

Derivatives markets, products and participants: an overview

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1. Introduction

Derivatives have been associated with a number of high-profile corporate events that roiled the global financial markets over the past two decades. To some critics, derivatives have played an important role in the near collapses or bankruptcies of Barings Bank in 1995, Long-term Capital Management in 1998, Enron in 2001, Lehman Brothers in and American International Group (AIG) in 2008. Warren Buffet even viewed derivatives as time bombs for the economic system and called them financial weapons of mass destruction (Berkshire Hathaway Inc (2002)).

But derivatives, if “properly” handled, can bring substantial economic benefits. These instruments help economic agents to improve their management of market and credit risks. They also foster financial innovation and market developments, increasing the market resilience to shocks. The main challenge to policymakers is to ensure that derivatives transactions being properly traded and prudently supervised. This entails designing regulations and rules that aim to prevent the excessive risk-taking of market participants while not slowing the financial innovation aspect. And it also calls for improved data quantity and quality to enhance the understanding of derivatives markets.

This chapter provides an overview of derivatives, covering three main aspects of these securities: instruments, markets and participants. It begins with a quick review of some key concepts, including what derivatives are; why they exist; who use these instruments and for what purpose. It also discusses the factors that have contributed to the rapid growth of the markets over the past few decades. In section 3, the main types of derivative contracts will be discussed. Section 4 examines how specific derivatives contracts are written on various underlying asset classes. Section 5 discusses two main types of markets: exchange-traded and over-the-counter. The key differences of these markets will be highlighted. Section 6 reviews some recent credit events and to what extent counterparty risk has played a role. Finally, section 7 concludes.

2. Derivative securities: some basic concepts

The Oxford dictionary defines a derivative as something derived or obtained from another, coming from a source; not original. In the field of financial economics, a derivative security is generally referred to a financial contract whose value is derived from the value of an underlying asset or simply *underlying*. There are a wide range of financial assets that have been used as underlying, including equities or equity index, fixed-income instruments, foreign currencies, commodities, credit events and even other derivative securities. Depending on the types of underlying, the values of the derivative contracts can be derived from the corresponding equity prices, interest rates, exchange rates, commodity prices and the probabilities of certain credit events.

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What is the main function of derivatives? They allow users to meet the demand for cost-effective protection against risks associated with movements in the prices of the underlying. In other words, users of derivatives can hedge against fluctuations in exchange and interest rates, equity and commodity prices, as well as credit worthiness. Specifically, derivative transactions involve transferring those risks from entities less willing or able to manage them to those more willing or able to do so. Derivatives transactions are now common among a wide range of entities, including commercial banks, investment banks, central banks, fund managers, insurance companies and other non-financial corporations.

Participants in derivatives markets are often classified as either “hedgers” or “speculators”. Hedgers enter a derivative contract to protect against adverse changes in the values of their assets or liabilities. Specifically, hedgers enter a derivative transaction such that a fall in the value of their assets will be compensated by an increase in the value of the derivative contract. By contrast, speculators attempt to profit from anticipating changes in market prices or rates or credit events by entering a derivative contract. According to this definition, activities of speculators are inherently more risky and should warrant close monitoring by financial regulators. However, it is difficult to differentiate the two in practice. As pointed out by Jarrow and Turnbull (20), “Hedging – risk reduction – speculation – risk augmentation are flip sides of the same coin.”

Hedging and speculating are not the only motivations for trading derivatives. Some firms use derivatives to obtain better financing terms. For example, banks often offer more favourable financing terms to those firms that have reduced their market risks through hedging activities than to those without. Fund managers sometimes use derivatives to achieve specific asset allocation of their portfolios. For example, passive fund managers of specific index-tracking funds may need to use derivatives to replicate exposures to some not so liquid financial assets.

Derivatives have a long history and early trading can be traced back to Venice in the 12th century.² Credit derivative deals at that period took the form of loans to fund a ship expedition with some insurance on the ship not returning. Later in the 16th century, derivatives contracts on commodities emerged. During that time, the slow speed in communication and high transportation costs presented key problems for traders. Merchants thus used derivatives contracts to allow farmers to lock in the price of a standardised grade of their produce at a later delivery date.

A number of fundamental changes in global financial markets have contributed to the strong growth in derivative markets since the 1970s. First, the collapse of the Bretton Woods system of fixed exchange rates in 1971 increased the demand for hedging against exchange rate risk. The Chicago Mercantile Exchange allowed trading in currency futures in the following year.

Second, the changing of its monetary policy target instrument by the US Federal Reserve (FED) promoted various derivatives markets. The adoption of a target for money growth by the FED in 1979 has led to increased interest-rate volatility of Treasury bonds. That in turn raised the demand for derivatives to hedge against adverse movements in interest rates. Later in 1994 when the US Federal Open Market Committee moved to explicitly state its target level for the federal funds rate, that policy has spurred the growth of derivatives on the federal funds rates. Third, the many emerging market financial crises in the 1990s, which were often accompanied by a sharp rise in corporate bankruptcy, greatly increased the demand of global investors for hedging against credit risk.

² See Swan (2000).

Fourth, innovation in financial theory was another contributing factor. The advancements in options pricing research, most notably the Nobel-prize winning Black-Scholes options pricing model, provided a new framework for portfolio managers to manage risks. More importantly, the rapid improvements in computer technology in the 1990s allowed these asset managers to design and develop increasingly sophisticated derivatives as part of their risk management tools.

3. Major types of derivatives

There are four main types of derivatives contracts: forwards; futures, options and swaps. This section discusses the basics of these four types of derivatives with the help of some specific examples of these instruments.

3.1 Forwards and futures contracts

Forward and futures contracts are usually discussed together as they share a similar feature: a forward or futures contract is an agreement to buy or sell a specified quantity of an asset at a specified price with delivery at a specified date in the future.

But there are important differences in the ways these contracts are transacted. First, participants trading futures can realise gains and losses on a daily basis while forwards transaction requires cash settlement at delivery. Second, futures contracts are standardised while forwards are customised to meet the special needs of the two parties involved (counterparties). Third, unlike futures contracts which are settled through established clearing house, forwards are settled between the counterparties. Fourth, because of being exchange-traded, futures are regulated whereas forwards, which are mostly over-the-counter (OTC) contracts, and loosely regulated (at least in the run up to the global financial crisis). This importance of exchange-traded versus OTC instruments will be discussed further in later section.

3.2 Options contracts

Options contracts can be either standardised or customised. There are two types of option: *call* and *put* options. Call option contracts give the purchaser the right to buy a specified quantity of a commodity or financial asset at a particular price (*the exercise price*) on or before a certain future date (*the expiration date*). Similarly, put option contracts give the buyer the right to sell a specified quantity of an asset at a particular price on or before a certain future date. These definitions are based on the so-called American-style option. And for a European style option, the contract can only be exercised on the expiration date.

In options transaction, the purchaser pays the seller – the writer of the options – an amount for the right to buy or sell. This amount is known as the *option premium*. Note that an important difference between options contracts and futures and forwards contracts is that options do not require the purchaser to buy or sell the underlying asset under all circumstances. In the event that options are not exercised at expiration, the purchaser simply loses the premium paid. If the options are exercised, however, the option writer will be liable for covering the costs of any changes in the value of the underlying that benefit the purchasers.

3.3 Swaps

Swaps are agreements between two counterparties to exchange a series of cash payments for a stated period of time. The periodic payments can be charged on fixed or floating interest rates, depending on contract terms. The calculation of these payments is based on an agreed-upon amount, called the notional principal amount or simply the *notional*.

4. Underlying assets and derivative products

While forwards, futures, options and swaps can be viewed as the mechanics of derivation, the value of these contracts are based on the prices of the underlying assets. In this section, we discuss a range of derivatives products that derive their values from the performance of five underlying asset classes: equity, fixed-income instrument, commodity, foreign currency and credit event. However, given the speed of financial innovation over the past two decades, the variety of derivatives products have grown substantially. Thus a few key examples will be discussed below. For a more detailed discussion of other major financial innovations in recent years, see Anderson and McKay (2008).

4.1 Equity derivatives

Equity futures and options on broad equity indices are perhaps the most commonly cited equity derivatives securities. Way back in 1982, trading of futures based on S&P's composite index of 500 stocks began on the Chicago Mercantile Exchange (CME). Options on the S&P 500 futures began trading on the CME in the following year. Today, investors can buy futures based on benchmark stock indices in most international financial centres (Table 1). In 2010, the authorities approved trading of futures on the China Securities Index 300.

Table 1
International exchange with stock index futures or options

Americas	Asia Pacific	Europe, Africa, Middle East
BM&F BOVESPA	Australian Securities Exchange	Athens Derivatives Exchange
Chicago Board Options Exchange	Bombay Stock Exchange	Borsa Italiana
CME Group	Hong Kong Exchange	Budapest SE
ICE Futures US	Korea Exchange	Eurex
International Securities Exchange	National Stock Exchange India	Johannesburg SE
MexDer	Osaka Securities Exchange	MEFF
Montréal Exchange	Singapore Exchange	NASDAQ OMX Nordic
NASDAQ OMX PHLX	TAIFEX	NYSE Liffe (European)
NYSE Amex	Thailand Futures Exchange	Oslo Børs
	Tokyo Stock Exchange Group	Tel Aviv Stock Exchange
		Warsaw Stock Exchange
		Wiener Börse

Source: World Federation of Exchanges.

Index futures contract enable an investor to buy a stock index at a specified date for a certain price. It can be an extremely useful hedging tool. For example, an investor with a stock portfolio that broadly matches the composition of the Hang Seng index (HSI), he will suffer losses should the HSI record a fall in market value in the near future. Since he means to hold the portfolio as a long term strategy, he is unwilling to liquidate the portfolio. Under such circumstances, he can protect his portfolio by selling HSI index futures contracts so as to profit from any fall in price. Of course, if his expectations turned out to be wrong and the HSI rose instead, the loss on the hedge would have been compensated by the profit made on the portfolio.

Some investors prefer to purchase options on futures (or “futures options”) instead of straight futures contracts. The option strike price is the specified futures price at which the future is traded if the option is exercised. For some market participants, the pricing of an option reveals valuable information about the likely future volatility of the returns of the underlying asset.³ One commonly cited example is the Chicago Board Options Exchange Market Volatility Index (VIX index), which is calculated based on a range of options on the S&P 500 index. When investors are concerned about a potential drop in the US stock market, they buy the VIX index as an insurance against losses in the value of their portfolio. The more investors demand, the higher the price of the VIX. As such, the VIX can be viewed as an “investor fear gauge” (Whaley (2008)).

Other commonly traded equity derivatives are equity swaps. Under an equity swap contract, an investor pays the total return on a stock to his counterparty and receives in return a floating rate of interest. With this equity swap, the investor can hedge his equity position without giving up ownership of his share. At the same time, the party receiving equity return enjoys exposure without actually taking ownerships of shares.

4.2 Interest rate derivatives

One of the most popular interest rate derivatives is interest rate swap. In one form, it involves a bank agreeing to make payments to a counterparty based on a floating rate in exchange for receiving fixed interest rate payments. It provides an extremely useful tool for banks to manage interest rate risk. Given that banks’ floating rate loans are usually tied closely to the market interest rates while their interest payments to depositors are adjusted less frequently, a decline in market interest rates would reduce their interest income but not their interest payments on deposits. By entering an interest rate swap contract and receiving fixed rate receipts from a counterparty, banks would be less exposed to the interest rate risk.

Meanwhile, interest rate futures contract allows a buyer to lock in a future investment rate. For example, the Chicago Board of Trade offers federal funds futures contracts ranging from the current month to 24 months out. A by-product of these futures is that they provide useful information on the market expectations of future monetary policy decisions in the United States (Carlson, Craig, Higgins and Melick (2006)).

4.3 Commodity derivatives

As mentioned in section 1, the earliest derivatives markets have been associated with commodities, driven by the problems about storage, delivery and seasonal patterns. But modern day commodity derivatives markets only began to develop rapidly in the 1970s. During that time, the breakup of the market dominance of a few large commodity producers allowed price movements to better reflect the market supply and demand conditions. The resulting price volatility in the spot markets gave rise to demand of commodity traders for derivatives trading to hedge the associated price risks. For example, forwards contracts on Brent and other grades of crude became popular in the 1970s following the emergence of the Organisation of Petroleum Exporting Countries. Deregulations of the energy sector in the United States since the 1980s also stimulated the trading of natural gas and electrical power futures on the New York Mercantile Exchange (NYMEX) in the 1990s.

³ However, empirical evidence for informed traders preferring to trade options instead of the underlying stocks is mixed. See Ansi and Ben Ouda (2009) for an up-to-date survey of the empirical literature.

4.4 Foreign exchange derivatives

The increasing financial and trade integration across countries have led to a strong rise in demand for protection against exchange rate movements over the past few decades. A very popular hedging tool is forward exchange contract. It is a binding obligation to buy or sell a certain amount of foreign currency at a pre-agreed rate of exchange on a certain future date. Consider a Korean shipbuilder who expects to receive a \$1 million payment from a US cruise company for a boat in 12 months. Suppose the spot exchange rate is 1,200 won per dollar today. Should the won appreciate by 10 per cent against the dollar over the next year, the Korean shipbuilder will receive only 1,090 million of won (some 109 million of won less than he would have received today). But if the shipbuilder can hedge against the exchange risk by locking in buying dollars forwards at the rate of say 1,100 won per dollar.

For thinly traded currencies or currencies of those countries with restrictions on capital account transactions, the profit or loss resulting from the forwards transaction can be settled in an international currency. This is the so-called *non-deliverable forwards* contract, and very often they are traded offshore.

Another type of foreign exchange derivatives are cross-currency swaps. This involves two parties exchanging payments of principal (based on the spot rate at inception) and interest in different currencies. According to many market participants, having a liquid cross-currency swap market is an important for local currency bond market developments. This is because such instruments allow foreign borrowers in local bond markets to swap back their proceeds to their own currencies while hedging against the interest rate risk.

4.5 Credit derivatives

A credit derivative is a contract in which a party (the credit protection *seller*) promises a payment to another (the credit protection *buyer*) contingent upon the occurrence of a *credit event* with respect to a particular entity (the *reference entity*). A credit event in general refers to an incident that affects the cash flows of a financial instrument (the *reference obligation*). There is no precise definition, but in practice, it could be filing for bankruptcy, failing to pay, debt repudiation or moratorium.

The fastest growing type of credit derivatives over the past decade is credit default swap (CDS). In essence, it is an insurance policy that protects the buyer against the loss of principal on a bond in case of a default by the issuer. The buyer of CDS pays a periodic premium to the seller over the life of the contract. The premium reflects the buyer's assessment of the probability of default and the expected loss given default.⁴ In the event of a credit incident, the buyer has a right to demand compensation from the seller.

In its simplest form, the CDS is written with respect to one single reference entity, the so-called single-name CDS. Some data providers compile indices of a basket of single-name CDSs of similar ratings (eg, the S&P US Investment Grade CDS Index consists of 100 equally weighted investment grade US corporate credits). These index tranches give investors the opportunity to take on exposures to specific segments of the CDS index default loss distribution (see Amato and Gyntelberg (2005)).

⁴ Duffie and Singleton (2003) discusses the basic principles of pricing CDSs.

5. Derivatives markets

Derivatives are traded either on organised exchanges or in OTC markets. The differences between the exchange-traded and OTC derivatives are not confined to where they are traded but also how.

In exchange-traded markets, derivatives contracts are standardised with specific delivery or settlement terms. Negotiation between traders traditionally was conducted by shouting on the trading floor (open outcry). But electronic trading system has become increasingly popular in many major exchanges. Exchange-traded derivative trades are publicly reported and cleared in a clearing house. The clearing house will be obliged to honour the trade if the seller defaults. The solvency of the clearing house was protected by marking all positions to market daily through a system of margins.

By contrast, derivative trades in OTC markets are bilateral in nature. All contract terms such as delivery quality, quantity, location, date and prices are negotiable between the two parties. Transactions can be arranged by telephone or other communication means. Prices are not reported publicly.

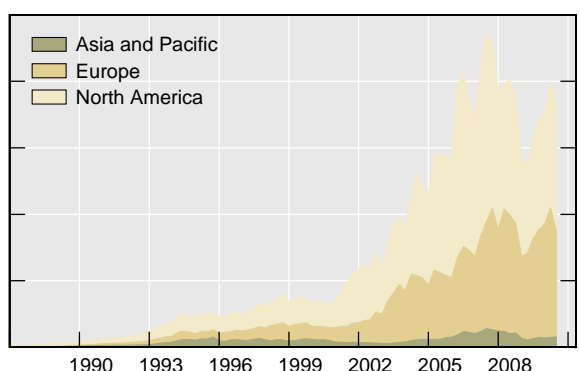
The different characteristics of the two types of markets mean that they complement each other in providing a trading platform to suit various business needs (see Nystedt (2004)). On the one hand, exchange traded derivative markets have better price transparency than OTC markets. Counterparty risks are also smaller in exchange-traded markets with all trades on exchanges being settled daily with the clearing house. On the other hand, the flexibility of OTC markets means that they suit better for trades that do not have high order flow and or with special requirements. In this context, OTC markets perform the role as an incubator for new financial products.

Graph 1

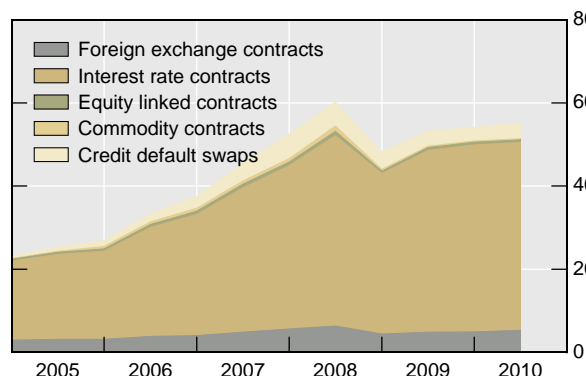
Growth of derivatives markets

Notional amounts outstanding, in trillions of US dollars

Exchange-traded derivative markets¹



OTC derivative markets²



¹ In trillions of US dollars. ² In billions

Source: BIS.

The size of both exchange-traded and OTC derivative markets have grown sharply since the 2000s. The trend was briefly interrupted by the global financial crisis. But the notional amounts outstanding in both markets have since returned to almost pre-crisis levels (Graph 1). Exchanges in North America and Europe remain dominant, accounting for 90% of total market share. Interest rate futures and options are by far the most popular instruments traded on organised exchanges. Total notional amounts outstanding of derivatives traded in

OTC markets are much larger than those on exchanges. Like on organised exchanges, interest rate contracts are also the most commonly traded instruments in OTC markets.

It should be noted that notional amount is only an imperfect measure of the size of derivative markets (see ISDA (2008)). Notional amount is the total principal of the underlying security around which the transaction is structured. It is easy to collect and understand. However, it does not represent the actual amount exchanged in derivatives transaction as the actual amount exchanged is uncertain at the initiation of many derivative contracts. Furthermore, in OTC markets, contracts are negotiated bilaterally and can only be closed before maturity by entering into another derivative contract that offset the payoff stream of the initial contract. This means that notional amount overstate the level of market activity.

6. Role of derivatives in recent credit events and regulatory issues

Financial derivatives have been associated with a number of high-profile credit events over the past two decades. In the early 1990s, Procter and Gamble Corporation lost over \$100 million in transactions in equity swaps. On December 6 1994, Orange County declared bankruptcy after suffering losses of around \$1.6 billion from a wrong-way bet on interest rates (the so-called “inverse floaters”) in one of its principal investment pools. In 1995, Barings collapsed when one of its traders lost \$1.4 billion (more than twice its available capital) in trading equity index derivatives.

The amounts involved with derivatives-related corporate distress in the 2000s have increased substantially. Two such events were the bankruptcy of Enron Corporation in 2001 and the near collapse of AIG in 2008. One common feature of these events was that OTC derivative tradings were thought to have played some role.

Enron’s filing for bankruptcy in December 2001 took many commentators by surprise. At that time, the company was estimated to have a shareholder value of \$70 billion. The core of Enron’s business was dealing in derivative contracts based on the prices of oil, gas, electricity and other variables in OTC markets. Enron’s derivatives transactions in these markets were largely unregulated with no reporting requirements. There was little information is available about the profitability of these derivatives activities. Some thought that speculative losses in derivatives, perhaps masked by “creative” accounting, was one of the main contributing factor to the collapse of the company.

In 2008, the US government introduced a \$150 billion financial package to prevent AIG, once the world’s largest insurer by market value, from filing for bankruptcy. Being an AAA-rated company, AIG was being exempted from posting collateral on most of its derivatives trading at that time. In addition, AIG was unique among CDS market participants in that it acted almost exclusively as credit protection seller. As the global financial crisis reached its peak in late 2008, AIG’s CDS portfolios recorded substantial mark-to-market losses. Consequently, the company was asked to post \$40 billion of collateral, partly contributed to the near collapse.

These credit events raised some important questions concerning the regulations of derivatives trading and financial stability.⁵ The focus appears to centre on improvements in counterparty risk management and in favour of promoting exchange-traded derivative markets. Very often, the lack of knowledge of a counterparty’s financial health can lead to fears about its solvency and contagion risk. Under such an environment, OTC contracts are particularly exposed to risks of inadequate collateral and capitalisation. In this context,

⁵ For a detailed exposition of a large number of regulatory issues related to OTC derivative markets, see Banque de France (2010).

central clearing of derivatives transactions and more robust collateralisation are important for mitigating counterparty risk in OTC markets. In addition, financial regulators are designing new rules to improve post-trade price transparency. There are also proposals in some jurisdictions to encourage the migration of trading in some actively OTC traded products to exchanges.

7. Conclusions

The chapter provides an overview of derivatives markets, products and participants. Derivatives are invented in response to some fundamental changes in the global financial system. They, if properly handled, should help improve the resilience of the system and bring economic benefits to the users. In this context, they are expected to grow further with financial globalisation. However, past credit events exposed many weaknesses in the organisation of derivatives trading. The aim is to minimise the risks associated with such trades while enjoying the benefits they bring to the financial system. An important challenge is to design new rules and regulations to mitigate the risks and to promote transparency by improving the quality and quantity of statistics on derivatives markets.

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