, who made big bets on the future direction of the Nikkei 225 using futures and options. The total loss was close to \$1 billion.

*Daiwa Bank*

A trader working in New York for this Japanese bank lost more than \$1 billion in the 1990s.

*Kidder Peabody (see page 103)*

The activities of a single trader, Joseph Jett, led to this New York investment dealer losing \$350 million trading US government securities. The loss arose because of a mistake in the way the company's computer system calculated profits.

*Long-Term Capital Management (see page 30)*

This hedge fund lost about \$4 billion in 1998 as a result of Russia's default on its debt and the resultant flight to quality. The New York Federal Reserve organized an orderly liquidation of the fund by arranging for 14 banks to invest in the fund.

*Midland Bank*

This British bank lost \$500 million in the early 1990s largely because of a wrong bet on the direction of interest rates. It was later taken over by the Hong Kong and Shanghai bank.

*National Westminster Bank*

This British bank lost about \$130 million from using an inappropriate model to value swap options in 1997.

*Société Générale*

Jérôme Kerviel lost over \$7 billion speculating on the future direction of equity indices in January 2008.

*Subprime Mortgage Losses (see page 539)*

In 2007 investors lost confidence in the structured products created from US subprime mortgages. This led to a "credit crunch" and losses of tens of billions of dollars by financial institutions.

**Business Snapshot 34.2 Big Losses by Nonfinancial Organizations***Allied Lyons*

The treasury department of this drinks and food company lost \$150 million in 1991 selling call options on the US dollar–sterling exchange rate.

*Gibson Greetings*

The treasury department of this greeting card manufacturer in Cincinnati lost about \$20 million in 1994 trading highly exotic interest rate derivatives contracts with Bankers Trust. They later sued Bankers Trust and settled out of court.

*Hammersmith and Fulham (see page 171)*

This British Local Authority lost about \$600 million on sterling interest rate swaps and options in 1988. All its contracts were later declared null and void by the British courts, much to the annoyance of the banks on the other side of the transactions.

*Metallgesellschaft (see page 66)*

This German company entered into long-term contracts to supply oil and gasoline and hedged them by rolling over short-term futures contracts. It lost \$1.8 billion when it was forced to discontinue this activity.

*Orange County (see page 84)*

The activities of the treasurer, Robert Citron, led to this California municipality losing about \$2 billion in 1994. The treasurer was using derivatives to speculate that interest rates would not rise.

*Procter & Gamble (see page 741)*

The treasury department of this large U.S. company lost about \$90 million in 1994 trading highly exotic interest rate derivatives contracts with Bankers Trust. It later sued Bankers Trust and settled out of court.

*Shell*

A single employee working in the Japanese subsidiary of this company lost \$1 billion dollars in unauthorized trading of currency futures.

*Sumitomo*

A single trader working for this Japanese company lost about \$2 billion in the copper spot, futures, and options market in the 1990s.

**Define Risk Limits**

It is essential that all companies define in a clear and unambiguous way limits to the financial risks that can be taken. They should then set up procedures for ensuring that the limits are obeyed. Ideally, overall risk limits should be set at board level. These should then be converted to limits applicable to the individuals responsible for managing particular risks. Daily reports should indicate the gain or loss that will be experienced for particular movements in market variables. These should be checked against the actual gains and losses that are experienced to ensure that the valuation procedures underlying the reports are accurate.

It is particularly important that companies monitor risks carefully when derivatives are used. This is because, as we saw in Chapter 1, derivatives can be used for hedging,

speculation, and arbitrage. Without close monitoring, it is impossible to know whether a derivatives trader has switched from being a hedger to a speculator or switched from being an arbitrageur to being a speculator. Barings is a classic example of what can go wrong. Nick Leeson's mandate was to carry out low-risk arbitrage between the Singapore and Osaka markets on Nikkei 225 futures. Unknown to his superiors in London, Leeson switched from being an arbitrageur to taking huge bets on the future direction of the Nikkei 225. Systems within Barings were so inadequate that nobody knew what he was doing.

The argument here is not that no risks should be taken. A treasurer working for a corporation, or a trader in a financial institution, or a fund manager should be allowed to take positions on the future direction of relevant market variables. But the sizes of the positions that can be taken should be limited and the systems in place should accurately report the risks being taken.

### **Take the Risk Limits Seriously**

What happens if an individual exceeds risk limits and makes a profit? This is a tricky issue for senior management. It is tempting to ignore violations of risk limits when profits result. However, this is shortsighted. It leads to a culture where risk limits are not taken seriously, and it paves the way for a disaster. In many of the situations listed in Business Snapshots 34.1 and 34.2, the companies had become complacent about the risks they were taking because they had taken similar risks in previous years and made profits.

The classic example here is Orange County. Robert Citron's activities in 1991–93 had been very profitable for Orange County, and the municipality had come to rely on his trading for additional funding. People chose to ignore the risks he was taking because he had produced profits. Unfortunately, the losses made in 1994 far exceeded the profits from previous years.

The penalties for exceeding risk limits should be just as great when profits result as when losses result. Otherwise, traders who make losses are liable to keep increasing their bets in the hope that eventually a profit will result and all will be forgiven.

### **Do Not Assume You Can Outguess the Market**

Some traders are quite possibly better than others. But no trader gets it right all the time. A trader who correctly predicts the direction in which market variables will move 60% of the time is doing well. If a trader has an outstanding track record (as Robert Citron did in the early 1990s), it is likely to be a result of luck rather than superior trading skill.

Suppose that a financial institution employs 16 traders and one of those traders makes profits in every quarter of a year. Should the trader receive a good bonus? Should the trader's risk limits be increased? The answer to the first question is that inevitably the trader will receive a good bonus. The answer to the second question should be no. The chance of making a profit in four consecutive quarters from random trading is  $0.5^4$  or 1 in 16. This means that just by chance one of the 16 traders will "get it right" every single quarter of the year. It should not be assumed that the trader's luck will continue and the trader's risk limits should not be increased.

## Do Not Underestimate the Benefits of Diversification

When a trader appears good at predicting a particular market variable, there is a tendency to increase the trader's limits. We have just argued that this is a bad idea because it is quite likely that the trader has been lucky rather than clever. However, let us suppose that a fund is really convinced that the trader has special talents. How undiversified should it allow itself to become in order to take advantage of the trader's special skills? The answer is that the benefits from diversification are huge, and it is unlikely that any trader is so good that it is worth foregoing these benefits to speculate heavily on just one market variable.

An example will illustrate the point here. Suppose that there are 20 stocks, each of which have an expected return of 10% per annum and a standard deviation of returns of 30%. The correlation between the returns from any two of the stocks is 0.2. By dividing an investment equally among the 20 stocks, an investor has an expected return of 10% per annum and standard deviation of returns of 14.7%. Diversification enables the investor to reduce risks by over half. Another way of expressing this is that diversification enables an investor to double the expected return per unit of risk taken. The investor would have to be extremely good at stock picking to get a better risk–return tradeoff by investing in just one stock.

## Carry out Scenario Analyses and Stress Tests

The calculation of risk measures such as VaR should always be accompanied by scenario analyses and stress testing to obtain an understanding of what can go wrong. These were mentioned in Chapter 20. They are very important. Human beings have an unfortunate tendency to anchor on one or two scenarios when evaluating decisions. In 1993 and 1994, for example, Procter & Gamble and Gibson Greetings may have been so convinced that interest rates would remain low that they ignored the possibility of a 100-basis-point increase in their decision making.

It is important to be creative in the way scenarios are generated. One approach is to look at 10 or 20 years of data and choose the most extreme events as scenarios. Sometimes there is a shortage of data on a key variable. It is then sensible to choose a similar variable for which much more data is available and use historical daily percentage changes in that variable as a proxy for possible daily percentage changes in the key variable. For example, if there is little data on the prices of bonds issued by a particular country, historical data on prices of bonds issued by other similar countries can be used to develop possible scenarios.

## 34.2 LESSONS FOR FINANCIAL INSTITUTIONS

We now move on to consider lessons that are primarily relevant to financial institutions.

### Monitor Traders Carefully

In trading rooms there is a tendency to regard high-performing traders as “untouchable” and to not subject their activities to the same scrutiny as other traders. Apparently Joseph Jett, Kidder Peabody's star trader of Treasury instruments, was

often “too busy” to answer questions and discuss his positions with the company’s risk managers.

It is important that all traders—particularly those making high profits—be fully accountable. It is important for the financial institution to know whether the high profits are being made by taking unreasonably high risks. It is also important to check that the financial institution’s computer systems and pricing models are correct and are not being manipulated in some way.

### **Separate the Front, Middle, and Back Office**

The *front office* in a financial institution consists of the traders who are executing trades, taking positions, and so forth. The *middle office* consists of risk managers who are monitoring the risks being taken. The *back office* is where the record keeping and accounting takes place. Some of the worst derivatives disasters have occurred because these functions were not kept separate. Nick Leeson controlled both the front and back office for Barings in Singapore and was, as a result, able to conceal the disastrous nature of his trades from his superiors in London for some time. Jérôme Kerviel had worked in Société Générale’s back office before becoming a trader and took advantage of his knowledge of its systems to hide his positions.

### **Do Not Blindly Trust Models**

Some of the large losses incurred by financial institutions arose because of the models and computer systems being used. We discussed how Kidder Peabody was misled by its own systems on page 103. Another example of an incorrect model leading to losses is provided by National Westminster Bank. This bank had an incorrect model for valuing swap options that led to significant losses.

If large profits are reported when relatively simple trading strategies are followed, there is a good chance that the models underlying the calculation of the profits are wrong. Similarly, if a financial institution appears to be particularly competitive on its quotes for a particular type of deal, there is a good chance that it is using a different model from other market participants, and it should analyze what is going on carefully. To the head of a trading room, getting too much business of a certain type can be just as worrisome as getting too little business of that type.

### **Be Conservative in Recognizing Inception Profits**

When a financial institution sells a highly exotic instrument to a nonfinancial corporation, the valuation can be highly dependent on the underlying model. For example, instruments with long-dated embedded interest rate options can be highly dependent on the interest rate model used. In these circumstances, a phrase used to describe the daily marking to market of the deal is *marking to model*. This is because there are no market prices for similar deals that can be used as a benchmark.

Suppose that a financial institution manages to sell an instrument to a client for \$10 million more than it is worth—or at least \$10 million more than its model says it is worth. The \$10 million is known as an *inception profit*. When should it be recognized? There appears to be quite a variation in what different investment banks do. Some

recognize the \$10 million immediately, whereas others are much more conservative and recognize it slowly over the life of the deal.

Recognizing inception profits immediately is very dangerous. It encourages traders to use aggressive models, take their bonuses, and leave before the model and the value of the deal come under close scrutiny. It is much better to recognize inception profits slowly, so that traders have the motivation to investigate the impact of several different models and several different sets of assumptions before committing themselves to a deal.

### **Do Not Sell Clients Inappropriate Products**

It is tempting to sell corporate clients inappropriate products, particularly when they appear to have an appetite for the underlying risks. But this is shortsighted. The most dramatic example of this is the activities of Bankers Trust (BT) in the period leading up to the spring of 1994. Many of BT's clients were persuaded to buy high-risk and totally inappropriate products. A typical product (e.g., the 5/30 swap discussed on page 741) would give the client a good chance of saving a few basis points on its borrowings and a small chance of costing a large amount of money. The products worked well for BT's clients in 1992 and 1993, but blew up in 1994 when interest rates rose sharply. The bad publicity that followed hurt BT greatly. The years it had spent building up trust among corporate clients and developing an enviable reputation for innovation in derivatives were largely lost as a result of the activities of a few overly aggressive salesmen. BT was forced to pay large amounts of money to its clients to settle lawsuits out of court. It was taken over by Deutsche Bank in 1999.

### **Do Not Ignore Liquidity Risk**

Financial engineers usually base the pricing of exotic instruments and other instruments that trade relatively infrequently on the prices of actively traded instruments. For example:

1. A financial engineer often calculates a zero curve from actively traded government bonds (known as on-the-run bonds) and uses it to price bonds that trade less frequently (off-the-run bonds).
2. A financial engineer often implies the volatility of an asset from actively traded options and uses it to price less actively traded options.
3. A financial engineer often implies information about the behavior of interest rates from actively traded interest rate caps and swap options and uses it to price products that are highly structured.

These practices are not unreasonable. However, it is dangerous to assume that less actively traded instruments can always be traded at close to their theoretical price. When financial markets experience a shock of one sort or another there is often a "flight to quality." Liquidity becomes very important to investors, and illiquid instruments often sell at a big discount to their theoretical values. This happened in 2007 following the jolt to credit markets caused by lack of confidence in securities backed by subprime mortgages.

Another example of losses arising from liquidity risk is provided by Long-Term Capital Management (LTCM), which was discussed in Business Snapshot 2.2. This hedge fund followed a strategy known as *convergence arbitrage*. It attempted to identify

two securities (or portfolios of securities) that should in theory sell for the same price. If the market price of one security was less than that of the other, it would buy that security and sell the other. The strategy is based on the idea that if two securities have the same theoretical price their market prices should eventually be the same.

In the summer of 1998 LTCM made a huge loss. This was largely because a default by Russia on its debt caused a flight to quality. LTCM tended to be long illiquid instruments and short the corresponding liquid instruments (for example, it was long off-the-run bonds and short on-the-run bonds). The spreads between the prices of illiquid instruments and the corresponding liquid instruments widened sharply after the Russian default. LTCM was highly leveraged. It experienced huge losses and there were margin calls on its positions that it was unable to meet.

The LTCM story reinforces the importance of carrying out scenario analyses and stress testing to look at what can happen in the worst of all worlds. LTCM could have tried to examine other times in history when there have been extreme flights to quality to quantify the liquidity risks it was facing.

### **Beware When Everyone Is Following the Same Trading Strategy**

It sometimes happens that many market participants are following essentially the same trading strategy. This creates a dangerous environment where there are liable to be big market moves, unstable markets, and large losses for the market participants.

We gave one example of this in Chapter 17 when discussing portfolio insurance and the market crash of October 1987. In the months leading up to the crash, increasing numbers of portfolio managers were attempting to insure their portfolios by creating synthetic put options. They bought stocks or stock index futures after a rise in the market and sold them after a fall. This created an unstable market. A relatively small decline in stock prices could lead to a wave of selling by portfolio insurers. The latter would lead to a further decline in the market, which could give rise to another wave of selling, and so on. There is little doubt that without portfolio insurance the crash of October 1987 would have been much less severe.

Another example is provided by LTCM in 1998. Its position was made more difficult by the fact that many other hedge funds were following similar convergence arbitrage strategies. After the Russian default and the flight to quality, LTCM tried to liquidate part of its portfolio to meet margin calls. Unfortunately, other hedge funds were facing similar problems to LTCM and trying to do similar trades. This exacerbated the situation, causing liquidity spreads to be even higher than they would otherwise have been and reinforcing the flight to quality. Consider, for example, LTCM's position in U.S. Treasury bonds. It was long the illiquid off-the-run bonds and short the liquid on-the-run bonds. When a flight to quality caused spreads between yields on the two types of bonds to widen, LTCM had to liquidate its positions by selling off-the-run bonds and buying on-the-run bonds. Other large hedge funds were doing the same. As a result, the price of on-the-run bonds rose relative to off-the-run bonds and the spread between the two yields widened even more than it had done already.

A further example is provided by the activities of British insurance companies in the late 1990s. These insurance companies had entered into many contracts promising that the rate of interest applicable to an annuity received by an individual on retirement would be the greater of the market rate and a guaranteed rate. At about the same time, all insurance companies decided to hedge part of their risks on these contracts by



buying long-dated swap options from financial institutions. The financial institutions they dealt with hedged their risks by buying huge numbers of long-dated sterling bonds. As a result, bond prices rose and long sterling rates declined. More bonds had to be bought to maintain the dynamic hedge, long sterling rates declined further, and so on. Financial institutions lost money and, because long rates declined, insurance companies found themselves in a worse position on the risks that they had chosen not to hedge.

The chief lesson to be learned from these stories is that it is important to see the big picture of what is going on in financial markets and to understand the risks inherent in situations where many market participants are following the same trading strategy.

### **Do Not Finance Long-Term Assets with Short-Term Liabilities**

As discussed in Section 4.10, it is important for a financial institution to match the maturities of assets and liabilities. If it does not do this, it is subjecting itself to significant interest rate risk. Savings and Loans in the United States ran into difficulties in the 1960s, 1970s, and 1980s because they financed long-term mortgages with short-term deposits. Continental Bank failed in 1984 for a similar reason (see Business Snapshot 4.3).

During the period leading up to the credit crunch of 2007, there was a tendency for subprime mortgages and other long-term assets to be financed by commercial paper while they were in a portfolio waiting to be packaged into structured products (see Business Snapshot 23.3). Conduits and special purpose vehicles had an ongoing requirement for this type of financing. The commercial paper would typically be rolled over every month. For example, the purchasers of commercial paper issued on April 1 would be redeemed with the proceeds of a new commercial paper issue on May 1. This new commercial paper issue would in turn be redeemed with another new commercial paper issue on June 1, and so on. When investors lost confidence in subprime mortgages in August 2007, it became impossible to roll over commercial paper. In many instances banks had provided guarantees and had to provide financing. This led to a shortage of liquidity. As a result, the credit crunch was more severe than it would have been if longer-term financing had been arranged.

### **Market Transparency Is Important**

One of the lessons from the credit crunch of 2007 is that market transparency is important. During the period leading up to 2007, investors traded highly structured products without any real knowledge of the underlying assets. All they knew was the credit rating of the security being traded. With hindsight, we can say that investors should have demanded more information about the underlying assets and should have more carefully assessed the risks they were taking—but it is easy to be wise after the event!

The subprime meltdown of August 2007 caused investors to lose confidence in all structured products and withdraw from that market. This led to a market breakdown where tranches of structured products could only be sold at prices well below their theoretical values. There was a flight to quality and credit spreads increased. If there had been market transparency so that investors understood the asset-backed securities they were buying, there would still have been subprime losses, but the flight to quality and disruptions to the market would have been less pronounced.

### 34.3 LESSONS FOR NONFINANCIAL CORPORATIONS

We now consider lessons primarily applicable to nonfinancial corporations.

#### **Make Sure You Fully Understand the Trades You Are Doing**

Corporations should never undertake a trade or a trading strategy that they do not fully understand. This is a somewhat obvious point, but it is surprising how often a trader working for a nonfinancial corporation will, after a big loss, admit to not knowing what was really going on and claim to have been misled by investment bankers. Robert Citron, the treasurer of Orange County did this. So did the traders working for Hammersmith and Fulham, who in spite of their huge positions were surprisingly uninformed about how the swaps and other interest rate derivatives they traded really worked.

If a senior manager in a corporation does not understand a trade proposed by a subordinate, the trade should not be approved. A simple rule of thumb is that if a trade and the rationale for entering into it are so complicated that they cannot be understood by the manager, it is almost certainly inappropriate for the corporation. The trades undertaken by Procter & Gamble and Gibson Greetings would have been vetoed using this criterion.

One way of ensuring that you fully understand a financial instrument is to value it. If a corporation does not have the in-house capability to value an instrument, it should not trade it. In practice, corporations often rely on their derivatives dealers for valuation advice. This is dangerous, as Procter & Gamble and Gibson Greetings found out. When they wanted to unwind their deals, they found they were facing prices produced by Bankers Trust's proprietary models, which they had no way of checking.

#### **Make Sure a Hedger Does Not Become a Speculator**

One of the unfortunate facts of life is that hedging is relatively dull, whereas speculation is exciting. When a company hires a trader to manage foreign exchange, commodity price, or interest rate risk, there is a danger that the following might happen. At first, the trader does the job diligently and earns the confidence of top management. He or she assesses the company's exposures and hedges them. As time goes by, the trader becomes convinced that he or she can outguess the market. Slowly the trader becomes a speculator. At first things go well, but then a loss is made. To recover the loss, the trader doubles up the bets. Further losses are made—and so on. The result is likely to be a disaster.

As mentioned earlier, clear limits to the risks that can be taken should be set by senior management. Controls should be put in place to ensure that the limits are obeyed. The trading strategy for a corporation should start with an analysis of the risks facing the corporation in foreign exchange, interest rate, commodity markets, and so on. A decision should then be taken on how the risks are to be reduced to acceptable levels. It is a clear sign that something is wrong within a corporation if the trading strategy is not derived in a very direct way from the company's exposures.

## Be Cautious about Making the Treasury Department a Profit Center

In the last 20 years there has been a tendency to make the treasury department within a corporation a profit center. This appears to have much to recommend it. The treasurer is motivated to reduce financing costs and manage risks as profitably as possible. The problem is that the potential for the treasurer to make profits is limited. When raising funds and investing surplus cash, the treasurer is facing an efficient market. The treasurer can usually improve the bottom line only by taking additional risks. The company's hedging program gives the treasurer some scope for making shrewd decisions that increase profits. But it should be remembered that the goal of a hedging program is to reduce risks, not to increase expected profits. As pointed out in Chapter 3, the decision to hedge will lead to a worse outcome than the decision not to hedge roughly 50% of the time. The danger of making the treasury department a profit center is that the treasurer is motivated to become a speculator. This is liable to lead to the type of outcome experienced by Orange County, Procter & Gamble, or Gibson Greetings.

### SUMMARY

The huge losses experienced from the use of derivatives have made many treasurers very wary. Following some of the losses, some nonfinancial corporations have announced plans to reduce or even eliminate their use of derivatives. This is unfortunate because derivatives provide treasurers with very efficient ways to manage risks.

The stories behind the losses emphasize the point, made as early as Chapter 1, that derivatives can be used for either hedging or speculation; that is, they can be used either to reduce risks or to take risks. Most losses occurred because derivatives were used inappropriately. Employees who had an implicit or explicit mandate to hedge their company's risks decided instead to speculate.

The key lesson to be learned from the losses is the importance of *internal controls*. Senior management within a company should issue a clear and unambiguous policy statement about how derivatives are to be used and the extent to which it is permissible for employees to take positions on movements in market variables. Management should then institute controls to ensure that the policy is carried out. It is a recipe for disaster to give individuals authority to trade derivatives without a close monitoring of the risks being taken.

### FURTHER READING

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