

The Origins and Growth of the Market

DEFINITIONS

A **derivative** is an asset whose value is derived from that of some other asset, known as the **underlying**.

As an example, suppose you agree a contract with a dealer that gives you the **option** to buy a fixed quantity of gold at a fixed price of \$100 at any time in the next three months. The gold is currently worth \$90 in the world spot market. (A spot market is where a commodity or financial asset is bought or sold for immediate delivery.)

The option contract is a derivative and the underlying asset is gold. If the value of gold increases then so too does the value of the option, because it gives you the right (but not the obligation) to buy the metal at a fixed price. This can be seen by taking two extreme cases. Suppose that soon after the option contract is agreed the spot value of the gold specified in the contract rises to \$150. Alternatively, suppose the price collapses to \$50.

- **Spot Price Rises to \$150.** If this happens you can exercise (take up) the option, buy the gold for \$100 via the option and then sell the gold at a profit on the open market. The option has become rather valuable.
- **Spot Price Falls to \$50.** It is much cheaper to buy the gold in the spot market than to acquire it by exercising the option. Your option is virtually worthless. It is unlikely that it will ever be worth exercising.

As discussed in Chapter 8, because an option contract provides flexibility (it does not have to be exercised) an initial fee has to be paid to the dealer who writes or creates the option. This is called the **option premium**.

Derivatives are based on a very wide range of underlying assets. This includes metals such as gold and silver; commodities such as wheat and orange juice; energy resources such as oil and gas; and financial assets such as shares, bonds and foreign currencies. In all cases, the link between the derivative and the underlying commodity or financial asset is one of value. An option to buy a quantity of IBM shares at a fixed price is a derivative because if the underlying IBM share price increases then so too does the value of the option.

DERIVATIVES BUILDING BLOCKS

In the modern world there is a huge variety of different derivative products. These are either traded on **organized exchanges** or agreed directly with dealers in what is known as the **over-the-counter** (OTC) market. The good news is that the more complex structures are constructed from simple building blocks – forwards and futures, swaps and options. These are defined below.

Forwards

A forward contract is made directly between two parties. In a **physically delivered** forward contract one party agrees to buy an underlying commodity or financial asset on a future date at an agreed fixed price. The other party agrees to deliver that item at the stipulated price. Both sides are obliged to go through with the contract, which is a legal and binding commitment, irrespective of the value of the underlying at the point of delivery.

Some forward contracts are **cash-settled** rather than through the physical delivery of the underlying. This means that the difference between the fixed price stipulated in the contract and the actual market value of the underlying commodity or financial asset at the expiry of the contract is paid in cash by one party to the other.

Since forwards are privately negotiated, the terms and conditions can be customized. However, there is a risk that one side might default on its contractual obligation unless some kind of guarantee can be put in place.

Futures

A futures contract is essentially the same as a forward, except that the deal is made through an organized and regulated exchange rather than being negotiated directly between two parties.

In a physically delivered contract one side agrees to deliver a commodity or asset on a future date (or within a range of dates) at a fixed price, and the other party agrees to take delivery. In a cash-settled futures contract the difference between the fixed price and the actual market value of the underlying at expiry is settled in cash.

Traditionally there are three key differences between forwards and futures, although as discussed later the distinctions have blurred somewhat in recent years. Firstly, a futures contract is guaranteed against default. Secondly, futures are standardized, in order to promote active trading. Thirdly, profits and losses on futures are realized on a daily basis to prevent them from accumulating. The process is explained in detail in later chapters.

Swaps

A swap is an agreement made between two parties to exchange payments on regular future dates, where each payment leg is calculated on a different basis.

For example, suppose that a US company has to make interest payments on a euro loan over the next five years. Unfortunately its income is in US dollars, so it is exposed to changes in the exchange rate between the euro and the dollar. The firm can enter into a **currency swap** with a bank, in which the bank gives it the euros it needs on the required dates to make its loan payments. In return it makes payments to the bank in US dollars.

Although it is often considered as one of the most basic derivative products, a swap is actually composed of a series of forward contracts. Chapter 6 illustrates this fact with the example of an interest rate swap contract.

Options

A call option gives the holder the right to buy an underlying asset by a certain date at a fixed price. A put option conveys the right to sell an underlying asset by a certain date at a fixed price. As noted above, the purchaser of an option has to pay an initial fee called a premium

Table 1.1 Summary of four basic options strategies

Strategy	Premium	Characteristic
Buy a call	Pay	Right to buy the underlying at a fixed price.
Write a call	Receive	Obligation to deliver the underlying if exercised.
Buy a put	Pay	Right to sell the underlying at a fixed price.
Write a put	Receive	Obligation to take delivery of the underlying if exercised.

to the seller or writer of the contract. This is because the option provides flexibility for the purchaser – it need never be exercised.

Table 1.1 summarizes the four basic options strategies. Note that the most money the buyer of an option can ever lose on the deal is the initial premium paid for the contract. This is the case for a call and for a put option.

MARKET PARTICIPANTS

Derivatives have a very wide range of applications in business as well as in finance and banking. There are four main types of participants in the derivatives market: dealers, hedgers, speculators and arbitrageurs. However the same individuals and organizations may play different roles in different market circumstances.

Dealers

Derivatives contracts are bought and sold by dealers working for banks and securities houses. Some contracts are traded on exchanges, others are OTC transactions.

In a large investment bank the derivatives function is now a highly specialized affair. Marketing and sales staff speak to clients about their needs. Experts help to assemble solutions to those problems using combinations of forwards, swaps and options. Any risk that the bank assumes as a result of providing tailored products for clients is managed by the traders who run the bank's derivatives books. Meantime, risk managers keep an eye on the overall level of risk the bank is running; and mathematicians – known as 'quants' – devise the tools required to price new products.

Originally large banks tended to operate solely as intermediaries in the derivatives business, matching buyers and sellers. Over time, however, they assumed more and more risk themselves.

Hedgers

Corporations, investors, banks and governments all use derivative products to hedge or reduce their exposure to market variables such as interest rates, share prices, bond prices, currency exchange rates and commodity prices.

The classic example is the farmer who sells a futures contract to lock into a price for delivering a crop on a future date. The buyer might be a food processing company that wishes to fix a price for taking delivery of the crop in the future, or a speculator.

Another typical case is that of a company due to receive a payment in a foreign currency on a future date. It enters into a forward contract to sell the foreign currency to a bank and

receive a predetermined quantity of domestic currency. Or it purchases an option which gives it the right but not the obligation to sell the foreign currency at a set rate.

Speculators

Derivatives are very well suited to speculating on the prices of commodities and financial assets and on market variables such as interest rates, stock market indices and currency exchange rates. Generally speaking, it is much less expensive to create a speculative position using derivatives than by trading the underlying commodity or financial asset. As a result, the potential returns are that much greater.

A classic case is the trader who believes that increasing demand or reduced supply is likely to boost the market price of oil. Since it would be too expensive to buy and store the physical commodity, the trader buys exchange-traded futures contracts agreeing to take delivery of oil on a future delivery date at a fixed price. If the oil price rises in the spot market, the value of the futures contracts will also rise and they can be sold back into the market at a profit.

In fact if the trader buys and then sells the futures contracts before they reach the delivery point the trader never has to take delivery of any actual oil. The profit from the trades is realized in cash.

Arbitrageurs

An arbitrage is a deal that produces risk-free profits by exploiting a mispricing in the market. A simple example occurs when a trader can buy an asset cheaply in one location and simultaneously arrange to sell it in another for a higher price. Such opportunities are unlikely to persist for very long, since arbitrageurs would rush in to buy the asset in the 'cheap' location, thus closing the pricing gap.

In the derivatives business arbitrage opportunities typically arise because a product can be assembled in different ways out of different building blocks. If it is possible to sell a product for more than it costs to buy the constituent parts, then a risk-free profit can be generated. In practice the presence of transaction costs often means that only the large market players can profit from such opportunities.

In fact many so-called arbitrage deals constructed in the financial markets are not entirely risk-free. They are designed to exploit differences in the market prices of products which are very similar, but not completely identical. For this reason they are sometimes (and more accurately) called **relative value** trades.

SUPPORTING ORGANIZATIONS

There are, in addition, many individuals and organizations supporting the derivatives market and helping to ensure orderly and efficient dealings. For example, those who are not members of a futures and options exchange have to employ a broker to transact or 'fill' their orders on the market. A broker acts as an agent and takes an agreed fee or commission. The smaller brokers operate through larger banks and securities houses.

Trading in derivatives generally is overseen and monitored by government-appointed regulatory organizations. For example, the US Commodity and Futures Trading Commission (CFTC) was created by Congress in 1974 as an independent agency to regulate commodity futures and options markets in the United States.

Market participants have also set up their own trade bodies, such as the International Swaps and Derivatives Association (ISDA) which promotes best practice in the OTC derivatives industry and develops and publishes legal documentation. (Chapter 20 discusses the widely-used ISDA Master Agreement.)

Trade prices on exchanges are reported and distributed around the world by electronic news services such as Reuters and Bloomberg. Finally, information technology companies provide essential infrastructure for the derivatives market, including systems designed to value derivative products, to distribute dealer quotations and to record and settle trades.

EARLY ORIGINS OF DERIVATIVES

The history of derivatives goes back a very long way. In Book One of his *Politics*, Aristotle tells a story about the Greek philosopher Thales who concluded (by means of astronomical observations) that there would be a bumper crop of olives in the coming year. Thales bought options on a large number of olive presses. He was not obliged to exercise the contracts if the harvest was poor – in which case his losses would have been restricted to the original price paid for the options.

In the event the harvest was excellent. Thales exercised his options and was then able to rent out the olive presses to others at a substantial profit. Some argued that this proves that philosophers can easily make money if they choose to, but that their minds are focused on higher things. Aristotle (who knew a thing or two about philosophy) was rather less impressed. He thought Thales' scheme was based on cornering or monopolizing the market for olive presses rather than any particularly brilliant insight into the prospects for the olive harvest.

Forwards and futures are equally ancient. In medieval times sellers of goods at European fairs signed contracts promising delivery on future dates. Commodity futures can be traced back to rice trading in Osaka in the 1600s. Feudal lords collected their taxes in the form of rice, which they sold in Osaka for cash. Successful bidders were issued with vouchers that were freely transferable. Eventually it became possible to trade standardized contracts on rice (similar to modern futures) by putting down a deposit that was a relatively small fraction of the value of the underlying rice.

The Osaka rice market attracted speculators, as well as hedgers who were seeking to manage the risks associated with fluctuations in the market value of the rice crop.

Tulip Mania and the Amsterdam Market

The tulip mania in sixteenth-century Holland, which saw bulbs being bought and sold in Amsterdam at hugely inflated prices, also saw the introduction of trading in tulip forwards and options. The bubble burst spectacularly in 1637. Derivatives on shares also appeared on the Amsterdam Stock Exchange by the seventeenth century. Traders could deal in call and put options which provided the right to buy or to sell shares on future dates at predetermined prices.

London superseded Amsterdam as Europe's main financial centre, and derivative contracts started to trade in the London market. The development was at times controversial. In the 1820s problems arose on the London Stock Exchange over trading in call and put options. Some members condemned the practice outright. Others argued that dealings in options greatly

increased the volume of transactions on the exchange, and strongly resisted any attempts at interference.

The committee of the exchange tried to ban options, but it was eventually forced to back down when it became clear that some members felt so strongly about the matter that they were prepared to subscribe funds to found a rival exchange.

DERIVATIVES IN THE USA

Stock options (options on individual shares) were being traded in the US as early as the 1790s, very soon after the foundation of the New York Stock Exchange.

The next big step forward followed the foundation of the Chicago Board of Trade (CBOT) in 1848 by 83 Chicago merchants. The earliest forward contract (on corn) was traded on the CBOT in 1851 and the practice rapidly gained in popularity.

In 1865, following a number of defaults on forward deals, the CBOT formalized grain trading by developing standardized agreements called **futures contracts**. The exchange required buyers and sellers operating in the grain markets to deposit collateral called **margin** against their contractual obligations. Futures trading later attracted speculators as well as food producers and food-processing companies.

Trading volumes in the US expanded as new exchanges were formed in the late nineteenth and early twentieth centuries. The New York Cotton Exchange (later part of the New York Board of Trade) was founded in 1870. The Chicago Butter and Egg Board was founded in 1898, becoming the Chicago Mercantile Exchange (CME) in 1919. It became possible to trade futures contracts based on a wide range of commodities and (later) metals.

ICE

IntercontinentalExchange[®] (ICE) acquired the New York Board of Trade in 2007, which is now renamed ICE Futures U.S.[®] ICE also acquired the International Petroleum Exchange in 2001, now renamed ICE Futures Europe. ICE is a public company founded in 2000 and is a constituent of the S&P 500 index of top US shares.

Futures on financial assets are much more recent in origin. CME launched futures contracts on seven foreign currencies in 1972. In 1977 the CBOT introduced 30-year US Treasury Bond futures contracts, and in 1982 it created options on these futures contracts (see Chapters 4 and 12). In 1981 CME introduced a Eurodollar futures contract based on short-term US dollar interest rates, a key hedging tool for banks and traders. It broke new ground in being settled in cash rather than through the physical delivery of a financial asset (see Chapter 5).

The Chicago Board Options Exchange (CBOE) started up in 1973, founded by members of the CBOT. It revolutionized stock option trading by creating standardized contracts listed on a regulated exchange. Before that stock options in the USA were traded in informal over-the-counter markets. The CBOE first introduced calls on 16 underlying shares and later in 1977 launched put option contracts. Chapter 10 explores such products.

In 1983 the CBOE introduced options on the S&P 500 index of major US shares. In 1997 it launched options on the Dow Jones Industrial Average. By good fortune, just as the CBOE was starting up, the standard option pricing model developed by Black, Scholes and Merton was published. It became possible to value options on a common and consistent basis. The model is discussed in Chapters 13 and 14, and is set out in Appendix A.

CME Group

The two giant Chicago-based exchanges CBOT and CME finally merged in 2007. The combined entity is called CME Group. The group also includes the New York Mercantile Exchange (NYMEX). Its shares are listed on the US electronic stock market NASDAQ. CME Group revenues in 2009 totalled \$2613 million.

OVERSEAS DEVELOPMENTS, INNOVATION AND EXPANSION

Based on US developments, the London International Financial Futures and Options Exchange (LIFFE) was set up in 1982. After a 1996 merger with the London Commodity Exchange it also began to offer a range of commodity futures contracts.

LIFFE was acquired by Euronext in 2002, which in turn merged in 2007 with the holding group that operates the New York Stock Exchange. Now NYSE Liffe is the global derivatives business of NYSE Euronext Group and operates derivatives markets in London, Amsterdam, Brussels, Lisbon and Paris.

NYSE Liffe's great rival in Europe is Eurex, which was created in 1998. It is jointly operated by Deutsche Börse AG and SIX Swiss Exchange and is a fully electronic market, without a physical trading floor. More than two billion contracts were traded on Eurex in 2008.

As the exchanges have continued to expand their operations, over-the-counter trading in forwards, swaps and options has also experienced an explosion of growth. The first interest rate swap was agreed as late as 1982.

The statistics at the end of this chapter show how rapidly the global derivatives market has grown and diversified. In the OTC market nowadays dealers offer a wide array of more complex derivatives, including later-generation option products with exotic-sounding names such as barriers, cliquets and digitals. These products are discussed in later chapters, with practical examples, and are also summarized in Appendix B.

AN EXAMPLE OF RECENT INNOVATION: WEATHER DERIVATIVES

Food producers and companies such as utilities have long been able to insure against natural catastrophes such as hurricanes or floods. By contrast weather derivatives, first introduced in the OTC market in 1997, can be used to hedge against the business risks associated with less extreme events. These include an unusually cold winter or high rainfall in the summer months.

Some Weather-Related Risks

1. An energy provider could suffer from lower sales in a warm winter or a cooler summer.
2. Energy users could face higher heating (cooling) costs in cold winters (warm summers).
3. A grain producer may be affected by an unusually hot summer that decreases crop yields.
4. A tourist and leisure business may be faced with lower revenues in a cold or rainy summer.

In general terms, weather derivatives are financial products whose payoffs are based on measurable weather factors (such as temperature or rainfall) recorded at specific reference locations.

The market has expanded since exchange-traded contracts were introduced on Chicago Mercantile Exchange in 1999. Almost one million contracts were traded on CME in 2007, although growth slowed somewhat in the financial markets crisis in 2008. In the OTC market a wide range of swaps and option contracts are negotiated.

TEMPERATURE-LINKED DERIVATIVES

The most widely used weather contracts are linked to temperature. CME lists a series of futures and options based on the average temperatures over a month or a season for various cities in the US and overseas.

In the winter months the exchange constructs a **Heating Degree Day (HDD)** index, and in the summer months a **Cooling Degree Day (CDD)** index. With the contracts for US cities that cover a one-month period, an HDD index measures the extent to which the average temperature each day in the month in a city is *below* a benchmark level of 65° F. For example, if the average temperature in New York one day in November 2009 is (say) 50° F then the HDD value for that day is as follows.

$$\text{Daily HDD value} = 65 - 50 = 15$$

The HDD index for New York for November 2009 is then calculated by adding the daily HDD values. This means that if the weather is unusually cold that month then the index will be high (it is likely that heating bills in New York will go up). If the weather is unusually mild in the month the HDD index will be low. Note that if the average daily temperature for one day is *above* 65° F then the HDD value for that day is set to zero.

The value connection

A derivative is a product whose value is derived from that of some underlying item. The underlying in this case is the HDD or CDD index. To make the 'value' connection, CME assigns a monetary value of \$20 to each HDD and CDD index point on the US city futures and options contracts.

For example, suppose it is early 2009 and an energy-using company in New York wishes to hedge against a colder winter. The November 2009 HDD futures contracts for New York are currently trading at 500 index points. If the company buys November futures and the actual index for November turns out to be (say) 600 points (reflecting a spell of colder weather in that month), then the futures contracts will close at a level of 600. The company will make a profit of \$2000 per contract. This can be used to offset its rising energy bills.

$$\text{Futures profit per contract} = (600 - 500) \times \$20 = \$2000$$

The profit on the futures hedge is paid in cash. The compensating losses are made by those traders who *sold* the HDD contracts at low levels, perhaps expecting a mild winter in New York.

Table 1.2 Hedging with CME weather futures contracts

Risk	Futures hedge	Potential user of the hedge
Hot summer	Buy CDD futures	Agricultural business that would suffer from lower crop yields.
Mild summer	Sell CDD futures	Drinks company that would face lower sales.
Mild winter	Sell HDD futures	Energy suppliers that would face lower demand.
Cold winter	Buy HDD futures	Construction company that would suffer from project delays.

Summary and basis risks

Table 1.2 summarizes how HDD and CDD futures can be used to hedge weather-related risks. It is also possible to trade option contracts on CME.

There is a potential **basis risk** in using standardized exchange-traded futures to hedge weather risk. A basis risk occurs when the hedging tool does not exactly match the risk that is being covered. This would happen, for example, if a company based *outside* New York used the New York HDD or CDD futures contracts to manage its exposure to unusual temperatures. Climate conditions may be somewhat different in the two locations. A specially-tailored OTC contract can provide a more exact hedge.

THE WILD BEAST OF FINANCE?

Derivatives quite clearly bring major advantages to the modern world of business and finance. Indeed it would be impossible for many corporations to manage their operations unless they could hedge their exposures to commodity prices, interest rates and currency exchange rates. Financial institutions also need to manage the risks associated with factors such as changes in bond and share prices and the creditworthiness of borrowers.

Derivatives Use

In a 2009 survey, the International Swaps and Derivatives Association found that 94% of the world's largest 500 companies (headquartered in 32 countries) used derivatives to manage business and financial risks.

However derivatives also make it possible for traders and speculators to take highly **leveraged** bets on markets. That is, they make it possible to take large speculative positions with the promise of huge potential profits, but for a small initial outlay. The other side of the coin is that the losses can be massive if the bets go wrong.

The problem is not simply that an entire organization can be wiped out through losses derived from speculative trading using derivative products. There is also the danger of **systemic risk**, that is, that there may be a contagion or 'domino' effect bringing down a large part of the financial system and crippling the economy in general. Panic can set in because it can become difficult to establish which other entities may be affected by the losses. In the process, perfectly sound institutions may suffer from the general crisis of confidence.

Recognizing this danger early, Alfred Steinherr wrote a highly prescient book in 1998 entitled *Derivatives: The Wild Beast of Finance* (published by John Wiley). Steinherr argued that the rapid growth in derivatives could destabilize global financial markets unless effective tools and measures for risk management were put in place.

Enter Warren Buffett

The point was taken up later in typically forthright style by the legendary investor Warren Buffett. In his 2002 letter to shareholders Buffet warned that:

... derivatives are financial weapons of mass destruction, conveying dangers that, while now latent, are potentially lethal.

The examples from recent history in the next section illustrate the fact that such dangers are not illusory. The products discussed here, and the issues raised, are explored in more detail in the later chapters of this book.

LESSONS FROM RECENT HISTORY

This section outlines some of the more notorious episodes from the recent history of the derivatives markets. At the time of writing (early 2010), legislators and regulators are wrestling with understanding the role derivative products played in such events, and in particular in the global 'credit crunch' which started in 2007/8. They are also grappling with the implications for the future regulation of derivatives markets and financial institutions.

Hammersmith & Fulham Council (1988/9)

The London local authority entered into around 600 swap transactions in the late 1980s with a total notional value of some six billion pounds sterling. The amounts involved completely dwarfed the annual budget and the outstanding debt of the council. In effect, it was making a large speculative bet that UK interest rates would fall, rather than simply hedging its risks. In the event UK interest rates almost *doubled* in 1989 and the swap contracts moved into a substantial loss.

Unfortunately for the banks that were owed the money, the UK courts then decided that the swaps were *ultra vires*, that is, that a local authority had no legal power to enter into such speculative transactions. The deals were effectively cancelled, as were similar trades carried out by other British local authorities, resulting in substantial losses for a number of UK and international banks.

The case entered into the folklore of the derivatives industry and led to greater caution (for a time at least) over the legal and credit implications of swaps and other over-the-counter derivatives transactions.

Metallgesellschaft (1993)

The company was one of Germany's biggest conglomerates. Its subsidiary entered into a large number of forward contracts to supply oil products to customers for up to 10 years ahead at fixed prices. The buyers of the contracts included retailers and manufacturers seeking to hedge against potential increases in the oil price.

By entering into such deals Metallgesellschaft took on the risk itself that the price of oil would rise in the spot market. It decided to manage this risk by buying short-term exchange-traded energy futures and also similar products in the over-the-counter derivatives market. In theory, if the price of oil increased then any losses that arose from having to deliver oil

products to customers on the supply contracts at fixed prices would be offset by profits on the futures contracts. (If the spot price of oil rose the futures would also increase in value.)

One reason for hedging in this way with short-term futures contracts is that they are highly **liquid**, i.e. they can be easily traded in large quantities on the exchange. As futures contracts approached their expiry date Metallgesellschaft replaced them with the next expiry month contracts, in a process known as 'rolling'.

Unfortunately for Metallgesellschaft its futures hedge was imperfect. The price of oil fell sharply in late 1993. This incurred losses on the futures contracts, which have to be settled in cash on a regular basis. The compensating gains from being able to deliver oil on its forward delivery contracts to customers at what had then become high fixed prices would only be realized over 10 years. The company could run out of cash in the meantime. The matter is highly controversial, but the board decided to unwind all its obligations and lost around \$1.3 billion. It was rescued by a bailout from a group of banks and had to sell off parts of the business.

Orange County (1994)

Orange County in California declared bankruptcy in December 1994 as a result of reported losses of more than \$1.6 billion on its investment fund. The county treasurer Robert Citron had taken a large speculative bet based on a prediction of low US inflation and interest rates.

Part of the bet was implemented using new and exotic products called **reverse floaters** devised by specialists in banks. Unfortunately for Citron and Orange County, the US Federal Reserve actually started to *raise* interest rates during 1994. In such circumstances the losses on reverse floaters are greatly magnified. The resulting bankruptcy was the largest in US municipal history.

Barings Bank (1995)

The rogue trader Nick Leeson made losses of over 800 million pounds (GBP 800 million). His employer Barings, Britain's oldest merchant bank, was later sold to the Dutch financial group ING for one pound. Leeson was supposed to be exploiting pricing anomalies (low-risk arbitrage opportunities) between futures contracts traded on the Singapore and on the Osaka exchanges based on the Japanese stock market index, the Nikkei 225.

In reality, Leeson took very large 'long positions' or one-way bets, buying futures contracts and betting that the Nikkei index would rise. He also sold call and put options on the Nikkei in a risky trade called a **short straddle**. This produces a profit if the market moves in a narrow range but can lose a great deal of money if the market becomes more volatile (see Chapter 17).

Leeson was able to conceal his unauthorized deals and the resulting losses because he was not only the firm's 'star trader', but also ran the back-office accounting and settlement function in Singapore. (Chapter 20 discusses operational failures of this kind and the control measures banks now put in place.) His bosses in London were traditional merchant bankers with no experience of derivatives. The Nikkei index fell sharply after the Kobe earthquake in January 1995. Leeson then actually *increased* his long position in the futures, i.e. increased the size of his bet that the Nikkei index would rebound. Eventually massive losses were revealed.

Leeson fled Singapore but was captured and jailed. The case illustrated once again the need to keep trading and back-office functions separate. It also highlighted the risk that traders may be tempted to 'double up' loss-making positions to try to recoup their losses.

Long-Term Capital Management (1998)

LTCM was a hedge fund set up by the legendary bond trader John Meriwether. Members included the Nobel prize winners Robert Merton and Myron Scholes. LTCM's main bets were based on the idea that there would be convergence between the relative prices or returns available on safer and on riskier investments, and that any differentials or 'spreads' between the two that occurred over the short term would disappear over time.

Generally speaking the differentials involved were very small, and to make substantial returns for its fund holders LTCM borrowed large amounts of money and also used derivative products. Its big problems started in August 1998 when Russia defaulted on its debt and the prices of risky and of safer assets *widened* sharply. (This is sometimes called a 'flight to quality'.) LTCM was caught on the wrong side of this divergence and its losses were exaggerated by its high level of debt.

To prevent a systemic collapse in the financial markets, the Federal Reserve Bank of New York organized a \$3.625 billion bailout of LTCM by a group of major banks.

One of the lessons of the crisis was that the mathematical models used by LTCM failed to take into account properly the possible occurrence and the damaging consequences of extreme market events such as the Russian default, which can lead to market panics and very rapid collapses in asset prices. In such circumstances highly leveraged funds can find themselves having to offload their assets at cheap prices to pay off their creditors, in a so-called 'fire sale'.

Enron (2001)

The Houston-based energy firm filed for bankruptcy in December 2001. It had been a leader in electricity and natural gas trading. It reported revenues of over \$100 billion in 2000, more than double the 1999 figure.

Later investigations showed that Enron had used aggressive accounting techniques and derivative products to inflate its earnings and to boost the valuation of its assets. It created 'special partnerships' or **special purpose entities** to move billions of dollars of debt off its books.

Enron also boosted its income by booking profits up-front on trades that would take many years to mature. It valued energy contracts using the **mark-to-market** technique. This involves comparing the price at which a trade was entered into with its current value. However, unlike a simple asset such as a share, there was no publicly traded market that could establish the current value of Enron's contracts. As a result the managers had considerable discretion over the value that was reported.

In the wake of the Enron and other corporate scandals the US Congress passed the Sarbanes-Oxley Act in 2002. This set out new standards for the management and auditors of public firms, designed to ensure accurate financial disclosure.

Allied Irish Banks (2002)

AIB lost almost \$700 million as a result of the activities of currency trader John Rusnak in a US subsidiary. Rusnak claimed to be operating a low-risk strategy by trading currency options and hedging the risks by trading in the spot and forward foreign exchange markets. This is an **arbitrage strategy** and is based on capturing price anomalies in the market.

In fact, though, Rusnak's initial options deals were fictitious and he faked the trade confirmation documentation (Chapter 20 discusses trade confirmation). He had made very large unhedged bets on currencies such as the Japanese yen. As losses mounted, Rusnak devised further means to cover up his positions. The internal audit processes and back-office monitoring procedures at AIB proved ineffectual.

AIG, Merrill Lynch and Lehman Brothers (2008)

The global 'credit crunch', which saw massive defaults on subprime mortgages made to higher-risk borrowers, reached a dramatic peak in September 2008. The US government had to take control of American Investment Group (AIG), one of the world's largest insurers. The \$85 billion deal was designed to forestall fears about the collapse of the financial system. AIG had sustained huge losses on credit derivatives (see Chapters 7 and 19) and other types of insurance protecting against default on assets tied to corporate debt and mortgage loans.

In the same month of September 2008 the US brokerage and securities firm Merrill Lynch, which had also lost heavily on so-called 'toxic assets', mostly linked to mortgage loans, was taken over by Bank of America in a \$50 billion deal. The most controversial event was the refusal of the US authorities to rescue the giant US investment bank Lehman Brothers. The ensuing bankruptcy created shockwaves in global markets and fears that other banks might fail. Units of Lehman Brothers were later acquired by Barclays Capital and Nomura.

CREATIVE DESTRUCTION AND CONTAGION EFFECTS

The great economist Joseph Schumpeter argued that the defining characteristic of a capitalist society is the existence of constant waves of innovation that bring about 'creative destruction'. By this he meant that under capitalism new technologies, products, operating procedures and forms of organizational structure are continuously developed. They sweep away the old ways, and in the process create additional wealth in society.

Rather disturbingly, though, the history of the derivatives business offers examples where financial innovations can carry such extreme dangers for the health of the overall economic system that regulators and governments are obliged to intervene. (Sometimes the intervention is rather too slow.) It turns out that certain innovations in finance affect not only the nature of competition within the banking industry. They have serious external or 'spillover' effects on other parties, including the taxpayers who have to pick up the bill if things go badly wrong.

The task for regulators and government for the future is to create a system that permits innovation and legitimate risk-taking in derivatives where this is truly beneficial to society at large, but without allowing market experts the licence to build the 'weapons of mass destruction' that Warren Buffet warned against in 2002.

THE MODERN OTC DERIVATIVES MARKET

Figure 1.1 gives an idea of the huge size of the modern global derivatives market. It also shows how the growth was slowed down to some extent by the 'credit crunch' and by critical events such as the Lehman Brothers bankruptcy in late 2008. The values are in trillions of US dollars. The figure for June 2008 stood at about \$684 trillion, before falling back to \$547 trillion in December 2008. By June 2009 it had recovered to \$605 trillion.

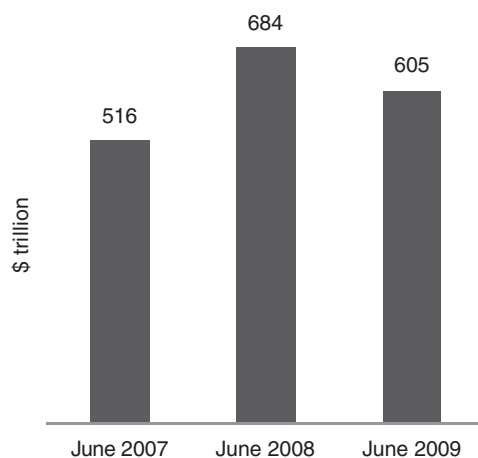


Figure 1.1 Notional amounts outstanding of OTC derivatives contracts at mid-year
Source: Based on data published by Bank for International Settlements available from www.bis.org

The notional amounts are enormous, although they can be a little misleading because with many contracts (such as interest rate swaps) the notional is never actually exchanged, and simply exists to calculate the payments due from one party to the other.

The **market value** of all OTC derivatives at June 2009 was around \$25 trillion. In addition, many derivatives deals are used to hedge or match other deals so that in overall terms much of the risk actually cancels out.

Figure 1.2 breaks the notional amounts down by 'risk category' or asset class, i.e. the type of underlying assets on which the OTC derivative contracts are based. The largest market is still for contracts based on interest rates, and the majority of these are interest rate swaps. At mid-2009 the notional amount outstanding on interest rate swaps globally was about \$342 trillion.

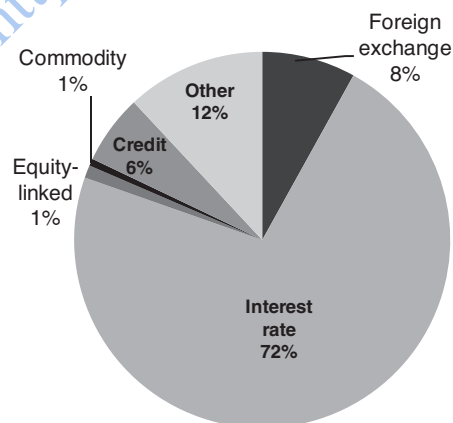


Figure 1.2 Global OTC derivatives at June 2009: notional amounts outstanding by type of underlying asset

Source: Based on data published by Bank for International Settlements available from www.bis.org

Table 1.3 Financial futures and options traded on organized exchanges. Notional principals outstanding in billions of US dollars

	At December 2007	At December 2008
Total futures	28 039	19 483
Interest rate futures	26 770	18 732
Currency futures	159	95
Equity index futures	1111	656
Total options	51 039	38 381
Interest rate options	44 282	33 979
Currency options	133	129
Equity index options	6625	4273

Source: Based on data published by Bank for International Settlements available from www.bis.org

The actual market value of those swaps transactions was approximately \$14 trillion. These figures reveal the extent to which swaps are used by banks and corporations to manage the risks associated with fluctuations in short-term interest rates.

The item for 'credit' in Figure 1.2 refers to **credit default swaps**, which are discussed in detail in Chapter 7 of this book. The notional amount outstanding worldwide on these particular deals reached \$58 trillion at end-2007. However in the wake of problems at AIG and elsewhere the figure for June 2009 had fallen back to \$36 trillion; a sharp reduction from previous highs but still a huge number.

THE EXCHANGE-TRADED DERIVATIVES MARKET

Following a period of stagnation, trading in exchange-traded derivatives started to expand again in the early 2000s. Much of the increased activity was in interest rate futures and options, which are used extensively by banks and by OTC derivatives dealers seeking to hedge against or take advantage of changes in short- and long-term market interest rates.

Table 1.3 shows the notional amount outstanding of exchange-traded financial futures and options contracts at the end of 2007 and 2008.

Overall the figures in Table 1.3 show a decline in 2008 as a result of the credit crunch. This decline continued in early 2009, but trading started to recover later in the year as more confidence returned to the markets. At end-June 2009 the notional amount outstanding on financial futures contracts was about \$19.7 trillion and on option contracts about \$43.8 trillion.

CHAPTER SUMMARY

In finance, a derivative is a product whose value depends on some other underlying asset, such as a commodity or a share or a bond or a foreign currency. Derivative contracts are either traded on organized exchanges, or agreed directly between two parties in the over-the-counter (OTC) market. Exchange-traded contracts are generally standardized but carry a guarantee that the contract will be honoured.

There are three main types of derivative products: forwards and futures, swaps, and options. A forward is a bilateral agreement that one party will deliver an underlying asset to another on a future date at a fixed price. In some cases there is no delivery and the difference between

the fixed contract price and the actual market price of the underlying at expiry is paid in cash. Futures are the exchange-traded equivalents of forwards.

A swap is an agreement between two parties to exchange payments on regular dates for an agreed period of time. Each payment leg is calculated on a different basis. In a standard or 'plain vanilla' interest rate swap one leg is based on a fixed rate of interest and the return leg is based on a floating or variable rate of interest. A swap is composed of a series of forward contracts.

The purchaser of an option has the right but not the obligation to buy (call) or to sell (put) an underlying asset at a pre-set price. The other side of the transaction is taken by the writer or seller of the option contract. The purchaser of an option has to pay an up-front sum of money called the premium to the writer of the contract.

Derivatives are used to manage risk, to speculate on the prices of assets and to construct risk-free or arbitrage transactions. The notional value of derivatives contracts outstanding globally amounts to trillions of US dollars.

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