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Introduction

A derivative is *a contract that is used to transfer risk*. There are many different underlying risks, ranging from fluctuations in energy prices to weather risks. Most derivatives, however, are based on financial securities such as common stocks, bonds and foreign exchange instruments. This chapter will explain, in broad terms, the following points:

- ❑ what derivatives are;
- ❑ how they are used;
- ❑ how derivatives can reduce risks such as price risk;
- ❑ how they can also increase risk – the aspect of derivatives that receives most attention from the media;
- ❑ how some recent derivatives disasters occurred; and
- ❑ the ways in which some basic derivative contracts such as forwards, options, swaps and futures work.

Derivatives have changed the world of finance as pervasively as the Internet has changed communication. Their growth has exploded during the last 30 years as ever more risks have been traded in this manner. By the end of 1999, the estimated dollar value of derivatives in force throughout the world was some US$102 trillion – about *10 times* the value of the entire US gross domestic product.[1]

Insurance is the traditional method for sharing risks. We will use the concept of insurance when discussing derivatives because insurance is a familiar notion and most people understand it. However, although insurance and derivatives share common features in that they are both devices for transferring risk, there are also distinct differences. The risks covered by insurance are generally different from those that are dealt with by derivatives.

We first need to clarify the meaning of the word "risk". "Risk" has a specialised meaning in an insurance context: it refers to *the chance that a future event might happen with bad consequences for somebody* – for example an airline might lose someone's baggage. This event is uncertain in that it may or may not happen. If it does not happen, you are no worse off but if it does, there is an adverse consequence that could involve an economic loss or something else untowards.[2]

The more usual meaning of "risk" has positive as well as negative undertones. In business and investment decisions risk involves both the prospect of gain as well as the chance of loss. When there is a wide variation in the range of outcomes we say that a project "carries a lot of risk". If there is little variation in the range of outcomes we say that it "carries very little risk". We willingly take on risks all the time – risk taking is a pervasive human and business activity. Individuals and firms undertake risky ventures because of their potential rewards even though there is the possibility of loss. Indeed, we have a basic intuition that high expected returns are associated with high risk.

Insurance risk, then, relates only to downside risk. Business risk, on the other hand, involves both an upside chance of gain and a downside possibility of loss. No one likes pure downside risk and we would like to dispose of it if we could. We can sometimes do this by entering a contract with an insurance company whereby we pay the premium up front and the insurance company reimburses us if a specified event happens. The policy specifies what the payment will be under different outcomes and is one way of eliminating downside risk.

A derivative is also a contract where the ultimate payoff depends on future events. To that extent it is very similar to insurance. However, derivatives are much more versatile because they can be used to transfer a wider range of risks and are not restricted to purely downside risks.

Contracts that serve a useful economic purpose such as reducing or transferring important types of risks are the ones most likely to survive and flourish. Thus, insurance contracts that serve to transfer risks from consumers to insurance companies are pervasive. One of the reasons why derivatives have become so popular is that they enable risks to be traded efficiently. Different firms face different risks and attitudes to risk vary across firms as well as individuals. These factors increase the gains from trade. The same event may have opposite impacts on two different firms. For example, a rise in the price of oil will benefit an oil-producing company because it receives more money for its product. The same price rise will hurt an airline company because it has to pay more for fuel. However, one can envisage a contract based on the price of oil that would make both companies better off.

The concept behind derivatives is simple. First, the risk is sliced up into standardised pieces, then these pieces are traded in a market so that there is a price for all to see. Those who want to dispose of the risk sell it and those who are willing to take on the risk buy it. The idea is that those players who are most able to bear the risk will end up doing so at market prices. In a competitive market it can be argued that the market price provides a fair basis for exchange.

SOME SIMPLE DERIVATIVES

With advancing technology it is now possible to write derivatives on a broader range of underlying assets and variables. There has been remarkable innovation in the development of new derivatives. In this section we shall look at two simple types of derivatives.

Common stocks

If you own 100 common shares of General Electric you actually own a very tiny piece of this huge company. Common stocks are very flexible vehicles for risk transfer. They are, in fact, early examples of derivatives. Their basic structure illustrates four simple yet powerful concepts that foreshadowed subsequent developments in derivatives:

- *Divisibility of the claim*. The division of the total-ownership pie into identical little slices is a very simple way to distribute risk.
- *Upside appreciation*. Common stocks do well when the firm does well, so they provide a way to share in the firm's good fortunes.
- *Downside protection*. Common stocks provide a way of limiting the investor's downside risk. Because of limited liability, the maximum a shareholder can lose is the initial investment made to buy the share. This protection does not exist under some other forms of ownership such as certain types of unlimited partnership.
- *An organised market*. Publicly traded stocks trade on an organised market. The prevailing market prices should accurately reflect their current value.

These four features make common stocks extremely efficient tools for transferring risk. Financial derivatives have magnified such features.

Forward contracts

A forward contract is an important example of a derivative. It is *an arrangement, made today, to buy something in the future for a fixed price*.

Consider the example of buying a house. Normally there is a period between the signing of the purchase contract and my taking possession of the property. This contract to purchase the house is an example of a forward contract. In other words, I agree *now* to buy the house in *three months' time* and to pay the agreed purchase price at that time. The seller also agrees now to sell me the house in *three months' time*. In the jargon of forward contracts, I have *a long position* in the forward contract or, more simply, I am *long the forward contract*. The seller is said to have a *short position* in the forward contract or, more simply, is *short the forward contract*.

A forward contract can be written on almost any type of underlying asset. The owner of a forward contract has the obligation to buy the underlying asset (or commodity) at a fixed date in the future for a fixed price.

The price to be paid for the asset is termed the delivery price or the contract price. This price is fixed at inception and does not change over the term of the contract. In contrast, the price of the underlying asset will change as time passes. If the price of the asset rises a lot over the term of the contract, the asset will be worth more than the contract price at the delivery date. In this case fortune has favoured the person holding the long position because they can buy the asset for less than its market value. However, if the price of the asset falls during the life of the contract, the asset will be less than the contract price at the delivery date. In this case fortune has favoured the person holding the short position because they can sell the asset for more than its market value.

The parties have agreed in advance to exchange the asset for the contract price at a fixed rate in the future. However, when the delivery date arrives, one of the parties will show a profit on the contract and the other will show a loss. We will explain later how the contract (delivery) price is determined at the outset so that when the forward contract is set up, the terms of the contract are fair to both parties.

HEDGING AND SPECULATION

Corporations use forward contracts to manage price risk. A gold mining company, Sperrin Corp (a hypothetical company named after a mountain range in Northern Ireland that does contain traces of gold) faces the risk that the price of gold will fall. To protect itself against this risk Sperrin could enter a forward contract to sell gold in one year's time at a fixed price of US$310 per ounce. In other words, the delivery price is US$310.

This forward contract protects Sperrin if gold prices drop below US$310. If the price falls to US$200 an ounce Sperrin will still be able to sell its gold at the prearranged price of US$310. On the other hand, if gold prices rise Sperrin still has to fulfil the terms of the contract. For example, if the price of gold jumps to US$400 an ounce Sperrin has to sell its gold for the contracted price of US$310 per ounce. In other words, Sperrin has given up the right to any price appreciation above the contract price of US$310. In this situation, the other party will be able to make money by buying gold from Sperrin under the forward contract at US$310 and selling it on the cash (spot) market at US$400.

Who might be willing to take the other side of the forward contract with Sperrin Gold? The forward contract might also be attractive to a firm that makes gold jewellery, as the risks it faces are the mirror image of those faced by Sperrin. Suppose the Old Triangle[3] jewellery firm normally buys its gold on the cash market. If the price of gold rises, Old Triangle faces higher production costs. If the price of gold falls the firm's costs decline. Gold price changes have opposing impacts on Old Triangle and Sperrin so they can both reduce their risks at the same time by entering the forward contract. Through the forward contract Sperrin has locked in a fixed price

at which it can sell gold in the future and Old Triangle has a contract to buy gold at a fixed price in the future.

This practice of reducing price risk using derivatives is known as *hedging*. In our example, Sperrin is hedging its exposure to gold price risk. Old Triangle is also hedging its price risk. Thus, the same contract can be used as a hedging vehicle by two different parties.

The opposite of hedging is speculating. Speculation involves taking on more risk. An investor with no exposure to the price of gold can obtain this exposure by entering into a forward contract. Many financial markets need risk takers or speculators to make them function efficiently and provide liquidity. Speculation serves a useful economic purpose. It can lead to improved risk sharing and provide a rapid and efficient way of incorporating new information into market prices. Derivatives provide a very powerful tool for speculating as they can increase an investor's exposure to a given type of risk.

OPTIONS

Options are classic examples of derivatives that can be used to increase or reduce risk exposure. *An option is a contract that gives its owner the right to buy or sell some asset for a fixed price at some future date or dates*. A call option gives its owner the right to *buy* some underlying asset for a fixed price at some future time. A put option confers the right to *sell* an asset for a fixed price at some future date.

The owner of the option has the right – but not the obligation – to buy (or sell) the asset. In contrast, under a forward contract one party is obliged to buy (or sell) the asset. Options can be based on a wide range of underlying assets. The asset could be a financial security such as a common stock or a bond. The underlying asset need not be a financial asset: it could be a Picasso painting or a rare bottle of Chateau Margaux.

The terms of the option contract specify the underlying asset, the duration of the contract and the price to be paid for the asset. In option jargon, the fixed price agreed upon for buying the asset, is called the *exercise* price or the *strike price*. The act of buying or selling the asset is known as *exercising the option*. The simplest type of option is a "European" option, which can only be exercised at the end of the contract period. On the other hand, an "American" option can be exercised at any time during the contract period.[6]

Put options provide protection in case the price of the underlying asset falls. Sperrin Corp could use put options on gold to lock in a floor price. For example, suppose the current gold price is US$280 an ounce and Sperrin decides it wants to have a guaranteed floor price of US$285 per ounce in one year's time. The company could buy one-year maturity put options with a strike price of US$285 an ounce. If the price of gold in one year's time is below US$285, Sperrin has the right to sell its gold for a fixed

price of US$285 per ounce. For example, if gold dropped to US$250 per ounce Sperrin has the right under the put option to sell the gold for US$285 per ounce and the option is then worth US$35 per ounce. However, if the price were to rise to US$360, Sperrin can make more money by selling its gold at the prevailing market price and would not exercise the option. In this case, the option would not have any value at maturity. The put option gives Sperrin protection against a fall in the price of gold below US$285 while still allowing the gold company to benefit from price increases. In this respect the put option differs from the forward contract. Under a forward contract, the firm still has price protection on the downside but it gives up the benefits of price increases because it has to sell the gold (at a loss) for the contract price.

We will now examine how call options can be used by an airline to reduce the risks of high fuel costs. Assume the current price of jet fuel is US$135 per tonne and American Airlines is concerned about future increases in fuel prices. If American Airlines buys one-year call options with a strike price of US$140 per tonne it has the option to buy jet fuel at a price of US$140 per tonne. We assume the option is "European", which means simply that it can only be exercised at its maturity. If the price of jet fuel in one year's time is US$180 per tonne, the airline can buy the fuel at US$140 per tonne or US$40 below what it costs on the cash market. In this case American Airlines will exercise the call option, which will then be worth US$40 per tonne. On the other hand, if the price of fuel in one year's time has dropped to US$100 per tonne, the airline will not exercise its option. It makes no sense to pay US$140 for fuel when it can be bought in the market for US$100. When American Airlines buys this option contract from a Texan-based energy company it has to pay for the option. The price it pays for the option is called the *option premium*. We will discuss how this premium is determined in Chapters 4 and 5.

Hedgers can use option contracts to reduce their exposure to different types of risk. In the above examples both Sperrin and American Airlines used options to reduce their risk. As is the case with all derivatives, options can also be used to increase risk. Victor Niederhoffer, a legendary trader, provides a dramatic example of how put options can be used to increase risk. Niederhoffer's hedge fund routinely sold put options on the Standard and Poor (S&P) Index. This index is based on a portfolio of the common stocks of large US corporations. When the fund sold the options it collected the option premiums. This strategy worked well as long as the Index did not drop too sharply. However, on October 27, 1997 the S&P fell by 7% in a single day and totally wiped out Niederhoffer's fund. Ironically, Victor Niederhoffer's autobiography was titled *Education of a Speculator*.[7]

SWAPS

A swap is an agreement between two parties to exchange a periodic stream of benefits or payments over a pre-arranged period. The payments could be based on the market value of an underlying asset.

For example, a pension plan that owned 10,000 shares of the Houston-based energy company Enron could enter an equity swap with an investment bank to exchange the returns on these shares in return for a periodic fixed payment over a two-year period. Assume the payments are exchanged every month. Each month the pension plan pays the investment bank an amount equal to the change in the market value of its Enron shares. In return, the plan receives the agreed fixed dollar amount every month; after two years the swap expires. The pension plan still owns its Enron shares. The two parties go their separate ways. During this two-year period the bank receives the same returns that it would have received had it owned the Enron common shares. The pension plan receives a fixed income for two years, thus giving up its exposure to the Enron shares for the two-year period.

Swap terminology

We now describe some of the terms associated with swaps. The duration of the swap contract is called the *tenor* of the swap. In the above example the tenor is two years. The two parties to the contract are called the *counterparties*, following the example, the counterparties are the pension plan and the investment bank. The sequence of fixed payments is called the *fixed leg* of the swap and the sequence of variable payments is called the *variable leg* of the swap.

In a *commodity swap* the payments on one leg of the swap may be based on the market price of the commodity. Sometimes the swap is based on the actual delivery of the underlying commodity. Cominco, the largest zinc producer in the world, is based in British Columbia, Canada. In December, 2000, Cominco entered an innovative swap with a large US energy company.[8] Under the terms of the swap Cominco agreed to deliver electricity to the energy company at a fixed price per megawatt hour. The energy company paid US$86 million for the power. The duration of the swap was from December 11, 2000, to January 31, 2001. During this period, electricity prices were very high in the western US as a result of the California power crisis (which we discuss in more detail in Chapter 2).

Cominco generates its own power from a dam on the Pend Oreille River. Normally, Cominco uses this power to refine zinc in its plant near the town of Trail in southern British Columbia. In the winter of 2000, the price of power in the Pacific North West was so high that Cominco found it profitable to scale back its production of zinc to free up the power. During this period, Cominco reduced its zinc production by 20,000 tonnes. To meet its customers' demands for zinc, Cominco purchased the zinc on the spot

market. The employees, who were no longer needed in the zinc-production operations, were deployed on maintenance activities. The revenue from the swap had a major impact on the company's bottom line. According to Cominco officials, the company has a goal of making an annual operating profit from its Trail operations of US$100 million – the revenue generated by the swap almost produced an entire year's projected profit.

Interest rate swaps

Interest rate swaps are very popular financial instruments. They have grown to such an extent that they are the most widely traded derivatives contracts in the world. In an interest rate swap, one counterparty pays a fixed rate of interest and the other counterparty pays a variable, or floating, rate of interest. The payments to be exchanged are based on a notional amount of principal.

Interest rate swaps are useful tools for managing interest rate risk. We can illustrate this use of interest rate swaps with an example involving a savings and loan bank. These institutions, often known as "thrifts", were set up in the US to provide mortgages to residential homeowners. Most of the assets of a typical thrift consist of long-term mortgages, which often pay fixed interest rates, and the liabilities tend to be consumer deposits. The interest rates paid on these deposits vary with market conditions and depend on the current level of short-term rates. This means that the thrift's income and outflow are not well matched. If there is a dramatic rise in the level of rates, the thrift has to pay out more money to its depositors. At the same time its revenue stream remains fixed because its existing assets provide a fixed rate of interest computed at lower rates. The thrift therefore faces a significant exposure to interest rate risk.

The thrift's problem can be neatly solved with an interest rate swap. The parties exchange a stream of fixed-rate payments for a stream of floating-rate (variable-rate) payments. The thrift agrees to pay the fixed interest rate and receive the floating rate. The dealer agrees to pay the floating rate and receive the fixed rate. These floating rate payments provide a much closer match to the amounts the thrift must pay to its depositors.

NEW CONTRACTS

New types of derivative instruments are being introduced all the time. Weather derivatives provide a good example of a recent innovation in this area. Many business organisations have profits that depend on the weather and there is considerable scope for such derivatives as hedging vehicles. For example, a brewery company's beer sales in the summer are strongly linked to the weather. As the temperature increases, more beer is consumed but if it gets too hot the consumption of beer may actually decrease. On the other hand, the yield on many crops may be adversely affected by a long, hot summer thereby reducing farmers' incomes.

If the winter is abnormally cold, a company that sells snowmobiles will experience increased sales. For example, Bombardier, a Quebec-based company that manufactures and sells snowmobiles, has sales that are highly related to the amount of snowfall in its sales areas. Bombardier has exposure to a specific type of weather risk and it was able to hedge this risk by buying a weather derivative, based on the amount of snowfall. Bombardier bought a snow derivative that meant it could offer cash back to customers if snowfall was less than half the norm. In a weather derivative we need to specify precisely the method by which the payment is to be computed: if the contract is to be based on the temperature level or the average temperature level, then the location needs to specified. For example, the traded weather options on the Chicago Mercantile Exchange use the temperature readings at O'Hare Airport as a basis for their Chicago contract.

Power providers and energy utilities have considerable exposure to the vagaries of the weather. If the summer is very hot consumers will turn up the air conditioning and if the winters are very cold there will be a surge in heating demand. These companies can reduce their risk exposure using weather derivatives. For example, consider Hank Hill, a propane distributor. Hank lives in Arlen, Texas and he is concerned that in a very mild winter propane sales will be low, reducing his profit. Suppose that under normal winter conditions his sales are one million gallons but if the winter is very mild he will only sell half this amount, reducing his profit. Hank can protect himself against this risk by buying a weather derivative from Koch Industries. The payoff on this derivative will be based on the actual average winter temperature for Hank's sales region. Panel 1 describes an interesting weather derivative that is designed to protect the revenues of a chain of London pubs from adverse weather conditions.

MARKETS

In the next chapter we will discuss the reasons for the significant growth of derivatives that has taken place in recent years. Much of the initial growth was in the development of exchange-traded instruments, which are standardised contracts that are traded on organised markets such as the Chicago Board Options Exchange (CBOE) or the London International Financial Futures Exchange (LIFFE). The exchanges provide a secondary market for derivatives and current information on market prices. There are a number of safeguards to maintain orderly markets and, in particular, to guard against the risk of default. For example, there are limits on the position any one firm can take. If an investor is losing money on a short position, the exchange will monitor the situation and require additional funds from time to time, known as "margin funds". These include the posting of margins and position limits. The exchange knows the positions of all the participants and can step in if necessary to take corrective action. Kroszner

PANEL 1
ENRON WEATHER DEAL FOR UK WINE BAR CHAIN

LONDON, 6 June – Corney & Barrow (C&B), which owns a chain of wine bars in the City of London, has closed a weather derivatives deal with US energy giant Enron – the first such undertaking by a non-energy company in the UK. The deal was brokered by Speedwell Weather, a division of the UK-based bond software company Speedwell Associates.

Sarah Heward, managing director of C&B Wine Bars, told RiskNews that the deal helps to protect her company against volatility in business caused by spikes and falls in temperature. "This deal protects a total of £15,000 in gross profit, so it is not a huge contract. But it does show that weather derivatives can be used by small companies", says Heward. She was introduced to the idea of hedging her business's volatility with weather derivatives by her own customers. "Many of our customers are market makers – including Speedwell – and we were talking about the volatility in C&B's business. They suggested that weather derivatives might help", she says. Heward acknowledges that for some executives of small companies, convincing their board of the need to use weather derivatives will be difficult. She says it was not a tough pitch for her, as her board members all work in the City of London.

Steven Docherty, chief executive of Speedwell Weather, says that the market responded surprisingly well to the offer of the C&B deal. Once Speedwell had taken some time to research and define C&B's particular problem, the deal itself was closed a couple of days after it was offered, he says. He believes that those involved in the weather derivatives market will view non-energy contracts as a good way of hedging against putting too many eggs in the energy basket. However, he points out that these deals will still need to be aggressively priced.

While Docherty told RiskNews that the weather market has developed more slowly than was expected, he still describes himself as "insanely optimistic". He believes that banks and funds are becoming more interested in weather products and that this will bring a capital markets approach – resulting in aggressive pricing and efficient marketing of weather products, as well as additional liquidity.

(1999) suggests that the control of credit risk is an important achievement of organised exchanges.

The other main market for derivatives is the so-called over-the-counter (OTC) market, which now accounts for about 85% of all derivatives. This market does not have a fixed geographical location, rather, it is formed by the world's major financial institutions. OTC derivatives are extremely flexible instruments and they have been the vehicles for much of the finan-

cial innovation in the last two decades. OTC contracts tend to be much longer dated than exchange-traded options: in some cases they last for as long as 30 to 40 years. One of the most critical differences between exchange-traded derivatives and OTC derivatives is that the former are guaranteed by the exchange whereas OTC derivatives are only guaranteed by the issuer. Thus, the investor is subject to credit (default) risk. The longer the term, the higher is the risk that one of the parties will default. Firms and countries that seem strong today may be in default in the future. Steve Ross has noted that the largest stock markets in the world 100 years ago were in Russia, Austria and the UK.[9]

DERIVATIVES AND DISASTERS

Inordinate risk taking, however, can have harmful results. Indeed, the term "speculator" has acquired unsavoury associations because of past excesses. In their role as speculative instruments, derivatives have been associated with some of the most famous financial failures in recent years.

For example, in 1995 the venerable British bank, Barings, collapsed with a loss of US$1.4 billion. The scapegoat for this loss was Nick Leeson, the bank's 28 year-old head trader. A characteristic of derivatives is that the price paid to enter the contract is often small in relation to the size of the risk. We call this property *leverage* because a lever gives us the ability to magnify our efforts. Leeson used derivatives to take very highly leveraged positions, betting on the direction of the Japanese stock market. He guessed wrongly and brought down the bank. However, the bank's internal control system proved to be ineffective and Leeson's activities were not supervised. Most of Leeson's pay was in performance bonuses: if he made a large trading profit his bonus would be huge. Leeson therefore had a very strong incentive to take risks.

One of the criticisms of the Barings case was that Nick Leeson was not an expert in the derivatives area. In contrast , Long Term Capital Management (LTCM), which collapsed in 1998, was advised by some of the brightest minds in the business. LTCM was a very prominent hedge fund that invested the funds of very rich clients and provides a spectacular example of extreme speculation. Note that the word "hedge" in this context does not mean that these funds actually hedge. LTCM tottered on the brink of collapse in 1998 in the aftermath of the Russian debt crisis because it had taken on massive and very risky positions in several markets. Edward Chancellor observes that LTCM "used derivatives wantonly to build up the largest and most levered position in the history of speculation".[4] Paul Krugman describes the role of leverage in the fund's near collapse:[5]

> Rarely in the course of human events have so few people lost so much money so quickly. There is no mystery about how Greenwich-based Long-Term Capital Management managed to make billions of dollars disappear.

> Essentially, the hedge fund took huge bets with borrowed money – although its capital base was only a couple of billion dollars, we now know that it had placed wagers directly or indirectly on the prices of more than a trillion dollars' worth of assets. When it turned out to have bet in the wrong direction, poof! – all the investors' money, and probably quite a lot more besides, was gone.

Funds such as LTCM historically operated with very few restrictions and little disclosure. The justification for this state of affairs was that people who invested in hedge funds were presumed to be sophisticated investors who needed less protection. The most frightening aspect of the LTCM affair was the threat its demise posed to the entire financial industry which was already under pressure from the Russian debt crisis. LTCM was such a major player that it had very significant positions with many large institutions. If it fell into disarray, the domino effect could topple the entire financial system. LTCM was rescued by an infusion of US$3.6 billion from a consortium of some of the world's largest investment banks, which had significant exposure to LTCM. The rescue was mounted after it was realised that LTCM would have to default if the banks stood idly by. Disasters such as Barings and LTCM provided a compelling incentive for banks and other financial institutions with large derivatives positions to improve the way in which they managed these positions. This trend was reinforced by regulation at both the domestic level and the international level. Trade associations, motivated by enlightened self-interest, also developed codes of best practice for the derivatives business.

We have seen that derivatives have two contradictory powers. On the one hand they are remarkably efficient tools for reducing risk. At the same time derivatives have an awesome capacity to increase risk through leverage. This dual nature of derivatives can be viewed in terms of two conflicting emotions that can be used to describe attitudes to risk: fear and greed. The common tendency to reduce risk stems from fear of loss. The motivation to take on large amounts of risk and reap high profits is based on greed. Derivatives provide an efficient way to construct a strategy that is consistent with either of these attitudes.

DEFAULT RISK

Default risk has been a factor since the first contracts were arranged and various procedures have been used to deal with it. One is to try to set up the contract so that it provides incentives that discourage default or non-performance. The life of the Russian author Dostoevsky provides an interesting example of a contract with draconian penalties for non-performance. The contract involved an agreement to produce a new book within a given time. Dostoevsky was deeply in debt because of his gambling activities and he was under pressure from his creditors, so, he

entered a deal with an unscrupulous publisher named Stellovsky. Under this deal Dostoevsky sold the copyright to all his published books for 3,000 roubles. The deal also stipulated that Dostoevsky would deliver a new novel by November 1, 1866. If he failed to deliver on time, then Stellovsky would also gain the rights to all of Dostoevsky's future books. This created a severe penalty if the book was not produced on time. Dostoevsky with help from a secretary, Anna Snitkin, whom he later married, managed to write the book in under a month and finished it by October 31, 1866. By a twist of irony the new book was called *The Gambler*.

Futures contracts provide a further example of how the design of a derivative contract can help reduce exposure to default risk. These are exchange-traded instruments. The owner of a futures contract has the obligation to buy some underlying asset. In this respect futures contracts are similar to forward contracts but there are important differences between them concerning the realisation of gains and losses. For example, if an investor is long a forward to buy some asset and the price of the underlying asset rises steadily over the contract period, the gain will not be realised until the end of the contract term. In contrast, if the investor owns (is long) a futures contract and the price of the underlying goes steadily up, the gains would be realised on a daily basis and they are posted to the investor's account. By the same token, if a trader sells (is short) a futures contract and the price rises every day, then the loss will have to be settled up each day and the trader loses money every day. The exchange clearing house ensures that losses and gains are settled up on a daily basis. If the prices move dramatically during the day then the settling up can be more frequent. The exchange broker will ask his client to deposit more money (margin) as soon as a position exceeds a given loss. This periodic settling up means that no side of the transaction is allowed to build up a large loss position. If the client is unable to meet the margin call the position may be liquidated to prevent additional losses. The design of futures contracts provides a very sturdy mechanism for reducing default risk.

CONCLUSION

This chapter demonstrated how widely derivatives are used as tools for transferring risk. It described some basic derivative contracts such as forwards, options, swaps and futures, and gave examples of how these contracts are used to reduce different types of risk. It emphasised that derivatives can be used to increase leverage and take on more risk, while pointing out the dangers of unbridled risk taking. There are also important differences between exchange-traded derivatives and OTC derivatives. The next chapter will analyse the reasons for the tremendous growth of derivatives.

1 These figures refer to the notional amounts. Figures are from the Bank for International Settlements (BIS) press release, 18May 2000 ref 14/2000E. The data relate to December, 1999.
2 Sometimes the term "risk" is used to describe the occurrence that triggers the bad consequences. This usage of "risk" to mean "peril" is common in insurance. For example, an insurance policy may be described as offering protection against named "risks".
3 The firm, invented by the authors, gets its name from a song by Brendan Behan: "And the old triangle/Went jingle jangle/Along the banks of the Royal Canal."
4 See Chancellor (1999).
5 Paul Krugman, "What Really Happened to Long-Term Capital Management", Slate, URL:http"//slate.msn.com/dismal/98-10-01/dismal.asp (1 October 1998).
6 The terms "European" and "American" are misleading in this respect. They have nothing to do with geography. The names are apparently due to Samuelson, who coined the term European to describe the simpler type of option and the term American to describe the more complicated type of option. Samuelson picked these names because of some Europeans he met during his research on options.
7 See Niederhoffer (1998).
8 At the time of writing the name of the energy company was not public.
9 Reference for this point Steve Ross survivorship bias.